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Socioeconomic Impact of Limestone Mining on Local Communities in the Khumnoh Area, Kashmir, India

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Abstract

Limestone mining, while pivotal to industrialization and infrastructure expansion, often begets a paradoxical coexistence of economic promise and socio-environmental adversity—particularly in ecologically sensitive and socially fragile landscapes. This study interrogates the multifaceted implications of limestone extraction on the local communities of Khumnoh, situated within the tectonically active and resource-rich belt of South Kashmir. Despite burgeoning industrial interest in the region, scholarly inquiry into the sociological and economic reverberations of mineral extraction remains conspicuously limited. This research endeavors to bridge this epistemic lacuna by conducting an in-depth, community-centric investigation into the socioeconomic ramifications of limestone mining in the aforementioned locale. Employing a robust mixed-methods framework, the study integrates quantitative data from 100 structured household surveys with qualitative insights derived from 10 semi-structured interviews involving diverse community stakeholders—including miners, traders, educators, healthcare workers, and governance representatives. Stratified random sampling ensured representational integrity, while thematic analysis of narrative accounts augmented the statistical findings, thereby affording a comprehensive evaluative lens. The analysis focused on key dimensions such as livelihood diversification, income generation, public health, environmental degradation, gendered access to mining benefits, and infrastructural evolution. The findings reveal an ambivalent reality: while a notable segment of the population has experienced marginal economic uplift through mining-related employment and trade linkages, the majority remains either unengaged or inadequately compensated. Dust proliferation, water resource vulnerability, and respiratory ailments were recurrent environmental grievances, compounded by a palpable deficit in corporate transparency and public participation in decision-making processes. Furthermore, infrastructure benefits were largely confined to transport routes, with limited investment in healthcare, education, or gender-inclusive development. The study concludes that while limestone mining in Khumnoh does contribute to regional economic circuits, it does so in a manner that is neither equitably inclusive nor environmentally sustainable. Absent proactive regulatory oversight and participatory governance, the current trajectory of extractive expansion portends long-term socioecological dislocation. It is thus imperative to recalibrate mining operations through community engagement mechanisms, environmental safeguards, and targeted corporate social responsibility (CSR) interventions. The study not only elucidates the nuanced interplay between resource extraction and human development in peripheral regions but also offers a replicable analytical paradigm for evaluating the social license to operate in similar geoeconomic contexts.

Keywords: ***Socioeconomic, Limestone Mining, Local Communities, Khumnoh Area***

Introduction

Limestone mining plays a pivotal role in regional economic development, particularly in developing countries where industrialization relies heavily on locally available raw materials. In India, limestone is a fundamental resource for the cement industry and is extensively extracted across various states, including Jammu and Kashmir (Bhattacharya et al., 2009). The Khumnoh limestone deposits, located in the northwestern Himalayas, are of strategic importance for regional cement production and infrastructure development. While the geological and geochemical suitability of these deposits has been well established (Mir, 2024), there remains a pressing need to examine the broader socioeconomic implications of mining activities in this ecologically sensitive and economically evolving region. Globally, the socioeconomic impacts of mining have attracted significant scholarly attention due to their dual nature: mining can generate employment, increase income, and stimulate local business

activity, but it can also lead to displacement, environmental degradation, and social conflicts (Hilson, 2002; Bebbington et al., 2008). In regions like Kashmir, where livelihoods are traditionally tied to agriculture, handicrafts, and small-scale trade, the introduction of mining operations has the potential to restructure community dynamics profoundly. Mining-induced changes may bring short-term economic gains but may also create long-term vulnerabilities in the form of environmental damage, health hazards, and cultural disruptions (Lahiri-Dutt, 2011; Tarras-Wahlberg et al., 2001).

The environmental dimensions of limestone mining, particularly in hilly and forested terrains such as the Himalayas, can have ripple effects on local ecosystems and public health. Dust emissions, noise pollution, and changes in land use patterns are commonly reported issues (Ghose and Majee, 2001). These factors can, in turn, influence community perceptions of mining projects and affect their level of support or resistance (Hilson and Murck, 2000). Importantly, these perceptions often shape social license to operate, an increasingly vital concept in sustainable resource governance (Prno and Slocombe, 2012). Despite the growing body of literature addressing the environmental and economic dimensions of mining, there remains a lack of localized studies focusing on the socioeconomic experiences of communities adjacent to small- to medium-scale limestone mining sites. Existing works on coal, bauxite, and metal mining dominate the Indian discourse (Dash et al., 2008; Mishra and Nayak, 2015), while non-metallic mineral mining, such as limestone extraction, is comparatively underexplored.

The case of Khumnoh is particularly significant due to its proximity to growing cement industries and its location within a region that has historically experienced both economic marginalization and ecological fragility. Moreover, studies that incorporate community voices through primary data collection methods—such as surveys and interviews—are scarce in this region. There is a need to document how local residents, workers, and small business owners perceive the social and economic transformations brought about by limestone mining. Questions surrounding job opportunities, wage levels, access to basic services, and shifts in traditional livelihoods warrant critical examination (Sahu, 2012). Equally important is the investigation into whether the benefits of mining are equitably distributed or concentrated among a few stakeholders, as inequity often leads to social discontent and resistance movements (Jenkins, 2004).

This study aims to fill these gaps by conducting a comprehensive, community-based investigation into the socioeconomic impacts of limestone mining in the Khumnoh area. By employing a mixed-methods approach—integrating survey data with qualitative interviews—this research will assess both the tangible and perceived effects of mining on employment, income, health, education, and social cohesion. The findings will not only contribute to the academic understanding of mining-community interactions in Himalayan regions but will also provide actionable insights for policymakers, local governance bodies, and industry stakeholders to promote more inclusive and sustainable mining practices.

Literature Review

Mining has long been a key driver of economic development, especially in resource-rich but economically underdeveloped regions. However, the social and economic effects of mining on host communities remain complex and often contradictory. Globally, scholars have observed that while mining operations generate employment, improve infrastructure, and increase local revenue, they can simultaneously lead to displacement, environmental degradation, and social disintegration (Bebbington et al., 2008; Hilson, 2002). These outcomes vary significantly depending on the scale of operations, regulatory enforcement, community participation, and nature of extracted resources. The relationship between mining and community welfare is particularly nuanced in the case of non-metallic mineral extraction, such as limestone, which is not always associated with large-scale environmental damage but may still trigger localized social and economic disruptions (Lahiri-Dutt, 2004). Research has shown that while limestone mining may offer livelihood opportunities to a section of the population, its long-term effects on land use, health, and water quality can create significant challenges for local residents (Ghose and Majee, 2001).

In the Indian context, mining has contributed substantially to industrial growth, yet its impacts on marginalized communities—particularly in rural and tribal regions—have sparked widespread concern. Dash et al. (2008) argue that mining in India often occurs in ecologically sensitive and socially vulnerable areas, leading to displacement without adequate rehabilitation. This has resulted in persistent underdevelopment in many mineral-bearing districts. The state of Odisha, for instance, has been the focus of several studies where mining has led to significant displacement, land alienation, and disruption of traditional livelihoods (Mishra and Nayak, 2015). These studies underscore the importance of examining not only the economic benefits of mining but also the distribution of those benefits within and across communities. Despite this growing body of literature on the mining-development interface, the impacts of non-metallic mining such as limestone extraction have received comparatively less attention. Much of the Indian mining literature focuses on coal, iron ore, and bauxite (Sahu, 2012; Jenkins, 2004). However, limestone, which is a critical raw material for cement production, is increasingly

being extracted in several states including Rajasthan, Madhya Pradesh, Andhra Pradesh, and Jammu & Kashmir (Bhattacharya et al., 2009). These operations, while smaller in scale, still shape the socioeconomic landscape of their respective regions. Studies by Ghose (2007) and Chakraborty and Mukherjee (2012) emphasize the need for environmental and social safeguards in limestone mining regions. Their findings show that dust pollution, depletion of groundwater, and land-use conflicts are common challenges faced by communities living adjacent to quarrying operations. Moreover, the introduction of mining into predominantly agrarian or forest-based economies often leads to a shift in local occupational structures, with varying consequences for household income and food security. In Kashmir, the intersection of geology, ecology, and socio-political dynamics makes mining impacts particularly sensitive. While large-scale mineral exploitation has historically been limited in the region, recent industrialization trends—especially in cement manufacturing—have increased limestone extraction in districts like Anantnag and Pulwama (Sharma and Jain, 2010). However, detailed studies analyzing how these activities affect local residents' livelihoods, health, and perceptions of development remain scarce.

Another notable gap in existing literature is the lack of community-driven assessments. Most studies in India rely heavily on environmental impact assessments (EIAs) submitted by industries or governments, which may overlook grassroots-level social changes. As Lahiri-Dutt (2011) emphasizes, participatory research involving local voices is essential to understanding the nuanced and lived experiences of mining-affected populations. Furthermore, Sahu (2012) highlights that while Corporate Social Responsibility (CSR) programs are often implemented by mining companies, their effectiveness and coverage remain inconsistent and poorly documented. Given these gaps, the present study seeks to contribute to the literature by offering a community-centric, data-driven understanding of the socioeconomic consequences of limestone mining in the Khumnoh region. By focusing on local employment, health concerns, business opportunities, and resident perceptions, this research aligns with recent calls for a more human-centered and regionally grounded mining discourse.

Study Area

The Khumnoh region, located in the southern part of Kashmir Valley within the Anantnag district, constitutes a geologically and economically significant zone due to its substantial limestone reserves. The area falls within the northwestern Himalayan belt, a region characterized by complex tectonic activity and rich sedimentary formations. Khumnoh lies approximately 60 kilometers southeast of Srinagar, the summer capital of Jammu and Kashmir, and is accessible via the National Highway that connects Srinagar to Anantnag and further to Pahalgam. Geographically, the study area is defined by undulating terrain with low to moderate hills interspersed with agricultural plains and forested patches. The region's average elevation ranges between 1,900 and 2,200 meters above sea level, and the climate is temperate, with cold winters and mild summers. The local vegetation includes mixed coniferous forests and cultivated land, primarily used for horticulture and subsistence farming.

The Khumnoh limestone deposit belongs to the Lesser Himalayan sequence, composed mainly of carbonate-rich sedimentary rocks of Proterozoic to Paleozoic age. These formations are interbedded with dolomite, quartzite, and shale, reflecting a history of shallow marine deposition with periodic tectonic influence (Srikantia and Bhargava, 1998). Structurally, the area is situated near major thrust zones such as the Main Boundary Thrust (MBT) and Main Central Thrust (MCT), which have significantly impacted the stratigraphic arrangement and mineral distribution in the region (Valdiya, 1980). Limestone mining in the Khumnoh area has intensified in recent years due to increasing demand from the regional cement industry, particularly industries located in Pulwama and Anantnag districts. Local enterprises have engaged in extraction and transportation of limestone from this site, stimulating economic activity in the vicinity. However, the scale of operations remains moderate, involving both mechanized and manual mining methods, and is distributed across multiple small quarries.

The villages surrounding the mining sites—such as Khumnoh, Brakpora, and parts of Hutmurah—form the core of the study area. These communities rely on a mix of livelihoods, including agriculture, livestock rearing, wage labor, and small-scale trade. The onset of mining activities has introduced new economic opportunities for some households through employment and transportation contracts. However, concerns have also emerged regarding land degradation, air pollution, dust exposure, and pressure on local infrastructure. Given the socio-ecological sensitivity of the region and its strategic role in local economic development, Khumnoh presents an ideal site to explore the dual dimensions of resource extraction—namely, economic gain and social cost. The area's demographic composition, access to education and health services, and proximity to both rural and semi-urban settlements make it a suitable setting for assessing diverse community perspectives on limestone mining. This study therefore focuses on a 5–7 kilometer radius around the active mining zones, incorporating a representative mix of directly and indirectly affected households. The fieldwork is grounded in the spatial, geological, and socioeconomic characteristics that define Khumnoh's evolving relationship with the mining industry.

Methodology

Research Design

This study employs a mixed-methods research design, combining both quantitative and qualitative approaches to gain a comprehensive understanding of the socioeconomic impacts of limestone mining on local communities in the Khumnoh region. The rationale behind this design is to integrate numerical data with personal narratives and perceptions, allowing for a more holistic analysis of mining-related changes in the area. This approach facilitates triangulation, ensuring greater validity and depth in the research findings (Creswell, 2014).

Study Area and Sampling

The research was conducted in the Khumnoh region of Anantnag district in South Kashmir, an area known for its substantial limestone reserves and proximity to cement industries. Communities located within a 5–7 km radius of the primary mining sites were selected for investigation, including both directly and indirectly affected villages.

For the quantitative component, a sample of 100 respondents was selected through stratified random sampling, ensuring representation across three main stakeholder groups:

- Local residents not employed by the mining sector
- Workers involved in limestone mining and associated industries
- Small business owners and service providers operating near mining zones

This stratification enabled to capture a diversity of perspectives regarding economic opportunities, environmental conditions, and perceived social changes.

In addition, 10 key informant interviews were conducted as part of the qualitative component**,** involving:

- Community elders
- School teachers
- Health workers
- Panchayat members
- Mining site employees

Participants were selected based on their knowledge, community involvement, and experience with mining-related developments.

Data Collection Tools and Techniques

1. Structured Questionnaire

A structured questionnaire was developed to collect quantitative data from the 100 respondents. The questionnaire consisted of both closed-ended and Likert scale-based questions, covering areas such as:

- Employment and income changes
- Access to education and healthcare
- Environmental perception (air, water, noise)
- Displacement, land use, and housing
- Perceived benefits and challenges of mining activities

The questionnaire was pre-tested on a small group of individuals from a neighboring village and refined based on their feedback to improve clarity and relevance.

2. Semi-Structured Interviews

For the qualitative aspect, a semi-structured interview guide was used to gather detailed insights from the 10 key informants. Interviews explored themes such as:

- Changes in livelihood and traditional occupations
- Health issues linked to mining activity
- Shifts in community dynamics and cohesion
- Local governance and corporate accountability
- Community participation in decision-making

All interviews were conducted in the local language (Kashmiri) and later translated into English for analysis. With participant consent, interviews were audio-recorded and transcribed.

Data Analysis

Quantitative Analysis

The data collected from the structured questionnaires was analyzed using Microsoft Excel and **SPSS**. Descriptive statistics such as frequency distributions**,** means**,** and percentages were used to summarize responses.

Cross-tabulation was applied to explore relationships between demographic factors (e.g., age, occupation) and mining perceptions.

Qualitative Analysis

Interview transcripts were analyzed using thematic coding. Recurring themes were identified, categorized, and interpreted to understand the broader patterns in community sentiment and experience. Thematic analysis enabled the researcher to draw connections between individual narratives and collective trends.

Ethical Considerations

This study was conducted in accordance with ethical research standards. Informed consent was obtained from all participants, who were briefed about the purpose, scope, and voluntary nature of their involvement. Confidentiality was ensured by anonymizing participant identities and storing data securely. Participants were given the right to withdraw from the study at any stage without any repercussions.

Limitations of the Study

While this study aims to provide a detailed understanding of the local socioeconomic impacts of limestone mining, certain limitations are acknowledged. The sample size, though adequate for a localized study, may not capture the full diversity of experiences in other mining-affected regions. Additionally, some participants may have withheld or exaggerated responses due to personal biases or fears regarding mining authorities.

Outcome Results

Table 1: Demographic Profile of Respondents

Variable	Categories	Frequency	Percentage
Gender	Male	68	68%
	Female	32	32%
Age Group	18–30	24	24%
	31–45	42	42%
	46–60	26	26%
	61+	8	8%
Education Level	No formal education	21	21%
	Primary	29	29%
	Secondary	30	30%
	Higher secondary and above	20	20%
Occupation	Farming	28	28%
	Mining labor	24	24%
	Shopkeeper/trader	15	15%
	Government/private service	12	12%
	Unemployed	21	21%

Table 2: Household Economic Impact of Mining

Indicator	Categories	Frequency	Percentage
Household income increased?	Yes	58	58%
	No	42	42%
Source of income from mining	Labor employment	24	24%
	Transportation contract	10	10%
	Selling goods to miners	18	18%
	No benefit	48	48%
Any household member employed?	Yes	40	40%
	No	60	60%
Average monthly mining income	Below ₹5,000	16	40% (of 40)
	₹5,000–₹10,000	18	45%
	Above ₹10,000	6	15%

Table 3: Perceived Environmental and Health Effects

Indicator	Categories	Frequency	Percentage
Noticed increase in dust levels?	Yes	85	85%
	No	15	15%
Suffering from respiratory issues?	Yes	37	37%
	No	63	63%
Access to clean water affected?	Yes	22	22%
	No	78	78%
Noise from trucks or blasting?	High	40	40%
	Moderate	30	30%
	Low/None	30	30%

Table 4: Social and Infrastructure Perceptions

Indicator	Categories	Frequency	Percentage
Perceived benefit to community	High	28	28%
	Moderate	35	35%
	Low/None	37	37%
Infrastructure improved due to mining?	Roads	42	42%
	Healthcare facilities	11	11%
	Schools	7	7%
	No improvement noticed	40	40%
Community consulted before mining?	Yes	19	19%
	No	81	81%

Table 5: Community Attitude Toward Mining

Statement	Agree	Neutral	Disagree
Mining has improved livelihoods in this area	54	28	18
Mining companies care about community welfare	21	33	46
Mining should continue with stricter regulations	67	18	15
Mining has caused more harm than benefit	39	27	34

Qualitative Summary: Key Interview Insights (n = 10)

Stakeholder	Key Concern/Observation
School teacher	Increased absenteeism due to dust-related illness among students.
Mining worker	Employment opportunities are seasonal and lack job security.
Panchayat member	No formal consultation before project initiation; local governance excluded.
Shop owner	Business has grown due to miner customers, but fears economic dependence on mining.
Elderly resident	Complaints of high noise and road dust; worries about land becoming infertile.
Healthcare worker	Noted rise in respiratory and skin conditions in recent years.
Truck driver	Acknowledged income benefits but concerned about long working hours and safety.
Farmer	Claims dust has reduced apple yield and soil moisture retention.
Women's group head	Mining jobs favor men; women get no direct benefit, leading to inequality.
Local youth leader	Wants CSR activities to include sports, education, and clean drinking water.

Discussion and Data Interpretation

The findings of this study present a multifaceted view of how limestone mining in the Khumnoh region of Kashmir has reshaped the local socioeconomic landscape. Through the combination of quantitative survey responses and qualitative insights from key informants, this research offers a grounded understanding of both the benefits and challenges experienced by the surrounding communities.

Economic Impact

A key outcome of the study is the apparent economic diversification introduced by limestone mining in the region. As Table 2 indicates, 58% of respondents reported an increase in household income attributable either directly or indirectly to mining operations. Among these, mining labor, transportation contracts, and the sale of

consumer goods to workers emerged as primary sources of income generation. This aligns with global patterns where mining serves as a catalyst for local enterprise development and wage employment (Bebbington et al., 2008). However, the benefits appear unevenly distributed. While 40 households have at least one family member employed in the sector, a majority (60%) remain excluded from direct mining-related income**,** raising concerns about economic inequality and social stratification. Moreover, among those employed, income levels are modest. Only 15% earn above ₹10,000 per month**,** indicating that while mining provides livelihoods, it may not deliver sustained economic upliftment for most. This reinforces the observations from interviews, where laborers described their employment as seasonal**,** physically taxing, and often lacking long-term security. The data thereby underlines a critical point: mining creates opportunities but not necessarily upward mobility, particularly in the absence of skills training or labor rights awareness.

Environmental and Health Dimensions

Environmental concerns emerge as a dominant theme across both survey responses and interview narratives. As seen in Table 3, 85% of respondents acknowledged an increase in dust levels, a figure corroborated by local schoolteachers and healthcare workers who noted rising respiratory illnesses, particularly among children and the elderly. 37% of surveyed households reported respiratory symptoms linked to mining-related air pollution. Additionally, 22% reported disruptions to clean water access**,** potentially due to increased sedimentation or groundwater depletion—both commonly documented side effects of open-pit mining (Ghose and Majee, 2001).
The environmental toll, although expected, appears to be underestimated by mining operators. Residents expressed frustration at the lack of dust suppression systems, poorly maintained haulage roads, and uncontrolled blasting activities. These perceptions were strongly echoed by Panchayat members who argued that no formal environmental mitigation plans were communicated to village representatives.

Social Perception and Community Engagement

Perhaps the most compelling evidence of mining's contested legacy in Khumnoh is seen in the social perception data**.** Although 54% agreed that mining improved livelihoods, a sizeable minority (39%) believed that it had caused more harm than good. Moreover, only 19% felt that their community was adequately consulted before the initiation of mining operations. This lack of participation erodes community trust and is likely to contribute to resistance or resentment in the long run (Hilson, 2002; Prno and Slocombe, 2012). Infrastructure improvements appear selective: 42% observed road upgrades, but only 7% noticed enhancements in educational facilities**,** and 11% in health infrastructure. This implies that most visible benefits are logistical in nature—geared toward operational efficiency rather than community welfare**.** Gender-based disparities were also apparent. Qualitative interviews with women's groups indicated that mining employment largely favors men, leaving women economically marginalized. No targeted skill-building or inclusion efforts for women were mentioned by any respondent, suggesting a gender gap in mining benefits**.**

Conclusion

The limestone mining operations in the Khumnoh region present a classic example of a development paradox—economic stimulation without equitable or sustainable inclusion. While the industry provides employment and local business opportunities, it simultaneously generates significant environmental degradation, health concerns, and social dissatisfaction. The voices from the community clearly point to growing tensions between industrial activity and local wellbeing**.** Mining, in its current form, is largely extractive—both in the literal and figurative sense. It extracts resources from the earth and value from the community, with insufficient mechanisms for redistribution or reinvestment. Without a structured engagement framework, the community remains passive recipients rather than active stakeholders in the development process.

Recommendations

Based on the findings and interpretations, the following recommendations are proposed:

1. **Establish a Community Liaison Mechanism**
   Mining companies must create formal platforms for regular dialogue with community members and local governance bodies. These can facilitate grievance redressal, collaborative planning, and information sharing.
2. **Implement Environmental Mitigation Measures**
   Dust suppression through water sprinkling, vegetation buffers, and covered transport vehicles must be prioritized. Noise and blast impact studies should guide safe operational scheduling.
3. **Expand Corporate Social Responsibility (CSR) Programs**

Mining firms should allocate funds for local healthcare, education, and skill development, particularly targeting women and youth. CSR should be aligned with local needs, identified through participatory assessment.

4. **Enforce Employment Transparency and Fair Wages**
   Contractual workers should be given written agreements, insurance coverage, and protective equipment. Government labor departments must monitor labor practices for compliance.
5. **Introduce Community-Based Monitoring**
   Local residents can be trained to monitor air and water quality, mining boundaries, and safety hazards. This will ensure accountability and community empowerment.
6. **Promote Alternative Livelihoods**
   To reduce dependence on mining, government and NGOs should support horticulture, handicrafts, and eco-tourism ventures. Economic diversification can safeguard community resilience.
7. **Conduct Periodic Impact Assessments**
   Third-party audits of social and environmental impacts must be conducted every two years, with findings made public and discussed in village forums.

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Author Contribution

The author is solely responsible for the conceptualization, design, data collection, analysis, interpretation, and drafting of this manuscript. All aspects of the research, including fieldwork and manuscript preparation, were executed independently by the author.

Conflict of Interest Statement

The author declares that there are no commercial or financial relationships that could be construed as a potential conflict of interest with respect to the research, authorship, or publication of this paper.

Ethical Statement

This study was conducted in accordance with the ethical standards of academic research involving human participants. Informed consent was obtained from all respondents prior to participation in surveys and interviews. Confidentiality and anonymity were strictly maintained, and no personally identifiable information has been disclosed in the publication. The study did not involve any vulnerable populations or invasive procedures.

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