ESG Practices in the Mining Industry: A Study of Environmental and Social Sustainability in Chhattisgarh

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Abstract: *Chhattisgarh's industrial and economic growth is greatly influenced by the mining sector. Rich natural resources, like as coal, iron ore, limestone, bauxite, and other minerals, are abundant in the state and support infrastructure development, job creation, industrial output, and government income. Deforestation, land degradation, air and water pollution, relocation, loss of traditional livelihoods, and strain on local people' natural resources are only a few of the environmental and social issues that mining operations bring about.*

In this regard, encouraging ethical mining and sustainable economic growth has made Environmental, Social, and Governance (ESG) practices more crucial. Mining businesses may evaluate their environmental effect, social responsibility, and governance requirements using an integrated framework provided by ESG. Water management, pollution prevention, biodiversity preservation, and mining rehabilitation are the main objectives of the environmental component. Community welfare, the preservation of tribal livelihoods, the creation of jobs, occupational health and safety, and the rehabilitation of impacted communities are all highlighted by the social component. Transparency, regulatory compliance, accountability, and stakeholder involvement are all included in the governance component.

The current research looks at ESG practices in Chhattisgarh's mining sector, with a focus on social and environmental sustainability. Additionally, it examines the significance of the Forest Rights Act of 2006, the District Mineral Foundation (DMF), the Pradhan Mantri Khanij Kshetra Kalyan Yojana (PMKKKY), and corporate sustainability reporting in promoting ethical mining practices. Based on secondary data gathered from government reports, policy papers, statutory publications, and scholarly literature, the study uses a descriptive and analytical research approach.

Stronger environmental monitoring, sustainable livelihood programs, community involvement, and transparent use of mineral development money are all necessary, according to the report, which emphasises the need of incorporating ESG principles into mining operations. In order to guarantee that mineral wealth contributes to equitable economic growth, environmental preservation, and long-term social development in Chhattisgarh, it is concluded that ESG practices should become an essential component of mining strategy.

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Introduction

The mining sector is crucial to economic growth, especially in states like Chhattisgarh that are rich in minerals. For sectors like steel, electricity generation, cement, aluminium, and infrastructure development, mineral resources provide vital raw materials. Additionally, the mining industry supports regional economic activity, government income, industrial investment, and the creation of jobs.

One of India's major mineral-producing states is Chhattisgarh. Coal, iron ore, limestone, bauxite, dolomite, tin, and other minerals are among its principal mineral resources. Korba, Raigarh, Surguja, Balod, Dantewada, and Bastar are significant mining areas. The expansion of thermal power plants, the steel and cement industries, and other mineral-based businesses has been aided by these natural resources.

Mining is linked to a number of environmental and social issues despite its economic significance. Deforestation, land degradation, biodiversity loss, air pollution, water contamination, and altered local ecosystems are all possible outcomes of large-scale mineral extraction. Tribal and forest-dependent groups' traditional means of subsistence may potentially be impacted by mining activities.

Local inhabitants in many of Chhattisgarh's mineral-rich regions rely on agriculture, forestry, small-scale forest products, and traditional jobs. Their income, employment, health, and general quality of life may be impacted by changes in land use and the availability of natural resources brought on by mining.

Therefore, mining-related economic development has to be balanced with social responsibility and environmental preservation

As a strategy for ethical corporate management, the idea of Environmental, Social, and Governance (ESG) has grown in significance. ESG pushes companies to include social welfare, ethical governance, and environmental preservation into their business choices.

Because mining activities directly affect land, water, forests, biodiversity, workers, and local people, ESG principles are especially crucial in the mining sector.

Companies must limit ecological harm and rehabilitate regions that have been mined out in order to be environmentally sustainable. Protecting community rights, job opportunities, health, education, and livelihood security are all necessary for social sustainability. Transparency, accountability, regulatory compliance, and significant stakeholder involvement are necessary for sustainable governance.

The implementation and importance of ESG practices in Chhattisgarh's mining sector are examined in this research, with an emphasis on social and environmental sustainability.

Background of the Study

The industrial development of Chhattisgarh is inextricably linked with its mineral economy. Iron ore helps the steel sector, limestone helps make cement, and coal mining aids the creation of thermal electricity.

Industrial operations connected to mining are concentrated in a number of the state's areas. While Bailadila in Dantewada is well-known for its iron ore mining, Korba is a significant coal and power-producing district. Important areas related to mineral extraction and mineral-based businesses include Raigarh and Surguja.

Economic possibilities have been generated by the growth of mining operations. But it has also made social protections, environmental management, and ethical business practices more important.

ESG has become a key paradigm for evaluating businesses' sustainability performance in recent years. Businesses are under growing pressure from investors, authorities, governments, and local communities to exhibit ethical environmental and social practices.

Statement of the Research Problem

Although mining operations are crucial for economic and industrial growth, their effects on the environment and society raise serious sustainability issues.

Mining activities occur in areas of Chhattisgarh where traditional livelihoods, agricultural land, and forests are significant sources of community income and survival.

Ecological stability may be impacted by environmental issues such deforestation, land degradation, water pollution, and air pollution. In a similar vein, populations impacted by mining may experience limited access to development opportunities, occupational health concerns, livelihood insecurity, and displacement.

Despite the introduction of corporate sustainability programs and government laws, a comprehensive analysis of the efficacy of ESG implementation is necessary.

Determining whether current ESG practices in the mining sector sufficiently address environmental sustainability and social development issues in Chhattisgarh is the main study challenge.

As a result, the study looks at the social and environmental aspects of ESG and finds ways to enhance ethical mining operations.

Review of Literature

The following themes can be used to analyse the literature on ESG and mining sustainability.

4.1 Sustainable Business Practices and ESG

ESG has grown to be a significant framework for assessing an organization's non-financial performance. By adding social responsibility, environmental duty, and governance norms, it expands on the conventional emphasis on profitability.

The environmental dimension looks at how natural resources are used, pollution control, dangers associated with climate change, and biodiversity preservation. The social dimension takes into account stakeholder participation, community connections, human rights, and employee wellbeing. Accountability, openness, and moral business practices are the main concerns of the governance dimension.

ESG is especially important for mining firms since their activities may have long-term effects on the environment and society.

4.2 Sustainability of the Environment in Mining

In the mining sector, environmental sustainability is a top priority. Forests, land, water resources, air quality, and biodiversity may all be impacted by mining operations.
The significance of scientific mine planning, pollution control, effective resource use, land reclamation, waste management, and mine closure planning is emphasised in sustainable mining literature.

The full mining life cycle, including exploration, extraction, transportation, processing, and post-mining rehabilitation, must be covered by environmental management.

4.3 Community Welfare and Social Sustainability

The potential of economic activity to enhance human well-being while defending the rights and interests of impacted communities is referred to as social sustainability.

Social sustainability in mineral-rich tribal areas encompasses community involvement, economic possibilities, healthcare and education access, rehabilitation, and the preservation of traditional livelihoods.

Subject to its provisions, the Forest Rights Act of 2006 offers a significant legal foundation for acknowledging the rights of Scheduled Tribes and other traditional forest residents.

4.4 Social Development and the District Mineral Foundation

The Mines and Minerals (Development and Regulation) Act of 1957 established the District Mineral Foundation.

It seeks to safeguard the rights of people and places impacted by mining-related activities.

Guidelines for using DMF funding for development initiatives such drinking water, healthcare, education, sanitation, environmental protection, and livelihood development are provided by the PMKKKY framework.

These strategies are crucial to comprehending the mining industry's social sustainability component.

4.5 Reporting on Corporate Sustainability

Companies can inform stakeholders about their environmental, social, and governance performance through sustainability reporting.

The Business Responsibility and Sustainability Reporting framework was introduced by SEBI in India for some listed firms.

Information about environmental performance, workers, communities, ethical business practices, and corporate governance may be reported on an organised basis thanks to BRSR.

4.6 Research Deficit

Environmental protection, corporate social responsibility, tribal development, and sustainable mining are all covered individually in existing literature and policy texts.

An integrated regional research that looks at how ESG practices affect social and environmental sustainability in Chhattisgarh's mining sector is necessary, nevertheless.

By analysing environmental management, social responsibility, tribal livelihood protection, and institutional procedures under a unified ESG framework, the current study aims to close this gap.

Objectives of the Study

The major objectives are:

1. To examine the concept and importance of ESG practices in the mining industry.
2. To study environmental sustainability practices adopted in the mining sector of Chhattisgarh.
3. To examine the social impact of mining activities on tribal and mining-affected communities.
4. To analyse the role of DMF and PMKKKY in promoting social sustainability.
5. To assess the importance of corporate social responsibility and sustainability reporting in responsible mining.
6. To identify major challenges in the implementation of ESG practices.
7. To suggest measures for strengthening environmental and social sustainability in the mining industry.

Research Methodology

6.1 Design of Research

The study uses a descriptive and analytical research design to look at ESG practices in Chhattisgarh's mining sector.

6.2 Character of the Research

The study examines current government policies, legal rules, corporate disclosures, and published literature and is based on secondary data.

6.3 Data Sources

The following are the main sources of secondary data: • India's Ministry of Mines. The Indian Bureau of Mines.

- The Ministry of Climate Change, Forests, and Environment.
- The Chhattisgarh government. reports from the District Mineral Foundation.
- The sustainability and annual reports of Coal India Limited.
- Annual and sustainability reports from NMDC Limited.
- Sustainability and Business Responsibility Reporting papers from SEBI.
- Reports from the auditor general and comptroller.
- Books, scholarly publications, and research journals.

6.4 Geographic Range

The study examines Chhattisgarh, paying particular attention on areas that produce minerals and are impacted by mining, such as:

- Korba
- Raigarh
- Surguja
- Dantewada
- Bastar

These places offer a local setting for investigating the social and environmental aspects of mining.

6.5 Study Period

Subject to the availability and comparability of secondary data, the analysis takes into account pertinent policy developments and published information from 2015 to 2026.

6.6 Framework for Analysis

The following ESG dimensions are used in the study:
Sustainability of the Environment

- Controlling air pollution. Conserving water.
- Restoration of land.
- Preservation of biodiversity. The management of waste.
- Mine rehabilitation and closure
- Sustainability in Society

- Protection of tribal livelihoods.
- Creating jobs.
- Safety and health at work.
- Education and healthcare. Resettlement and rehabilitation.
- Engagement with the community.
- Empowerment of women.
- Oversight Adherence to regulations.
- Corporate responsibility.
- Clear reporting.
- Using DMF funds. Participation of stakeholders.

ESG Practices in the Mining Industry

7.1 Ecological Methods

One of the most crucial components of ethical mining is environmental sustainability.
Mining firms must make sure that the exploitation of minerals does not harm the environment needlessly or permanently.
The following procedures are crucial.

A. Control of Air Pollution

Dust is produced by excavation, drilling, blasting, crushing, transporting, and mineral processing in mining activities.
Crucial actions consist of
1. Sprinkling mine routes with water.
2. Dust suppression system installation.
3. Mineral transportation that is covered.
4. Constant observation of the quality of the surrounding air.
5. Using equipment that uses less energy and is cleaner.

B. Water Management and Conservation

Groundwater and surface water resources may be impacted by mining operations
The following are examples of sustainable water management techniques:
1. Rainwater collection.
2. Process water recycling and reuse.
3. Mine discharge treatment.
4. Consistent groundwater quality monitoring.
5. The creation of buildings that save water.

C. Mine Reclamation and Land Restoration

Mining has the potential to alter the physical composition of land and impact agricultural output.
Mining responsibly necessitates:
1. Planning for scientific mine closure.
2. Backfilling mined-out sections where it is physically possible
3. Ecological restoration and planting.

4. Restoring degraded land
5. Observation of regions that have been rehabilitated.

D. Preservation of Biodiversity

Mining operations may disrupt biological processes and natural habitats in forest areas.
Mining enterprises should safeguard vulnerable ecosystems, minimise needless forest disturbance, conduct biodiversity assessments, and put suitable restoration methods in place.

E. Management of Waste

Overburden and garbage from mining should be handled scientifically.
Resource efficiency may be increased and environmental harm can be minimised via waste reduction, reuse, recycling, and safe disposal.

7.2 Practices of Social Sustainability

Social sustainability guarantees that mining operations benefit local communities and labourers.
This aspect is especially crucial in Chhattisgarh as mining activities may have an impact on tribal and forest-dependent communities.

A. Protection of Tribal Livelihoods

Forests, agriculture, livestock, and small forest products are the main sources of income for many indigenous families.
Alternative and supplemental livelihood alternatives should be supported by ethical mining practices.
Among the recommended actions are:
1. Youth skill development in the area.
2. The advancement of agriculture and related fields.
3. The growth of small businesses based on forest products.
4. Self-help groups are supported.
5. The growth of entrepreneurship.
6. Local job openings.

B. Creation of Jobs

In addition to offering vocational training, mining corporations have also support hiring competent local applicants.
Youth in the area may become more employable via technical training, safety education, and skill development.

C. Medical Care and Workplace Safety

While surrounding populations may encounter environmental health concerns, mining personnel may face occupational dangers.
Among the significant efforts are:
1. Regular physicals.
2. Training on occupational safety.
3. Emergency medical centers.

4. Monitoring exposure to noise and dust.
5. Health care initiatives for local communities.

D. Learning and Developing Skills

A key element of long-term social development is education.
Development organisations and mining firms may assist:
1. The facilities of schools
2. Scholarships.
3. Online learning resources.
4. Vocational and technical education.
5. Entrepreneurship and career counselling programs

E. Resettlement and Rehabilitation

Rehabilitation should safeguard the rights, livelihood, and dignity of impacted families when land acquisition or relocation takes place.
Sustainable restoration may not be guarantyd by compensation alone. Access to vital services and long-term livelihood restoration are also critical**.**

F. Empowerment of Women

Opportunities for employment, entrepreneurship, skill development, and involvement in local decision-making should be made available to women in areas impacted by mining.
Supporting women's small businesses and self-help organisations may increase family income and promote social inclusion.

ESG and the Mining Sector of Chhattisgarh: Regional Analysis

8.1 Korba: Coal Mining and Environmental Sustainability

Korba is an important coal-producing region of Chhattisgarh and is also associated with thermal power generation.
The region provides an important context for studying the environmental impact of coal mining and associated industrial activities.
Major sustainability concerns include:

- Dust and air pollution.
- Management of mine overburden.
- Water quality.
- Land degradation.
- Rehabilitation of mined-out areas.
- Occupational health and safety.

ESG practices in this region should emphasise air-quality monitoring, water conservation, scientific mine closure and community healthcare.

8.2 Raigarh: Mining, Industry and Community Development

Raigarh is an important industrial and mineral-producing district.
Coal mining and mineral-based industries create economic opportunities but also require effective environmental management.

Important ESG priorities include:

- Industrial pollution control.
- Sustainable water management.
- Local employment.
- Community healthcare.
- Skill development.
- Transparent environmental reporting.

8.3 Surguja: Mining and Forest-Based Livelihoods

Surguja and adjoining regions are important from the perspective of natural resources, forests and tribal livelihoods.

Mining-related development must consider the relationship between forest resources, agriculture and community welfare.

ESG priorities should include:

- Protection of forest ecosystems.
- Recognition of applicable community and individual forest rights.
- Sustainable livelihood development.
- Community consultation.
- Environmental rehabilitation.

8.4 Dantewada: Iron Ore Mining and Tribal Development

Dantewada is known for iron ore resources, particularly the Bailadila mining region.

The district is important for examining the relationship between mineral development, tribal communities and environmental sustainability.

Important ESG priorities include:

- Responsible mineral extraction.
- Biodiversity conservation.
- Local employment and skill development.
- Community infrastructure.
- Livelihood diversification.
- Participatory development planning

8.5 Bastar: Natural Resources and Inclusive Development

Bastar provides an important context for studying the relationship between mineral development, forest-dependent livelihoods and social inclusion.

Responsible development should ensure that economic activities respect applicable environmental safeguards, community rights and local development priorities.

Role of Government Policies in ESG Implementation

9.1 The 1957 Mines and Minerals (Development and Regulation) Act

The legal foundation for mineral development and regulation in India is provided by the MMDR Act.

Its District Mineral Foundation provisions provide an institutional framework for addressing the concerns of individuals and regions impacted by mining.

9.2 DMF, or the District Mineral Foundation

One important institutional tool for improving the socioeconomic circumstances of those impacted by mining is the District Mineral Foundation.

Development initiatives in sectors like these may be supported with DMF funds:

- Water consumption.
- Medical treatment.
- Learning.
- Hygiene.
- Preservation of the environment.
- The creation of livelihood.
- The development of skills.
- Development of infrastructure.

As a result, DMF is crucial to the social and governance aspects of ESG.

9.3 PMKKKY, or Pradhan Mantri Khanij Kshetra Kalyan Yojana

In order to guarantee that those impacted by mining operations get the proper development benefits, PMKKKY was implemented in 2015.

The program's main goals are to raise the living conditions of impacted communities and lessen the negative effects of mining.

The foundation for the planning and use of DMF funding was reinforced by the updated rules released in January 2024.

9.4 The 2006 Forest Rights Act

For qualifying Scheduled Tribes and other traditional forest inhabitants, the Forest Rights Act acknowledges their individual and collective forest rights.

In Chhattisgarh's tribal areas, where woods support traditional livelihoods and cultural identity, the Act is crucial.

Its rules and appropriate Gram Sabha procedures are crucial to development in forest regions that is socially responsible.

9.5 Evaluation of the Environmental Impact

An essential tool for determining and assessing the possible environmental effects of proposed developments is environmental impact assessment.

In accordance with relevant environmental rules, it facilitates environmental planning, impact assessment, and the development of mitigation strategies.

9.6 Social Responsibility of Businesses

The legislative basis for CSR duties is provided under Section 135 of the Companies Act, 2013, for businesses that satisfy the qualifying requirements.

CSR initiatives pertaining to healthcare, education, sanitation, skill development, and community welfare may be undertaken by mining firms.

ESG performance and CSR initiatives are connected but not the same. Environmental hazards, corporate behaviour, employee welfare, and corporate governance are all included in ESG.

9.7 Reporting on Sustainability and Business Responsibility

The disclosure of environmental, social, and governance information by some listed businesses is strengthened under SEBI's BRSR framework.
It informs stakeholders about ethical business practices and corporate sustainability.

Analysis of ESG Practices in the Mining Industry

The following analytical framework summarises the major ESG practices relevant to the mining industry of Chhattisgarh.

ESG dimension	Major practices	Expected sustainability outcome
Environmental	Air pollution control	Improved air quality
Environmental	Water conservation	Sustainable water resources
Environmental	Land restoration	Ecological rehabilitation
Environmental	Biodiversity protection	Conservation of ecosystems
Environmental	Waste management	Reduced environmental damage
Social	Local employment	Improved income opportunities
Social	Healthcare facilities	Better community health
Social	Education and training	Human resource development
Social	Tribal livelihood protection	Reduced livelihood insecurity
Social	Women's empowerment	Greater economic inclusion
Governance	DMF transparency	Better accountability
Governance	Social audits	Improved monitoring
Governance	Community participation	Inclusive development

10.1 Environmental Performance Indicators

Environmental performance should be evaluated through measurable indicators.

Indicator	Measurement
Air quality	Ambient PM10 and PM2.5 levels
Water quality	Water quality test results
Land restoration	Area rehabilitated in hectares
Plantation	Survival rate of planted trees
Water conservation	Water recycled and reused
Waste management	Waste reused or scientifically disposed
Mine closure	Compliance with approved closure plans

10.2 Social Performance Indicators

Social sustainability should be measured through indicators that reflect actual improvements in community welfare.

Indicator	Measurement
Local employment	Percentage of eligible local workforce
Skill development	Number of persons trained and placed
Healthcare	Access to healthcare facilities
Education	Beneficiaries and school infrastructure
Livelihood	Sustainable household income opportunities
Tribal welfare	Coverage of eligible affected households
Women's empowerment	Women-led enterprises and SHG participation
Rehabilitation	Livelihood restoration of affected families

These indicators can be used by researchers and policymakers to compare ESG performance across mining regions.

Major Challenges in ESG Implementation

The successful application of ESG practices may be hampered by a number of issues, even in the presence of laws and regulations.

11.1 Environmental Difficulties

1. Dust and industrial pollutants are difficult to regulate.
2. Stress on nearby water supplies.
3. Mining-related land degradation.
4. Natural ecosystems are being lost or fragmented.
5. Mined-out regions are not adequately restored.
6. Challenges in long-term environmental monitoring.

11.2 Social Difficulties

1. Insecurity of livelihood and displacement.
2. Reliance on natural resources and forests.
3. In some impacted communities, access to high-quality healthcare and education is restricted.
4. Disparities in local populations' skill levels.
5. An uneven allocation of financial gains.
6. Vulnerable communities' involvement in development planning is restricted.

11.3 Issues with Institutions and Governance

1. Institutional coordination is lacking.
2. Development project delays.
3. Insufficient outcome monitoring.
4. Information on sustainability is not readily available.
5. Limited involvement in the community.

6. Difficulties in assessing CSR and DMF programs' long-term efficacy.

Key Results of the Research

The following conclusions are drawn from the analysis of published literature, policy documents, and secondary data:
1. The significance of ESG: ESG practices provide a comprehensive strategy for striking a balance between social and environmental obligations and economic growth.
2. Environmental sustainability: Chhattisgarh's mining industry places a high priority on reducing air pollution, managing water resources, restoring land, and protecting wildlife.
3. Social sustainability: More focus is needed on local jobs, healthcare, education, rehabilitation, and the preservation of tribal livelihoods.
4. Regional variations: Coal, iron ore, and other mineral-producing areas have different objectives for social and environmental sustainability.
5. DMF's significance: DMF offers an institutional framework for allocating revenues connected to mining to communities impacted by mining.
6. PMKKKY's role: Through need-based welfare and infrastructure programs, PMKKKY promotes the growth of regions impacted by mining.
7. Corporate responsibility: Rather than considering sustainability as a distinct activity, mining firms should include ESG issues into their everyday business activities.
8. Community involvement: In order to promote inclusive development, Gram Sabhas and local institutions must actively participate.
9. Measurable indicators are necessary: Clear, quantifiable, and publically available performance indicators should be used to assess environmental and social consequences.
10. Long-term sustainability: Sustainable mining requires ongoing observation, ethical mine closure, and the restoration of livelihoods after mineral extraction.
These are not statistical results from a primary survey; rather, they are analytical conclusions drawn from secondary data and policy analysis.

Advice and Suggestions

13.1 Improving Environmental Administration
Cleaner technology, scientific extraction techniques, frequent environmental monitoring, and efficient mine closure plans should all be used by mining firms.

13.2 Encouraging Ecological Water Management
To lessen the strain on regional water supplies, businesses can promote water recycling, rainfall collection, and scientific mining discharge treatment.

13.3 Boosting Tribal Earnings
Agriculture, livestock, minor forest products, local business, and vocational training should be the main emphasis of development initiatives.

13.4 Increasing the Use of DMF

With a focus on healthcare, education, drinking water, environmental restoration, and livelihood development, DMF initiatives have to be grounded in the real needs of impacted people.

13.5 Promoting Involvement in the Community

In compliance with relevant regulations, local communities and Gram Sabhas should be involved in determining development priorities and project monitoring.

13.6 Encouraging the Economic Empowerment of Women

Women-led businesses, self-help organisations, vocational training, and entrepreneurship should get assistance from mining firms and regional development organisations.

13.7 Improving Reporting on Sustainability

Through relevant sustainability reports and quantifiable metrics, mining corporations should reveal their environmental and social performance.

13.8 Introducing Self-Monitoring

To increase accountability and transparency, third-party reviews, social audits, and environmental assessments should be conducted.

13.9 Encouraging Mine Rehabilitation and Closure

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