Tapping Mineral, Oil, and Gas Resources for Economic Development

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Abstract:

Pakistan is endowed with significant mineral, oil, and gas resources, with the potential to substantially contribute to the country's economic development. However, the nation faces several pressing challenges in effectively harnessing these resources, including declining reserves and production, inefficient exploration and production activities, suboptimal resource management and distribution, regulatory and policy complexities, and environmental and social concerns. This study provides a comprehensive analysis of the key factors and challenges influencing the development of Pakistan's extractive industries, including its mineral, oil, and gas resources. It assesses the scale of the country's resource potential, evaluates the policy and regulatory framework, examines the institutional capacity and governance structures, analyzes the investment climate and financing mechanisms, appraises the technological capabilities and infrastructure, investigates the environmental and social impacts, and evaluates the overall economic contributions and diversification potential of the extractive sectors.

Key words:

Mineral Resources, Oil and Gas, Resource Management, Regulatory Challenges, Economic Development.

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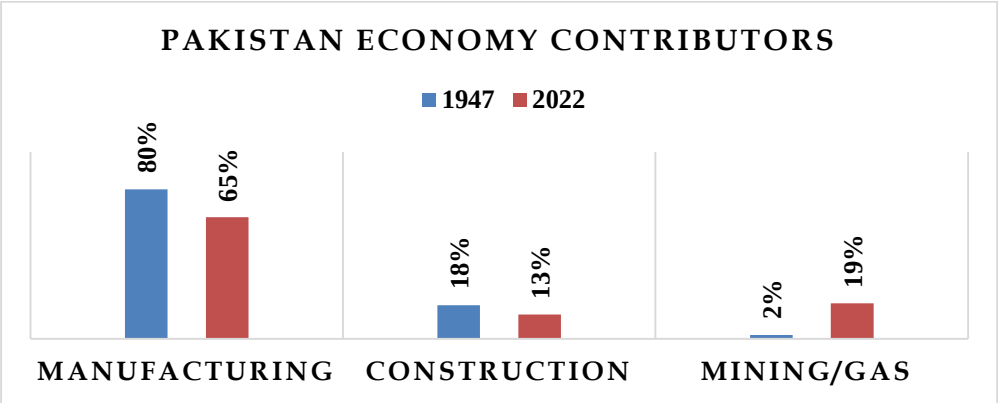
Introduction

After independence, the manufacturing sector dominated the economy of Pakistan, accounting for 80% of the total, while construction/mining and electricity/oil/gas generation and distribution accounted for 18% and 2%, respectively. However, by 2022, the share of manufacturing had decreased to 65%, while construction, oil/electricity/gas generation and distribution had increased to 13%, and mining had grown to 9% (Kulrashid, 2022).

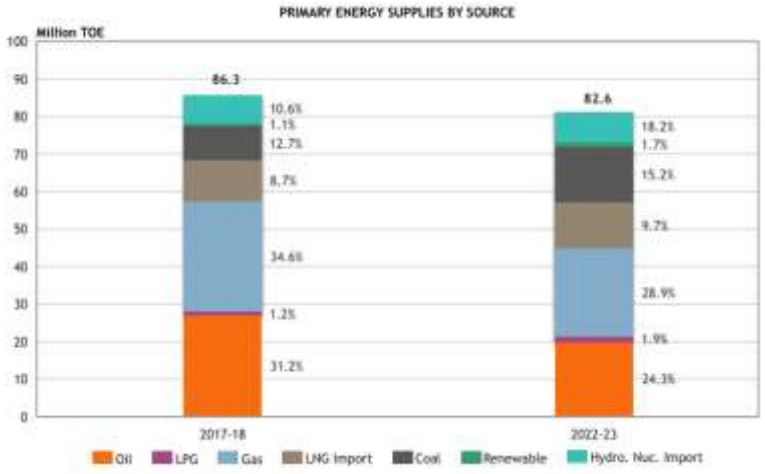


Surveys have identified that Pakistan has a total mineralized area of 600,000 square kilometers. In total, the country has discovered 92 different minerals, and mining companies are currently extracting 52 of these on a small scale through over 5,000 active mines (Naqeeb, Pheng, Ullah, & Mumtaz, 2024). Some of the key mineral resources found in Pakistan include:

- Coal: Estimated 185 billion tons
- Copper: Estimated 7,000 million tons
- Gold: Estimated 1,658 million tons
- Salt: Estimated 10 billion tons
- Silver: Estimated 620 million tons
- Lead and zinc: Estimated 24 million tons
- Manganese: Estimated 1.597 million tons
- Chromite: Estimated 3 million tons
- Iron ore: Estimated 1,450 million tons

Pakistan is recognized globally for having the 5th largest copper-gold reserves, the 2nd largest coal reserves, and the 2nd largest salt reserves in the world. However, the country has not been able to fully harness these mineral resources to drive economic development, with the mining sector currently contributing only around 2.7% to GDP (Naqeeb, Pheng, Ullah, & Mumtaz, 2024).

Pakistan's sedimentary basins are indeed promising areas for oil and gas exploration. Pakistan's oil production is 72,000 BPD, and consumption is 435,000 BPD. Estimates suggest significant potential, ranging from at least 300 million barrels of recoverable oil to 20 trillion cubic feet of natural gas, and potentially even higher figures (Year Book, 2022-23). Pakistan is a net importer of refined oil because its domestic refining capacity is limited. The country produces about 4.3 million metric tons of crude oil per year, which only meets 20% of its total petroleum needs. The remaining 80% is imported as crude oil and refined products, costing $15-$16 billion annually (ITA, 2021). Natural gas makes up 38% of Pakistan's total energy supply. Natural gas production in Pakistan is 3,200 MMCFD, and consumption is 4,100 MMCFD. Domestic gas production is around 4 billion cubic feet per day, but demand is 6-8 billion cubic feet per day, leading to a supply shortfall. Pakistan's gas production has been declining in recent years (ITA, 2021).



Source: Pakistan Energy Yearbook 2022-23

Statement of the Problem

There is no denying the fact that Pakistan is endowed with significant mineral, oil, and gas resources, which have the potential to contribute substantially to the country's economic development. However, the nation faces several pressing challenges in effectively harnessing these resources. Declining reserves and production, inefficient exploration and production activities, suboptimal resource management and distribution, regulatory and policy complexities, and environmental and social concerns have all hindered the effective utilization of these valuable resources. Therefore, addressing these multifaceted challenges through a comprehensive and coherent strategy is crucial for Pakistan to unlock the full potential of its mineral, oil, and gas resources and leverage them for sustainable economic growth and energy security through pertinent and pragmatic recommendations.

Scope of the Study

This study will take a comprehensive approach to analyzing the key factors and challenges influencing the development of Pakistan's extractive industries, including its mineral, oil, and gas resources. It will assess the scale of the country's resource potential, evaluate the policy and regulatory framework, examine the institutional capacity and governance structures, analyze the investment climate and financing mechanisms, appraise the technological capabilities and infrastructure, investigate the environmental and social impacts, and evaluate the overall economic contributions and diversification potential of the extractive sectors.

Literature Review

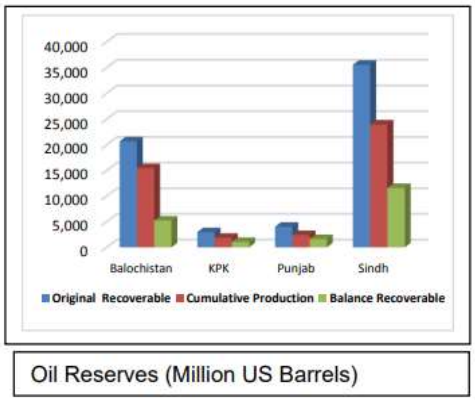
A qualitative approach was adopted for research on this topic. The task involved extracting specific information from secondary sources, such as analysis of reports, literature reviews, related rules/policies, and examining various brief and annual reports obtained from relevant stakeholder departments and oil & gas exploratory companies. The subsequent situational, comparative, and SWOT analyses further elaborated the requirements for pertinent and pragmatic recommendations.

1. Situational Analysis of Mineral & Oil & Gas Sectors

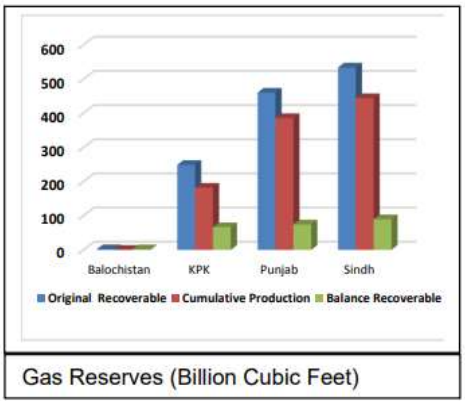
HIDDEN TREASURES	
Total mineralized area 600,000 square kilometers. Discovered Minerals 92 Mining companies 52 No. of Active Mines 5,000	
Key Mineral Resources (Estimated)	
• Total mineralized area 600,000 square kilometers. • Discovered Minerals 92 • Mining companies 52 • No. of Active Mines 5,000	• Silver: 620 million tons • Lead and zinc: 24 million tons • Manganese: 1.597 million tons • Chromite: 3 million tons • Iron ore: 1,450 million tons

Pakistan is undertaking a multi-pronged approach to enhance its road, rail, pipeline, port, and power infrastructure to unlock the economic potential of its extractive industries. This includes expanding and upgrading road networks to better connect resource-rich regions like Balochistan to major cities and ports, developing transportation projects under the China-Pakistan Economic Corridor, expanding and modernizing rail infrastructure, constructing new oil and gas pipelines, increasing storage and terminal capacities at ports, building new power generation and grid infrastructure to ensure a reliable electricity supply, and establishing specialized industrial parks and special economic zones near resource-rich areas to attract investment in downstream processing industries. These coordinated infrastructure development efforts aim to improve logistics, reduce transportation costs, enhance distribution, and create an enabling environment for the growth of Pakistan's mineral, oil, and gas sectors (ME&P, 2020).

Oil & Gas Reserves of Pakistan



Oil Reserves (Million US Barrels)



Gas Reserves (Billion Cubic Feet)

Source: Ministry of Energy, 2024

Pakistan's mineral, oil, and gas sectors are benefiting from advancements in areas such as advanced seismic imaging, digital oilfield solutions, enhanced oil recovery techniques, robotics and automation, and renewable energy integration. New 3D seismic imaging powered by AI is enabling more precise subsurface mapping to reduce exploration risks, while the integration of sensors, IoT, and data analytics is driving operational efficiencies, safety, and remote monitoring across the industry. Innovative Enhanced Oil Recovery (EOR) methods are extending the life of mature fields and increasing overall yield. Robotic and autonomous technologies are lowering costs and safety risks. Furthermore, oil and gas companies are adopting hybrid energy systems combining conventional and renewable sources to lower emissions and generate new revenue streams. These transformative technologies are expected to significantly boost Pakistan's ability to unlock and optimize the value of its natural resources in the coming years.

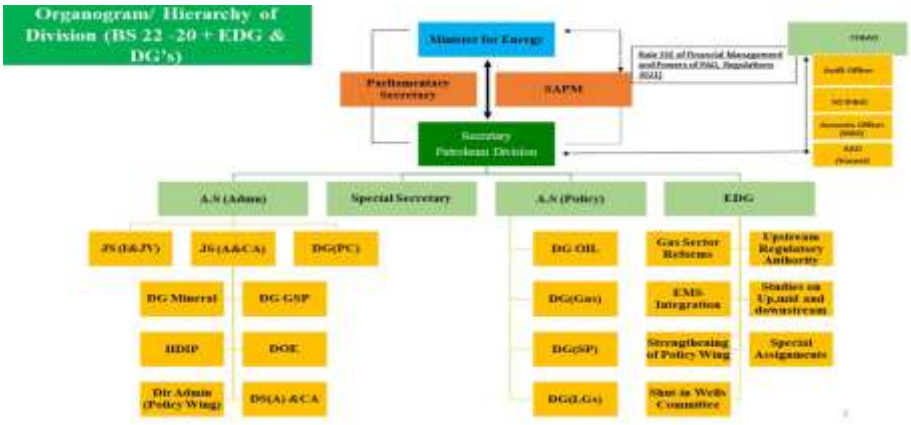
The provincial governments in Pakistan collect royalties from the extraction of minerals, oil, and gas, which are intended to provide financial benefits to the local communities affected by these activities. However, the distribution of these royalties has been uneven, and the actual impact on local development has been a source of contention. The extractive industries also have the potential to create direct and indirect employment opportunities for the local populations, and the development of supporting infrastructure, such as roads and power supplies, can also benefit the communities. Some extractive companies have established community development funds to support social, educational, and infrastructure projects, but the effective management and utilization of these funds to address the needs of the communities is crucial.

Before any extraction activities can commence, robust environmental impact assessments (EIAs) are conducted to identify and mitigate potential risks to water resources, air quality, biodiversity, and local communities. Effective water management strategies, including water recycling and conservation, are crucial to minimize the impact on local water supplies, while implementing best practices for air pollution control, such as the use of emission control technologies and regular monitoring, is essential to protect local air quality. The extraction and processing of resources also generate various types of waste, including hazardous waste, which must be properly handled and disposed of to prevent environmental contamination. Furthermore, extractive activities can lead to habitat destruction, fragmentation, and the displacement of wildlife, particularly in areas with sensitive or protected ecosystems, necessitating measures to preserve and restore biodiversity.

2. Regulatory & Institutional Analysis of Mineral & Oil & Gas Sectors

The legal and institutional analysis of the oil, gas, and minerals sector in Pakistan is crucial for ensuring the effective management and sustainable development of these sectors. It provides a framework for the formulation and implementation of policies, regulations, and laws that govern the exploration, production, and distribution of these resources. This analysis helps identify and address the challenges and issues faced by the sector, such as inadequate infrastructure, limited exploration, and regulatory barriers. It also ensures that the sector is governed in a way that balances federal and provincial interests, addresses environmental and social concerns, and contributes to the overall economic growth of the country. Furthermore, it helps create a favorable business environment, simplifies regulations, and improves infrastructure, which are essential for attracting investment and enhancing domestic production.

The Constitution of Pakistan provides a legal framework to govern the ownership, exploration, and development of the country's mineral, oil, and gas resources through articles like 154, 158, 161, and 172. The petroleum and mining sectors are primarily regulated through the Petroleum Exploration and Production Policy 2012 and the Mines and Minerals Development Act 1948, respectively, with provincial governments having jurisdiction over resources within their boundaries. Exploration and production activities are carried out through production sharing contracts and mineral licenses awarded by the relevant authorities, which specify terms like exploration periods, development plans, revenue sharing, and environmental compliance. Key regulatory bodies include the Ministry of Petroleum and Natural Resources, the Geological Survey of Pakistan, Provincial Mineral Development Corporations, and OGRA, which is a downstream body tasked with fixing prices of oil and gas. Environmental Protection Agencies work to balance the economic benefits with environmental and social considerations in the extractive industries.



Source: Ministry of Petroleum, 2024

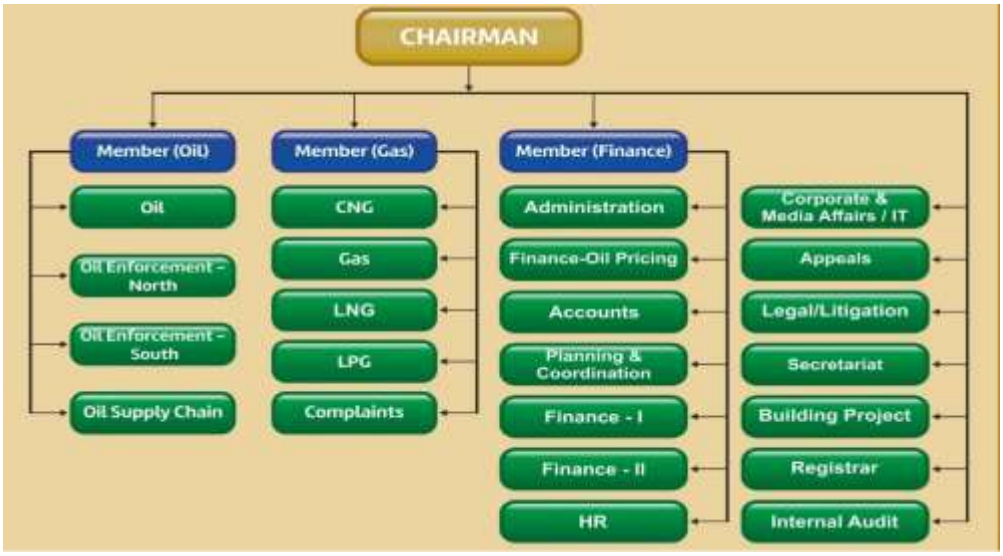
Oil & Gas Regulatory Authority (OGRA)

The Oil & Gas Regulatory Authority (OGRA) is the primary regulator of Pakistan's midstream and downstream oil and gas industry. It is responsible for formulating and fostering an effective regulatory framework to ensure the efficient and safe operation of the sector. OGRA's primary objectives include regulating the marketing and distribution of oil and gas products, ensuring compliance with technical standards, and handling complaints related to the sector.

OGRA's regulatory powers are derived from the OGRA Ordinance 2002 and the Pakistan Petroleum (Refining, Blending, and Marketing) Rules 1971, which were replaced by the Pakistan Oil (Refining, Blending, Transportation, Storage & Marketing) Rules 2016. The Authority is responsible for granting licenses to oil marketing companies, oil refineries, oil pipelines, oil storage facilities, and lubricant marketing companies, as well as for monitoring and enforcing compliance with these licenses.

OGRA's activities include coordinating with various government departments and agencies to ensure effective regulation of the sector. It also provides training to its employees and participates in international seminars and workshops to stay updated on best practices in the field. The Authority publishes regular reports on the state of the regulated petroleum industry and provides information on oil and gas prices, which are updated regularly.

Organogram of Oil & Gas Regulatory Authority (OGRA)



Source: OGRA, 2024

3. Comparative Analysis & Best Practices

The oil, gas, and mineral sectors in Pakistan and the United States differ significantly in scale, technological advancement, and economic impact. The U.S. boasts vast reserves and production capabilities, with proven oil reserves of around 44.2 billion barrels and natural gas reserves exceeding 450 trillion cubic feet (TCF), supported by advanced technologies such as hydraulic fracturing and horizontal drilling. This makes the U.S. a leading global producer and exporter of these resources. In contrast, Pakistan's oil reserves are modest at about 561 million barrels, and its natural gas reserves stand at approximately 19 TCF. Pakistan faces significant challenges, including outdated infrastructure, regulatory hurdles, and security concerns, which limit the full exploitation of its resources. While the U.S. mining sector is a significant contributor to its economy with advanced technologies and robust regulatory frameworks, Pakistan's mineral sector, despite having substantial deposits like those in Thar and Reko Diq, remains underdeveloped due to similar issues of infrastructure and investment.

The comparison of the Reko Diq copper-gold project in Balochistan, Pakistan, and the Pebble copper-gold project in Alaska, USA—two significant mining ventures—is used as a case study for analysis. Reko Diq, a joint venture between the Government of Balochistan and Barrick Gold, boasts a porphyry copper-gold deposit with estimated reserves of 5.9 billion tons of ore and 41.5 million ounces of gold. In contrast, Pebble, owned by Northern Dynasty Minerals, is a world-class porphyry deposit with substantial reserves of copper, gold, and molybdenum, estimated at 70.6 million tons of recoverable copper and 107.4 million ounces of gold. Both projects face unique challenges, including regulatory and legal hurdles, environmental concerns, and community resistance, which are compared in this study to highlight the differences in their approaches to these issues.

	Reko-Diq-Pakistan	**Northern Dynasty Minerals -Pebble – US**
Location and Geology	**Location**: Balochistan, Pakistan **Geology**: Porphyry copper-gold deposit with an estimated 5.9 billion tons of ore. **Ownership:** Joint venture between the Government of Balochistan and Barrick Gold	**Location**: Alaska, USA **Geology**: World-class porphyry deposit with substantial copper, gold, and molybdenum reserves. **Ownership:** Northern Dynasty Minerals
Economic Impact	Significant copper and gold reserves (41.5 million ounces of gold).	Estimated 70.6 million tons of recoverable copper, 107.4 million ounces of gold.
Regulatory and Legal Stability	Faces significant legal and regulatory uncertainty, including past disputes and changes in mining laws.	Operates within a more stable and predictable legal framework, despite facing stringent regulatory challenges.
Environmental Management	Limited engagement with local communities, leading to conflicts and resistance.	Has detailed environmental impact assessments and mitigation plans, although it faces strong opposition.
Community Engagement	Limited engagement with local communities, leading to conflicts and resistance.	More structured engagement with stakeholders, though still controversial.
Technological Advancement	Slower adoption of advanced mining technologies and best practices.	Higher integration of cutting-edge mining and environmental technologies.
Investment and Funding	Struggles with securing consistent funding and investment due to political and legal risks	More access to funding from established financial markets, despite environmental concerns.

4. SWOT Analysis

Oil Gas Regulatory Authority (OGRA)

"OGRA" stands for the Oil and Gas Regulatory Authority. It is a regulatory body in Pakistan responsible for overseeing and regulating the activities related to the oil and gas sector in the country. OGRA ensures compliance

with laws, rules, and regulations governing the exploration, production, refining, distribution, and marketing of oil and gas products. It plays a crucial role in ensuring fair competition, consumer protection, and the overall development of the oil and gas industry in Pakistan.

Strengths

1. **Regulatory Oversight**: Independent regulatory body overseeing the oil and gas sector, ensuring impartial decision-making and regulatory enforcement.
2. **Policy Formulation**: Involved in policy formulation and advises the government on matters related to the oil and gas industry, contributing to the development of the sector.
3. **Consumer Protection**: Works to protect consumer interests by regulating prices, ensuring quality standards, and promoting fair competition among companies.
4. **Licensing and Compliance**: Issues licenses and ensures compliance with regulations for entities involved in exploration, production, refining, distribution, and marketing.
5. **Technical Expertise**: Employs professionals with expertise in technical aspects, allowing for informed decision-making and effective regulation.
6. **Transparency**: Maintains transparency in its operations, decisions, and regulatory processes, fostering accountability and public trust.

Weaknesses

1. **Resource Constraints**: Faces limitations in terms of financial resources, staffing, and technical capabilities, which could hinder its ability to regulate the complex and dynamic oil and gas industry.
2. **Political Interference**: Like many regulatory bodies, OGRA might be susceptible to political pressure or influence, which could compromise its independence and impartiality in decision-making.
3. **Enforcement Challenges**: May encounter difficulties in enforcing regulations due to the vast geographic spread of oil and gas infrastructure, as well as illegal activities in the sector.
4. **Capacity Building**: Capacity-building efforts may be necessary in technological advancements and regulatory frameworks.
5. **Stakeholder Engagement**: Ensuring engagement with stakeholders, including industry players, government agencies, and civil society, could be challenging and may require enhanced communication and collaboration mechanisms.
6. **Regulatory Gaps**: May face challenges in keeping pace with rapid changes, leading to potential gaps in regulations or outdated policies that do not adequately address emerging issues.

Opportunities

1. **Policy Advocacy**: OGRA can advocate for policy reforms to promote investment, innovation, and sustainability. This could include advocating for renewable energy integration and supporting cleaner fuel standards.
2. **Technology Integration**: Embracing technological advancements such as digitalization, data analytics, and remote monitoring can enhance capabilities. This includes utilizing technologies for compliance verification and risk assessment.
3. **Diversification**: Explore opportunities to diversify its regulatory scope beyond traditional activities. This might involve regulating emerging sectors such as liquefied natural gas (LNG), renewable energy, and alternative fuels relevant in the energy transition.
4. **Capacity Building**: Investing in staff training and development programs can enhance proficiency in areas such as environmental impact assessments, safety management systems, and regulatory compliance auditing.
5. **International Collaboration**: Collaborating with international regulatory bodies and industry associations can facilitate knowledge exchange, align its regulatory standards with global best practices, and enhance the competitiveness of Pakistan's oil and gas sector.
6. **Public Engagement**: Strengthening public engagement and awareness initiatives can foster trust. This includes enhancing communication channels, conducting public consultations on regulatory decisions, and promoting consumer education on energy-related issues.

Threats

1. **Political Interference**: OGRA faces threats from political interference. Political pressures to manipulate prices, regulations, or licensing decisions may compromise its ability to enforce fair and transparent practices.
2. **Security Concerns**: The oil and gas infrastructure may be vulnerable to security threats such as sabotage, terrorism, or geopolitical tensions. These threats can disrupt operations, damage infrastructure, and pose risks to personnel safety.
3. **Economic Instability**: Economic instability, including currency devaluation, inflation, and fiscal deficits, can impact investment levels and project viability. Reduced investment may lead to supply shortages, price volatility, and regulatory challenges.
4. **Market Volatility**: Fluctuations in global oil prices and market demand create challenges in regulating price levels, managing supply chains, and ensuring energy security. Market volatility also impacts revenue streams for the government, affecting funding and operational capabilities.
5. **Environmental Risks**: Increasing awareness of environmental issues and climate change concerns pose regulatory challenges in ensuring

sustainable practices and compliance with environmental standards. Failure to address environmental risks could lead to public backlash, legal liabilities, and regulatory scrutiny.

6. **Technological Disruptions**: Rapid technological advancements, such as renewable energy integration, electric vehicles, and decentralized energy systems, pose challenges in adapting regulatory frameworks. Failure to embrace technological changes could result in regulatory gaps and market disruptions.

Ministry of Energy, Petroleum Division

The Ministry of Energy (Petroleum Division) in Pakistan is responsible for overseeing the country's oil, gas, and mineral sectors. It aims to ensure the availability and security of sustainable energy supplies to support economic development and meet the strategic requirements of the nation. The ministry has adopted an integrated approach to promote exploration, attract private investment, develop technical expertise, and optimize existing energy infrastructure. It oversees various attached departments, autonomous bodies, corporations, and companies that collectively work towards achieving the mission of catering to the energy needs of the people of Pakistan. Below is a SWOT analysis of the Ministry of Energy, Petroleum Division.

Strengths

1. **Policy and Regulation Framework**:
    - Existence of comprehensive energy policies and regulations aimed at improving the efficiency and sustainability of the energy sector.
2. **Government Support**:
    - Strong governmental backing and prioritization of the energy sector in national development plans.
3. **Resource Availability**:
    - **Natural Gas Reserves**: Pakistan has proven natural gas reserves of approximately 19 trillion cubic feet (Tcf) as of recent estimates.
    - **Oil Reserves**: Proven oil reserves stand at around 505 million barrels.
4. **Strategic Location**:
    - Pakistan is strategically located near major oil-producing countries and along key maritime trade routes, facilitating energy imports and exports.
5. **Human Capital**:
    - The country has a pool of skilled professionals in the petroleum sector, with several universities and institutions offering specialized degrees in petroleum engineering and energy management.

Weaknesses

1. **Infrastructure Deficiencies**:
    - **Pipeline Network**: Pakistan's pipeline infrastructure is inadequate and aging, with frequent reports of pipeline leaks and accidents.
    - **Refining Capacity**: The country's refining capacity is around 417,400 barrels per day (bpd), which is insufficient to meet domestic demand.
2. **Dependency on Imports**:
    - **Import Dependency**: Pakistan imports about 70% of its oil needs, making it vulnerable to global oil price fluctuations. In 2022, the import bill for petroleum products exceeded USD 17 billion.
3. **Regulatory and Bureaucratic Hurdles**:
    - Complex and slow regulatory processes can delay project approvals and deter investors. The Ease of Doing Business ranking for Pakistan remains a challenge, impacting investor confidence.
4. **Financial Constraints**:
    - Budgetary constraints and rising fiscal deficits limit the government's ability to invest in energy infrastructure. For example, the fiscal deficit for FY 2023 was around 6.9% of GDP.
5. **Energy Theft and Losses**:
    - Energy theft and losses in transmission and distribution are significant, with estimated losses around 20-30% in the gas sector alone.

Opportunities

1. **Exploration and Production**:
    - There are vast unexplored areas, particularly in offshore regions, with potential for significant oil and gas discoveries. Recent offshore exploration initiatives show promising prospects.
2. **Renewable Energy Integration**:
    - The government aims to increase the share of renewable energy to 30% of the total energy mix by 2030. Investment in solar, wind, and hydropower projects is on the rise.
3. **Technological Advancements**:
    - Adoption of modern extraction technologies such as hydraulic fracturing and horizontal drilling can boost domestic production. The introduction of digital technologies in monitoring and managing energy systems is also an area of growth.
4. **Foreign Investments**:
    - Initiatives like the China-Pakistan Economic Corridor (CPEC) include significant investments in the energy sector, with projects like the Gwadar LNG terminal and various power plants.

5. **Regional Energy Cooperation**:
    - Projects like the TAPI (Turkmenistan-Afghanistan-Pakistan-India) pipeline and the CASA-1000 (Central Asia-South Asia) electricity transmission project offer opportunities for regional cooperation and energy security.

Threats

1. **Political Instability**:
    - Political instability and security issues in the region can disrupt energy supply chains and deter investments.
2. **Environmental Concerns**:
    - Increasing environmental regulations and concerns over fossil fuel emissions are leading to stricter compliance requirements and potential penalties.
3. **Competition from Alternatives**:
    - Growing competition from alternative energy sources, such as renewables and electric vehicles, is reducing demand for traditional petroleum products.
4. **Global Energy Market Volatility**:
    - Fluctuations in global oil prices can severely impact the economy, as seen during the oil price crash in 2020 and the subsequent surge in 2022.
5. **Environmental Concerns**:
    - Increasing global and domestic pressure to reduce carbon emissions could lead to stricter regulations and higher costs for compliance. Pakistan's commitments under the Paris Agreement necessitate a shift toward greener energy sources.
6. **Competition from Alternatives**:
    - The global shift towards renewable energy and electric vehicles could reduce long-term demand for petroleum products. Countries are investing heavily in renewable technologies, which could outcompete traditional fossil fuels.

Pakistan Mineral Development Corporation (PMDC)

The Pakistan Mineral Development Corporation (PMDC) is a semi-autonomous corporation under the Ministry of Petroleum and Natural Resources, Government of Pakistan. Established in 1974, PMDC operates autonomously, with the primary objective of expanding and promoting mineral development activities in the country.

Strengths

1. **Government Support**: State-owned corporation, ensuring government support and backing for its operations and projects.
2. **Experience and Expertise**: PMDC has extensive experience in the mineral sector, particularly in exploration, development, and production.
3. **Infrastructure and Facilities**: The corporation has a network of offices, laboratories, and other facilities across Pakistan, providing a solid foundation for its operations.
4. **Access to Capital**: As a state-owned entity, PMDC has access to government funding and capital, which can be leveraged for new projects and investments.
5. **Strategic Partnerships**: PMDC can form strategic partnerships with other state-owned and private companies to enhance its capabilities and expand its reach.

Weaknesses

1. **Limited Resources**: PMDC's resources are limited, which hinders its ability to invest in new projects and expand its operations.
2. **Dependence on Government Funding**: The corporation's operations are heavily reliant on government funding, which can be unpredictable and subject to budget constraints.
3. **Limited Expertise in Certain Areas**: Despite its extensive experience in oil and gas exploration, it may lack expertise in other areas of the mineral sector, such as mining and metallurgy.
4. **Inefficient Operations**: PMDC's operations may be inefficient due to outdated infrastructure and lack of modern technology, which can impact its productivity and competitiveness.

Opportunities

1. **Unconventional Resources**: Pakistan has significant untapped unconventional oil and gas resources, which can be explored to increase the country's energy security.
2. **Mineral Sector Growth**: The mineral sector has significant growth potential, driven by increasing demand for minerals and metals globally.
3. **International Cooperation**: Collaboration with international companies and organizations to access new technologies, expertise, and markets will enhance its capabilities and competitiveness.
4. **Government Support for Diversification**: The government is promoting diversification of the economy, which can lead to increased investment in the mineral sector and new opportunities.

Threats

1. **Energy Crisis**: Pakistan faces a severe energy crisis, which can impact the demand for oil and gas and the overall performance of PMDC.
2. **Global Economic Uncertainty**: Global economic uncertainty can impact the demand for minerals and metals, affecting PMDC's operations and profitability.
3. **Competition from Private Companies**: Private and international companies can compete with PMDC for projects and resources, potentially impacting its market share and profitability.
4. **Environmental and Social Concerns**: Environmental and social concerns can lead to increased regulatory scrutiny and public opposition, impacting PMDC's operations and reputation.

5. GAP ANALYSIS OF THE MINERAL, OIL & GAS SECTORS

The gap analysis of the oil, gas, and mineral sectors of Pakistan reveals critical insights into the current state, desired state, and identified gaps within the sector. Currently, exploration and production activities in Pakistan are operating below their potential, coupled with challenges in resource management and regulatory complexities that impede efficient utilization and investment. The desired state aims to enhance exploration and production efforts, improve resource management practices, and streamline the regulatory framework to attract investment and optimize resource utilization. The identified gaps underscore the need to address limited exploration and production activities, inefficiencies in resource management, and regulatory complexities to bridge the existing disparities and propel the sector toward sustainable growth and development.

Current State

• **Limited Exploration and Production**: Exploration and production activities are below their potential.
• **Inefficient Resource Management**: Challenges in distribution and management hinder efficient utilization.
• **Regulatory Complexities**: Inefficient and misaligned regulatory frameworks deter investment.

Desired State

• **Increased Exploration and Production**: Enhance exploration activities to tap into untapped resources.
• **Efficient Resource Management**: Improve distribution and management practices for optimal utilization.

• **Streamlined Regulatory Framework**: Enhance regulatory efficiency and transparency to attract investment.

Gap

• **Exploration and Production**: Limited activities compared to potential resource reserves.
• **Resource Management**: Inefficiencies in distribution and utilization hinder optimal resource utilization.
• **Regulatory Framework**: Complexities and uncertainties deter investment and efficient resource management.

CHALLENGES

1. **Insufficient Exploration and Mapping of Resources**: The country's geological surveys and assessments of mineral, oil, and gas reserves are often outdated or incomplete, leading to uncertainties about the true potential of these resources. Lack of comprehensive data and information hinders effective resource planning and policy-making.
2. **Inadequate Infrastructure and Logistics**: Inadequate transportation networks, power supply, and water management systems in resource-rich areas impede the development of extraction and processing facilities. The absence of integrated infrastructure linking production sites to consumption centers and export markets reduces the overall competitiveness of the sector.
3. **Limited Access to Technology and Financing**: Domestic companies, especially small and medium-sized enterprises, lack access to advanced technologies, processing techniques, and management expertise required for efficient resource extraction and value addition. Difficulties in securing affordable financing from domestic and international sources constrain the industry's ability to invest in modernization and expansion.
4. **Regulatory Uncertainty and Institutional Weaknesses**:

   Inconsistent or unclear policies, lengthy approval processes, and overlapping jurisdictions of various government agencies create regulatory uncertainties for investors. Inadequate institutional capacity, coordination, and enforcement of existing laws and regulations undermine the effective governance of the extractive industries.

5. **Environmental and Social Concerns**:

   Lack of stringent environmental regulations and weak enforcement mechanisms lead to concerns about the environmental and social impact of resource extraction activities. Unresolved issues related to land rights, community displacement, and the equitable distribution of benefits from resource exploitation can fuel social tensions and conflicts.

6. **Skilled Labor Shortages and Brain Drain**:

The country faces a shortage of skilled professionals, technicians, and researchers required for the operation and maintenance of advanced extraction and processing facilities. Lack of adequate training and career development opportunities, as well as competition from better-paying jobs abroad, result in the brain drain of talented individuals from the extractive industries.

7. **Limited Domestic Demand and Export Competitiveness**:

The relatively small size of the domestic market and limited purchasing power of the population constrain the growth of local demand for value-added products from the extractive industries. Pakistani manufacturers often struggle to match the price and quality of imported mineral-based materials, chemicals, and refined petroleum products, hampering their export competitiveness.

8. Major Short comings

Short Comings	Area of Improvement
Mineral Sector 1. **Outdated Legislation:** The **Mines Act 1923** and the **Regulation of Mines and Oilfields and Mineral Development (Government Control) Act 1948** are outdated and may not fully address modern mining practices and environmental concerns. 2. **Lack of Comprehensive Environmental Regulation:** The **Pakistan Environmental Protection Ordinance 1997** is general and not tailored specifically to the mining sector, which needs more stringent and specific environmental regulations. 3. **Fragmented Institutional Framework:** The responsibilities are spread across multiple organizations (Ministry of Industry & Production, Geological Survey of Pakistan, Pakistan Mineral Development Corporation, Provincial Mineral Development Corporations), leading to potential overlaps and inefficiencies.	1. **Modernize Legislation:** Update the Mines Act 1923 and other relevant laws to include modern mining practices, technology, and stringent environmental standards. 2. **Enhance Environmental Regulations:** Develop specific environmental regulations for the mining sector, ensuring sustainable mining practices and minimizing environmental degradation. 3. **Streamline Institutional Framework:** Consolidate and clarify the roles of various institutions to reduce overlaps and improve coordination. Establish a single-window operation for licensing and regulatory approvals. 4. **Invest in Technology and Training** Increase funding for institutions like GSP and PMDC to adopt modern geological survey techniques and

4. **Limited Technological Advancement:** Institutions like the Geological Survey of Pakistan (GSP) and Pakistan Mineral Development Corporation (PMDC) are often underfunded and lack modern technological tools and expertise	mining technologies. Conduct regular training programs for personnel.
Oil & Gas Sector 1. **Complex Regulatory Environment:** Multiple regulations (e.g., Pakistan Petroleum (Production) Rules 1949, Pakistan Petroleum (Exploration & Production) Rules 1986, 2001, 2009, 2013, etc.) create a complex legal environment that can deter investment due to bureaucratic delays. 2. **Inconsistent Policy Implementation:** Inconsistent application and frequent changes in policies like the Petroleum Exploration and Production Policy 2012 can create uncertainty for investors. 3. **Regulatory Overlap:** Overlapping roles of the **Ministry of Energy (Petroleum Division)** and the **Oil and Gas Regulatory Authority (OGRA)** can lead to inefficiencies and delays in decision-making. 4. **Insufficient Data Management:** Lack of a centralized and updated database for exploration and production activities hinders effective monitoring and planning.	1. **Simplify Regulatory Framework:** Streamline and consolidate various regulations into a single comprehensive legal framework to reduce complexity and improve clarity for investors. 2. **Ensure Policy Consistency:** Implement consistent and stable policies to provide a predictable investment environment. Establish mechanisms for regular review and feedback to adapt policies without frequent overhauls. 3. **Improve Coordination between Institutions:** Clearly delineate the responsibilities of the Ministry of Energy and OGRA to avoid overlaps. Enhance inter-agency communication and coordination mechanisms. 4. **Develop Centralized Data Management System:** Invest in creating a centralized database for oil and gas exploration and production data. This will improve transparency, monitoring, and decision-making processes.

Conclusion

The study on tapping Pakistan's oil, mineral, and gas sectors for economic growth highlights the significant potential of these sectors in contributing to the country's economic development. The study emphasizes the need to address the challenges faced by these sectors, including inadequate infrastructure, limited exploration activities, and regulatory barriers. The conclusion underscores the importance of strategic planning and policy reforms to unlock the full potential of these sectors. It suggests that the government should focus on creating a favorable business environment by simplifying regulatory processes, improving infrastructure, and providing incentives for foreign investment. Additionally, the study recommends enhancing domestic production and reducing import dependency through the development of local refining capacities and exploration of new oil and gas reserves. The study concludes that Pakistan's mineral, oil, and gas sectors have significant potential to contribute to the country's economic growth, but they require strategic planning and policy reforms to overcome the challenges they face.

Recommendations

S#	Recommendation	Action By	Timeline
1	**Infrastructure Upgrades:** • Accelerate the expansion and modernization of road, rail, pipeline, and port infrastructure to improve connectivity between resource-rich regions and economic hubs, as well as enhance transportation and distribution capabilities. • Prioritize the timely completion of the China-Pakistan Economic Corridor (CPEC) projects related to energy, transportation, and logistics to unlock synergies. • Invest in building new power generation capacity, transmission networks, and grid infrastructure to ensure reliable electricity supply to support energy-intensive extractive industries.	Ministry of Planning Division	Immediate
2	**Regulatory Reforms:** • Review and update the Petroleum Exploration and Production Policy, as well as provincial mining policies, to provide a clear, stable, and investor-friendly regulatory framework.	Parliament of Pakistan, Ministry of Energy (Petroleum Division)	Medium Term

	• Streamline licensing and approval processes for exploration, development, and production activities to reduce administrative delays. • Strengthen coordination between Federal and provincial authorities to ensure coherent policymaking and effective implementation. • Enhance environmental regulations and enforcement to mitigate the impact of extractive operations.		
3	**Technology Adoption:** • Actively promote the adoption of advanced technologies like 3D seismic imaging, digital oilfield solutions, enhanced oil recovery techniques, and robotics/automation among local operators. • Collaborate with international technology providers and research institutions to facilitate knowledge transfer and build local capabilities. • Incentivize investments in renewable energy integration and emissions-reduction technologies to support the sustainability of the extractive sectors.	Ministry of Energy with help of ICT Department and Energy & Power Department	Long Term
4	**Capacity Building:** • Invest in developing a skilled workforce through technical and vocational training programs tailored to the extractive industries. • Establish centers of excellence and research institutions to foster innovation and technological progress in the sector. • Encourage public-private partnerships and international collaborations to bring in global best practices and expertise.	Ministry of Energy	Medium Term
5	**Re-structuring of Organizations** • Organization of DGPC with considerable n meaningful influence of the provinces in decision making, especially after the 18th Amendment. • An Up stream regulatory authority by the name of Pakistan Mines, Mineral and Petroleum Upstream Regulatory Authority is the need of the hour	Federal Govt	Long Term

Log Frame Matrix

Goal	Indicators	Sources of Verification	Assumptions
Enhance the contribution of mineral, oil, and gas sectors to Pakistan's economic development.	Increased GDP contribution from the extractive industries Growth in infrastructure projects completion Number of new investments and technological adoptions in the sectors Number of skilled workers trained Fulfillments of corporate sectors responsibilities	National economic reports Ministry of Planning Division reports Investment records Training institution records Progress review meetings and reports Monitoring inspection and reports	Political stability Continued government support Effective policy implementation Sustained development and prosperity Involvement and ownership of the locals Conducive security situation

Outcomes	Indicators	Sources of Verification	Assumptions
1. Improved infrastructure	Number of infrastructure projects completed Enhanced connectivity between regions	- Project completion reports Transport and logistics records	- Sufficient funding Timely project execution
2. Streamlined regulatory environment	- Updated and clear regulatory policies Reduced administrative delays Enhanced coordination between authorities	- Government policy documents Licensing and approval records Inter-departmental communication records	- Stakeholder cooperation Effective policy review
3. Adoption of advanced technologies	- Number of new technologies adopted Collaborations with international technology providers Investments in renewable energy integration	- Technology adoption records Collaboration agreements Investment reports	- Availability of technology Willingness to invest
4. Developed skilled workforce	- Number of technical and vocational training programs Establishment of centers of excellence Public-private partnerships in training initiatives	- Training program records Establishment documents Partnership agreements	- Interest from potential trainees Support from private sector

Outcome .1:- Infrastructure Development

Proposed Action	Responsibilities	Resources	Timeline	Key Performance Indicators
Expand and upgrade road networks	Ministry of Energy, Ministry of Planning Division	Funding for infrastructure projects, technical expertise	Immediate	Improved connectivity between resource-rich regions and economic hubs
Develop China-Pakistan Economic Corridor (CPEC) transportation projects	Ministry of Energy, Ministry of Planning Division	Funding for CPEC projects, technical expertise	Immediate	Enhanced synergies between energy, transportation, and logistics sectors
Expand and modernize rail infrastructure	Ministry of Energy, Ministry of Planning Division	Funding for infrastructure projects, technical expertise	Immediate	Improved transportation capabilities
Construct new oil and gas pipelines	Ministry of Energy, Ministry of Planning Division	Funding for infrastructure projects, technical expertise	Immediate	Enhanced distribution capabilities
Increase storage and terminal capacities at ports	Ministry of Energy, Ministry of Planning Division	Funding for infrastructure projects, technical expertise	Immediate	Improved logistics and distribution
Build new power generation and grid infrastructure	Ministry of Energy, Ministry of Planning Division	Funding for infrastructure projects, technical expertise	Immediate	Reliable electricity supply to support energy-intensive extractive industries

Out-come .2:- Stream line Regulatory Environment

Proposed Action	Responsibilities	Resources	Timeline	Key Performance Indicators
Review and update the Petroleum Exploration and Production Policy and provincial mining policies	Ministry of Energy, Ministry of Planning Division	Funding for policy development, technical expertise	Immediate	Clear, stable, and investor-friendly regulatory framework
Streamline licensing and approval processes for exploration, development, and production activities	Ministry of Energy, Ministry of Planning Division	Funding for regulatory development, technical expertise	Immediate	Reduced administrative delays
Strengthen coordination between federal and provincial authorities	Ministry of Energy, Provincial Governments	Funding for coordination, technical expertise	Immediate	Coherent policymaking and effective implementation

Out-come 2.1: - Re-structuring of Organizations

Proposed Action	Responsibilities	Resources	Timeline	Key Performance Indicators
Re-organize DGPC with meaningful provincial influence	Ministry of Energy, Provincial Governments	Funding for organizational re-structuring, technical expertise	Long-term	Effective decision-making and coordination
Establish Pakistan Mines, Mineral and Petroleum Upstream Regulatory Authority	Ministry of Energy, Ministry of Planning Division	Funding for regulatory development, technical expertise	Long-term	Effective regulation of upstream activities

Consolidate and clarify the roles of various institutions to reduce overlaps and improve coordination	Ministry of Energy, Ministry of Planning Division	Funding for institutional consolidation, technical expertise	Immediate	Improved coordination between institutions, reduced bureaucratic delays
Establish a single-window operation for licensing and regulatory approvals	Ministry of Energy, Ministry of Planning Division	Funding for single-window operation, technical expertise	Immediate	Simplified regulatory processes, reduced administrative delays

Out-come.3:- Technology and Innovation

Proposed Action	**Responsibilities**	**Resources**	**Timeline**	**Key Performance Indicators**
Adopt advanced seismic imaging and digital oilfield solutions	Extractive companies	Funding for technology adoption, technical expertise	Immediate	Improved exploration and production efficiency
Implement enhanced oil recovery techniques	Extractive companies	Funding for technology adoption, technical expertise	Immediate	Increased oil recovery rates
Integrate renewable energy sources	Extractive companies	Funding for technology adoption, technical expertise	Immediate	Reduced emissions and increased energy security

Out-come 4: - Capacity Building and Training

Proposed Action	Responsibilities	Resources	Timeline	Key Performance Indicators
Invest in developing a skilled workforce through technical and vocational training programs	Ministry of Energy, Ministry of Planning Division	Funding for training programs, technical expertise	Immediate	Skilled workforce in extractive industries
Establish centers of excellence and research institutions	Ministry of Energy, Ministry of Planning Division	Funding for centers of excellence, technical expertise	Immediate	Innovation and technological progress in extractive sectors

Out-come 4.1: - Community Engagement and Development

Proposed Action	Responsibilities	Resources	Timeline	Key Performance Indicators
Establish community development funds	Extractive companies	Funding for community development, technical expertise	Immediate	Effective management and utilization of community development funds
Implement robust environmental impact assessments and mitigation measures	Extractive companies	Funding for environmental assessments, technical expertise	Immediate	Minimized environmental and social impacts

Out-come 4.2: - Environmental and Social Concerns

Proposed Action	Responsibilities	Resources	Timeline	Key Performance Indicators
Conduct robust environmental impact assessments	Extractive companies	Funding for environmental assessments, technical expertise	Immediate	Minimized environmental impacts
Implement best practices for air pollution control	Extractive companies	Funding for air pollution control, technical expertise	Immediate	Protected local air quality
Implement effective water management strategies	Extractive companies	Funding for water management, technical expertise	Immediate	Minimized impact on local water supplies
Implement measures to preserve and restore biodiversity	Extractive companies	Funding for biodiversity preservation, technical expertise	Immediate	Preserved local ecosystems

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