

Advancing Gender-Inclusive Sustainable Iron Ore Mining Practices: Lessons from Jharkhand, India

Ushvinder Kaur Popli¹, Ashish Tiru²

¹Professor, Department of Social Work, Jamia Millia Islamia, New Delhi

²Research Scholar, Department of Social Work, Jamia Millia Islamia, New Delhi

ABSTRACT

Iron ore mining is a major driver of industrial growth, but often leads to environmental degradation and socio-economic challenges, disproportionately impacting women. This theoretical article examines gender-inclusive sustainable mining practices, focusing on Jharkhand, India—one of the country's leading mining regions. Drawing extensively from scholarly research, it highlights persistent gender disparities and sustainability issues in the mining sector, emphasizing the urgent need for inclusive and equitable approaches. While global best practices demonstrate the potential for sustainable mining, India's evolving framework still faces notable implementation gaps despite progressive policies. Literature indicates that women have historically been excluded from formal mining employment due to entrenched patriarchal norms and restrictive legislation, resulting in economic marginalization and heightened vulnerability to mining-related harms. However, recent policy reforms and corporate efforts show incremental progress toward gender inclusion. Jharkhand's experience, particularly through Tata Steel's Noamundi operations, offers important lessons in ecological restoration, water conservation, gender-sensitive employment, and community engagement. The article recommends mainstreaming gender equity in mining policies, strengthening enforcement of environmental regulations, adopting inclusive community development models, and fostering gender-responsive workplaces. It further advocates for promoting women's employment and leadership in the sector and transparent monitoring of gender and sustainability metrics. The article argues that integrating gender considerations into sustainable mining strategies is critical for achieving equitable social outcomes and ensuring the industry's long-term sustainability. The case of Jharkhand demonstrates that inclusive practices, alongside stringent environmental management, can transform mining into a catalyst for sustainable and community-driven development.

Keywords: Iron ore Mining, Sustainability, Gender Inclusivity, Marginalisation, Empowerment

INTRODUCTION

Mining is a cornerstone of industrial development, providing essential raw materials like iron ore for infrastructure and economic growth. However, the mining industry has historically been associated with significant environmental degradation and social disruption, prompting calls for more sustainable practices (Hilson & Murck, 2000). In parallel, there is growing recognition that the benefits and burdens of mining are not equitably distributed, particularly concerning gender. The extractive sector worldwide remains heavily male-dominated, often marginalizing women's participation in both the workforce and

decision-making processes (Lahiri-Dutt, 2007; Jenkins, 2014). This gender imbalance is not only an issue of social justice but also impacts community well-being and the effectiveness of sustainability initiatives (Eftimie et al., 2009). Ensuring that mining practices are both environmentally sustainable and gender-inclusive is increasingly seen as vital for achieving holistic development outcomes aligned with global equity and sustainability goals (Baum & Benschaul-Tolonen, 2021).

Jharkhand, a state in eastern India, provides a pertinent context for examining these issues. Rich in iron ore deposits and home to primary mining operations, Jharkhand exemplifies the challenges of balancing mineral-led economic development with social inclusion and environmental stewardship. Communities in Jharkhand's mining districts, many of which are indigenous populations, have experienced displacement, environmental pollution, and socio-economic upheaval as a result of mining activities (Areparampil, 1996). Women in these communities often bear a disproportionate share of the negative impacts – from loss of traditional livelihoods to increased health burdens – while also being largely excluded from the formal benefits that mining can bring (Lahiri-Dutt, 2007; Mukherjee, 2014). These dynamics make Jharkhand a compelling case for studying how gender inclusion and sustainable mining practices intersect. This article aims to advance a conceptual and theoretical discussion on advancing gender-inclusive sustainable iron ore mining practices, focusing on lessons from Jharkhand, India. It synthesizes two decades of literature (2000–2022) on gender in mining and sustainable mining practices, drawing insights from global experiences and the Indian context. The analysis covers the challenges that hinder gender inclusivity in mining, compares sustainable mining initiatives globally and in India, and examines community-level impacts focusing on gender. Based on these insights, the article proposes policy and industry recommendations to promote more gender-responsive and sustainable approaches in the iron ore mining sector. Lessons derived from Jharkhand's experience are highlighted to inform best practices and reforms relevant to other resource-rich regions in India and beyond.

LITERATURE REVIEW

Gender in Mining: Over the past two decades, a growing body of literature has examined the gender dynamics of the mining industry. Early research challenged the perception of mining as an exclusively male domain by documenting women's historical and contemporary roles in extractive industries (Lahiri-Dutt, 2007; Hinton, Veiga, & Beinhoff, 2003). Women participate in various capacities, especially in artisanal and small-scale mining, where they often comprise a significant portion of the workforce, performing tasks such as panning, ore processing, and trading (Hinton et al., 2003). Despite this involvement, the formal mining sector worldwide severely underrepresents women. In many countries, women account for only a small minority of formal mining employees – often in single-digit percentages – and are concentrated in lower-paid, less secure jobs (Lahiri-Dutt, 2012; Bashwira et al., 2014). Long-standing structural barriers, such as deeply rooted patriarchal norms and biased labour policies, have traditionally restricted women's opportunities for employment and leadership roles in the mining sector (Lahiri-Dutt, 2007; Eftimie et al., 2009). For example, in India, colonial-era legislation and prevailing social biases long prohibited women from working in underground mines or at night, reinforcing the notion that mining is “men's work” (Lahiri-Dutt, 2012). Such legal restrictions have only recently begun to be eased, but the legacy of exclusion persists.

Scholars have highlighted that the marginalization of women in mining is not just a labour issue but also a development issue. Jenkins (2014) observes that the experiences and contributions of women have often been absent from mainstream analyses of mining's impacts and benefits. Where women are excluded from

the formal benefits of mining, they may still disproportionately shoulder its social and environmental costs (Jenkins, 2014; Mukherjee, 2014). Case studies from diverse contexts reinforce this point. For instance, women in artisanal mining – for example, in the eastern Democratic Republic of Congo – are active contributors yet face significant marginalization in decision-making and resource control (Bashwira et al., 2014). More broadly, researchers note that men often capture the bulk of mining’s economic gains while women disproportionately endure the attendant hardships of environmental degradation and social disruption (Jenkins, 2014; Baum & Benschaul-Tolonen, 2021). Within India, Lahiri-Dutt (2007) and others have documented how formal mining operations historically excluded women, even though women from mining communities often continued to labour in informal roles such as sorting ore or in peripheral economies around mines. These gender disparities in the mining sector have prompted calls for a feminist perspective in mining research and policy – one that “genderizes” the mining field and brings to light women’s experiences and agency (Lahiri-Dutt, 2012; Parmenter, 2011).

Sustainable Mining and Community Impacts: Parallel to the gender-focused literature, extensive research has examined the environmental and social sustainability of mining. The concept of “sustainable mining” emerged from the broader sustainable development discourse, emphasizing that mining activities should meet present economic needs without compromising the environment or the well-being of future generations (Hilson & Murck, 2000; Azapagic, 2004). Globally, studies have chronicled the negative impacts of unrestrained mining on ecosystems – including deforestation, soil erosion, biodiversity loss, and water pollution – and on local communities through displacement and livelihood disruption (Kitula, 2006; Downing, 2002). Mining operations tend to externalize environmental and social costs onto surrounding communities without deliberate interventions, undermining long-term development goals. For example, mismanagement of mining revenues in Peru has been found to aggravate local conflicts (Arellano-Yanguas, 2011), while gold mining pollution in Tanzania harmed agriculture and livelihoods in nearby villages (Kitula, 2006). In India, uncontrolled extraction in the past led to deforestation and pollution in states like Jharkhand and Odisha (Ahmad & Lahiri-Dutt, 2006; Lahiri-Dutt, 2012). These findings underline the need for stronger governance and community engagement to achieve sustainability in mining.

In response, significant literature has focused on frameworks and strategies to improve mining’s sustainability performance. Research on corporate social responsibility (CSR) in the mining industry showed a rise in social and environmental disclosure by mining companies during the 2000s, indicating greater acknowledgement of sustainability issues (Jenkins & Yakovleva, 2006). Case studies have documented both successes and shortcomings of industry-led and policy-driven initiatives aimed at more responsible mining practices. On the one hand, there are examples of good practices – such as progressive mine rehabilitation, community development agreements, and adherence to international environmental standards – which have mitigated impacts and improved community relations in some projects (Keenan, Kemp, & Ramsay, 2016; Owen & Kemp, 2013). On the other hand, critical analyses note that some initiatives are superficial or fail to address power imbalances with local communities (Arsel et al., 2015). Overall, the literature suggests that achieving truly sustainable mining requires technological and managerial changes by companies, strong governance and incorporating social justice considerations into mining policy and practice (Jenkins & Yakovleva, 2006; Bainton et al., 2018).

Integrating Gender and Sustainability in Mining: Until recently, gender issues in mining and sustainable mining practices have often been discussed separately. However, an emerging vein of research and policy analysis contends that gender inclusion is integral to sustainable mining (Eftimie et al., 2009;

Baum & Benshaul-Tolonen, 2021). Sustainable development frameworks emphasize social inclusion and equity alongside environmental stewardship, and gender equality is recognized as a core aspect of the social dimension of sustainability. In mining, this means empowering women – as employees, community members, and decision-makers – can enhance the social outcomes and legacy of mining projects (Lahiri-Dutt, 2012; Keenan et al., 2016). Recent empirical studies provide evidence of this linkage. A study of mining districts in India found that where mining operations engaged more women (through employment or community benefit programs), there were measurable improvements in women’s agency, health, and economic status locally (Guimbeau et al., 2020). These gains – including increased female household decision-making power and better child nutrition – suggest that the benefits of mining were more equitably shared (Guimbeau et al., 2020). Such findings align with global analyses arguing that integrating gender considerations (for example, ensuring women have access to jobs, compensation, and consultation in mining projects) can reduce negative social externalities and support broader development goals (Baum & Benshaul-Tolonen, 2021).

Moreover, including women’s voices in mining governance can lead to different priorities and solutions that benefit communities. Women often emphasize issues like water quality, family health, and community well-being – sometimes overlooked in male-dominated decision-making (Lahiri-Dutt, 2012; Eftimie et al., 2009). By adopting a gender-inclusive approach, mining companies and policymakers may gain more holistic insights into community needs and environmental stewardship, thereby improving community acceptance and social license to operate (Owen & Kemp, 2013; Keenan et al., 2016). However, the literature also cautions that simply adding women to existing structures is not a panacea; meaningful inclusion requires addressing deep-rooted gender biases and power imbalances in the industry (Jenkins, 2014; Parmenter, 2011). In summary, the convergence of gender and sustainability discourses in recent mining literature underscores that mining enterprises’ long-term viability and fairness depend on reducing ecological harm and ensuring that women and other marginalized groups share in mineral development’s benefits and decision-making processes.

CHALLENGES IN ACHIEVING GENDER-INCLUSIVE MINING

Implementing gender-inclusive practices in the mining sector faces numerous challenges, many deeply ingrained in the socio-cultural and institutional fabric of the industry. One fundamental barrier is the persistence of patriarchal norms and gender stereotypes that label mining as unsuitable for women. In many mining regions, long-standing cultural beliefs portray mining work – especially tasks involving underground or heavy manual labour – as a male prerogative (Lahiri-Dutt, 2007; Mukherjee, 2014). These attitudes discourage women’s entry into mining-related education or jobs and can lead to social stigma for those who pursue such paths. The result is a self-reinforcing cycle: because so few women are visible in the sector, the stereotype of mining as “men’s work” remains unchallenged, as observed in both global contexts and India’s mining communities (Jenkins, 2014; Parmenter, 2011).

Legal and policy restrictions have also hindered women’s participation. Many countries had labour laws, some dating back to the early 20th century, that restricted women from working in underground mines or during night shifts under the guise of protecting female workers (Lahiri-Dutt, 2012). In India, until recent amendments, statutes like the Mines Act of 1952 effectively barred women from core mining operations, relegating them to daytime surface work, if any (Lahiri-Dutt, 2007). While ostensibly about safety, in practice, these provisions contributed to the systematic exclusion of women from higher-paying operational roles. Only recently have such rules been eased, but the legacy of these restrictions persists in

a very low share of women in the mining workforce (Eftimie et al., 2009). Furthermore, many mining policy frameworks have only begun acknowledging gender issues in the last decade. Earlier national mineral policies seldom mentioned women or gender equality, meaning companies had no mandates or incentives to hire women or include women stakeholders in planning (Lahiri-Dutt, 2012). This absence of gender-sensitive policy guidance has been a significant structural challenge.

Workplace and institutional challenges continue to limit gender inclusion even where women have entered the mining sector. One frequently cited issue is the lack of facilities and provisions for female employees at mine sites (Eftimie et al., 2009). Mines historically built for an all-male workforce often lack separate washrooms, changing rooms, or accommodations for women, creating practical barriers to integration. Safety and harassment concerns are also prevalent; women in mining have reported instances of gender-based harassment and a lack of effective grievance redressal mechanisms in the male-dominated work environment (Jenkins, 2014; Bashwira et al., 2014). Without deliberate efforts by companies to establish zero-tolerance policies for harassment and to provide support systems (such as mentorship programs or women's networks), many women find mining workplaces unwelcoming or even hostile. Another institutional challenge is the skills and training gap. Because mining engineering and technical training programs have historically seen low female enrollment, there is a smaller pool of qualified women for technical roles (Lahiri-Dutt, 2007). This gap is exacerbated by biases in hiring and promotion, where women may be passed over for operating heavy machinery or leadership positions due to assumptions about their physical capabilities or commitment (Hinton et al., 2003). Thus, even when formal barriers are removed, informal institutional biases can stall women's career progression in mining.

At the community level, additional challenges affect gender inclusion in mining governance and benefit-sharing. In many mining-affected communities, traditional gender roles mean that women's voices are marginalized in public meetings and negotiations with companies (Mukherjee, 2014). Male leaders often make decisions about land acquisition, compensation, and community development projects, excluding women from influencing outcomes that directly affect their lives. For example, compensation for land taken for mining is typically paid to male heads of households, leaving women with little control over those resources (Bhanumathi, 2002). When women are excluded from consultation, their priorities – such as maintaining access to water, healthcare, or child safety – may be overlooked in agreements between companies and the community.

Additionally, because men are more likely to obtain the formal jobs and contracts that mining brings, an income gap can develop at the household level, potentially shifting power dynamics and leading to domestic tensions (Baum & Benschaul-Tolonen, 2021). Studies in mining regions have also found that the loss of traditional livelihood resources like forests and clean water due to mining forces women to travel farther and work harder to secure basic necessities, adding to their workload and stress (Bhanumathi, 2002; Azim, 2009). However, women in such contexts often have less access to healthcare or support services. All these factors create an environment where women, whether as workers or community members, face higher hurdles to benefit from mining and are more vulnerable to its harm.

SUSTAINABLE MINING PRACTICES: GLOBAL TRENDS AND THE INDIAN CONTEXT

Global Best Practices and Evolving Standards: Around the world, the mining industry has come under increasing pressure to mitigate environmental damage and contribute positively to local development. In response, various global standards and best practices for sustainable mining have been developed since the early 2000s. Major international mining companies – often spurred by investor expectations and

advocacy from civil society – have adopted comprehensive environmental and social management systems to reduce the footprint of their operations. These include measures such as minimizing land disturbance, reducing water and energy consumption, proper waste and tailings management, and progressive mine reclamation to restore ecosystems after closure (Azapagic, 2004; Bainton et al., 2018). For example, leading firms now routinely rehabilitate mined-out areas by re-contouring land and replanting native vegetation, aiming to leave a usable landscape for local communities. Technological advances have also enabled cleaner production in mining, such as improved dust suppression, wastewater treatment, and the use of renewable energy at mine sites, which reduce pollution and greenhouse gas emissions (Jenkins & Yakovleva, 2006; Owen & Kemp, 2013).

Alongside environmental improvements, the concept of a mining company’s “social license to operate” has gained prominence. This refers to the level of community acceptance or approval of mining projects, and it is increasingly seen as critical for project continuity and sustainability (Owen & Kemp, 2013). Globally, companies have begun to engage more with local stakeholders, recognizing that neglecting community needs can lead to protests, conflicts, or shutdowns (Keenan et al., 2016). Best practices in this realm include conducting thorough social impact assessments, negotiating community development agreements, and establishing grievance mechanisms where local people – including women and marginalized groups – can voice concerns and seek remedies (Keenan et al., 2016; Arellano-Yanguas, 2011). In countries like Canada and Australia, mining firms often partner with Indigenous communities to share benefits (through royalties, local employment, or community trusts) and protect cultural heritage, learning from past conflicts. These countries also have relatively strong regulatory enforcement of environmental standards, and some have introduced gender diversity initiatives – for instance, mentorship programs and targets to increase women’s participation – as part of their corporate sustainability strategies (Baum & Benshaul-Tolonen, 2021). While challenges remain even in these contexts, there are documented cases where inclusive and responsible mining practices have led to more harmonious and longer-lasting operations. International initiatives similarly promote sustainable and inclusive mining, but significant gaps remain between high-level principles and on-the-ground practice, especially among smaller operators (Eftimie et al., 2009; Arsel et al., 2015).

India’s Approach to Sustainable Mining: In India, the drive toward sustainable mining has accelerated in policy and practice over the last decade, though significant gaps remain. Historically, India’s mining sector was governed by regulations focusing on production and basic environmental compliance, with less emphasis on social impacts or community rights. This approach led to outcomes such as deforestation, air and water pollution, and displacement in mining hubs like Jharkhand, Odisha, and Goa (Ahmad & Lahiri-Dutt, 2006; Lahiri-Dutt, 2012). In some instances, unchecked iron ore and coal mining resulted in severe degradation and illegal practices, prompting judicial intervention – for example, temporary mining bans by the Supreme Court in the early 2010s – that served as a wake-up call for regulators and industry alike. Since then, policy reforms have been introduced to embed sustainability into mining governance. The National Mineral Policy 2008 and its updated version in 2019 explicitly recognize sustainable development as a guiding principle for mining in India (Ministry of Mines, 2019). They call for balancing mineral development with environmental protection and ensuring local communities benefit from mining. One notable mechanism is the creation of District Mineral Foundations (DMFs) under the 2015 amendment to the mining law. DMFs are trust funds financed by a percentage of mining royalties to develop mining-affected areas and populations. Early evidence suggests that when DMF funds are well-utilised for healthcare, education, livelihood programs, etc., they can improve local welfare, including

outcomes for women and children (Guimbeau et al., 2020). This approach reflects global best practices of benefit-sharing, effectively channelling a portion of mining revenue back to grassroots development.

The Indian government has also introduced a “Star Rating” system for mining leases to incentivize higher environmental management, safety, and social responsibility standards. Mines are rated from 1 to 5 stars based on performance metrics in these areas, creating reputational incentives for improvement. In states like Jharkhand, some large iron ore operations run by leading companies have invested significantly in pollution control, afforestation, and community welfare programs to improve their sustainability ratings. There are examples of mines adopting innovative practices – such as using solar power for part of their energy needs or recycling mine water – aligning with broader sustainability and climate goals for the sector.

Tata Steel’s Noamundi Iron Ore Mine in West Singhbhum, Jharkhand, demonstrates a strong commitment to sustainable mining that is aligned with global standards. Key environmental initiatives include extensive afforestation using native species to restore degraded land and adopting modern water conservation techniques like rainwater harvesting and zero liquid discharge (ZLD) systems to minimise freshwater use and protect local water sources (Tata Steel Sustainability Report, 2021). Socially, Tata Steel promotes gender inclusion and community welfare through women-focused skill development, local employment initiatives under the “Tejaswini 2.0 program”, and accessible healthcare services for women and children. Its CSR programs address mining-affected communities’ critical health, education, and livelihood needs. The company’s inclusive approach has earned international recognition, including the World Economic Forum’s Global Diversity, Equity & Inclusion Lighthouse 2023 award and a Gold Employer status from the India Workplace Equality Index (IWEI) 2024 for LGBT+ inclusion. With a 20% workforce diversity rate, Tata Steel sets a benchmark for integrating sustainability and inclusivity in the Indian mining sector (“Tata Steel’s new workforce”, 2024).

Despite these positive developments, challenges persist in India’s quest for sustainable mining. Enforcement of environmental regulations remains uneven. Smaller mines and illegal operations often evade compliance, resulting in local hotspots of ecological damage (Ahmad & Lahiri-Dutt, 2006). Even among legitimate operations, compliance can sometimes be more nominal than substantive. For instance, mine rehabilitation efforts may not fully restore lost biodiversity, or pollution control equipment may not be consistently operated. Social issues also continue: resettlement of displaced families is often protracted and contentious, and mining companies have been criticized for not fully informing or involving communities (especially women) in decision-making (Mukherjee, 2014). Gender considerations are still at a nascent stage in Indian mining practices. While companies now more often include women in stakeholder engagement meetings, women’s representation in community committees or forums is usually minimal, and their specific concerns may not be separately addressed in project plans. On the industry side, there are signs of change. After labour restrictions were eased, several mining companies in India started recruiting and training women for roles typically dominated by men—such as operating heavy machinery, engineering, and geology—in an effort to enhance workforce diversity and fill skill gaps. Industry associations have also launched “women in mining” networks, inspired by global counterparts, to support mentorship and career development for female professionals. These shifts, though limited in scale so far, indicate a growing acknowledgement that sustainable mining is not just about environmental compliance but also social inclusion and equity.

In summary, India’s approach to sustainable mining is evolving to incorporate global best practices, but an implementation gap remains. The case of Jharkhand reflects this dual reality: the state has some mines

that serve as model examples of sustainable, inclusive practices, and other areas where mining has left scars on the landscape and society. Lessons from both the successes and the shortcomings in Jharkhand can inform more robust strategies to ensure that mineral development is both environmentally sound and socially inclusive.

POLICY AND INDUSTRY RECOMMENDATIONS

To move toward a more gender-inclusive and sustainable iron ore mining sector – in Jharkhand and elsewhere – concerted efforts are needed from policymakers and industry actors. Based on the analysis and lessons from global best practices, the following recommendations are proposed:

- **Mainstream Gender in Mining Policies and Laws:** National and state mining policies should explicitly incorporate gender equality objectives. This includes removing any remaining legal barriers to women's employment in mining and adding provisions that encourage or require the inclusion of women. For example, regulations could mandate that a gender impact assessment be conducted as part of the environmental and social impact assessment for new mining projects (Eftimie et al., 2009). Guidelines should ensure women's participation in stakeholder consultations and evaluate how project benefits and risks are distributed between men and women. By embedding gender criteria into mine licensing, monitoring, and impact mitigation plans, governments can hold companies accountable for progress on diversity and inclusion.
- **Strengthen Enforcement of Environmental and Social Regulations:** Robust regulatory oversight is critical for sustainable mining. Governments must improve the enforcement of existing environmental laws (on land restoration, pollution control, etc.) and social obligations (such as rehabilitation and resettlement of displaced families), with particular attention to impacts on women and vulnerable groups (Cernea, 2000; Downing, 2002). Independent audits and greater transparency – for example, public disclosure of compliance reports – can increase accountability. Incorporating gender-disaggregated indicators into monitoring (for instance, tracking how many women receive compensation or the female share of jobs created) will help ensure that sustainability efforts are not gender-blind (Baum & Benshaul-Tolonen, 2021).
- **Enhance Benefit-Sharing and Community Development Programs:** A fair share of mining benefits should be directed to local development, explicitly targeting women's needs. Mechanisms like the DMFs in India should fund programs that empower women, such as women's health clinics, girls' education, vocational training, and support for women's self-help groups or cooperatives (Guimbeau et al., 2020). International experience shows that when women gain access to education and economic opportunities from mining revenues, it creates positive feedback loops for the community's well-being (Eftimie et al., 2009; Arellano-Yanguas, 2011). Companies and local authorities could also set up community advisory committees with significant female representation to guide the use of community development funds. Such measures help ensure that mining-driven development is inclusive and begins to reduce gender gaps in wealth and opportunity in mining regions.
- **Promote Women's Employment and Leadership in Mining Companies:** Mining companies should adopt proactive strategies to recruit, retain, and advance more women. This can begin with setting tangible targets for female employment across job categories and publicly reporting on progress (Keenan et al., 2016). Companies can partner with educational institutions to encourage more women to pursue careers in geosciences, mining engineering, and trades, offering scholarships or internships

to female students. On the job, firms should provide training programs to help women build technical skills and leadership capabilities, creating a pipeline for promotion (Lahiri-Dutt, 2012). Mentorship networks and women-in-mining forums within companies can reduce isolation for female staff and support their professional growth. Importantly, top management commitment is needed – exemplified by CEOs and mine managers actively championing diversity – to shift corporate culture truly. Having more women involved in mine planning, operations, and management will ensure that decisions around sustainability and community engagement incorporate gender-informed perspectives.

- **Ensure Gender-Sensitive Workplace Conditions and Culture:** Companies must create an enabling and safe work environment to retain women in mining roles. This includes investing in facilities such as separate restrooms and changing areas, providing safe transportation for women on night shifts, and offering, where feasible, family-friendly amenities like on-site childcare or flexible shift options. All employees should undergo gender sensitivity and anti-harassment training to foster a respectful workplace culture. Clear policies against sexual harassment and accessible mechanisms to report and address grievances are essential. By making these adjustments, mining firms in Jharkhand and elsewhere can significantly improve job satisfaction and safety for female workers, reducing attrition and setting an example for the wider industry. A more inclusive workplace benefits women employees and has also been linked to better overall safety records and morale (Macintyre et al., 2016).
- **Inclusive Community Engagement and Consent Processes:** Both government agencies and companies need to improve how they engage with mining-affected communities by ensuring women are heard and involved. When new projects or mine expansions are planned in places like Jharkhand, outreach should deliberately include women – for example, by holding community meetings at times and venues accessible to women, providing information in local languages, and actively soliciting women’s feedback on plans for resettlement or environmental mitigation (Lahiri-Dutt, 2012; Mukherjee, 2014). Traditional male-led consultation methods should be modified to avoid bypassing half the community. Working through local women’s associations or self-help groups and including women representatives on village development or resettlement committees are effective strategies. Experience from various countries suggests that projects designed with women’s input are more likely to address issues like water supply, childcare, and community health, thereby reducing resistance and improving the project’s social license (Owen & Kemp, 2013). Gender-inclusive engagement helps mining operations better align with community needs and can mitigate conflicts before they escalate.
- **Monitoring, Transparency and Continual Learning:** A system of ongoing monitoring and transparency should underpin all of the above efforts. Governments can require mining companies to publish annual sustainability reports that include gender-disaggregated data on employment, training, community program beneficiaries, and grievances addressed (Jenkins & Yakovleva, 2006). Independent evaluations of key initiatives (such as women’s training programs or livelihood projects funded by DMFs) should be conducted in collaboration with academic or civil society experts to assess effectiveness and capture lessons. Regular multi-stakeholder reviews – involving government, industry, and community representatives – can be convened to track progress on gender and sustainability goals in the mining sector and to facilitate sharing of best practices. This continual learning process is crucial because advancing gender inclusion and sustainability is an ongoing journey; as contexts evolve and new challenges arise (such as climate change pressures or technological shifts toward automation), policies and practices must adapt. Keeping a transparent

scorecard and open dialogue will help India's mining sector strive toward international benchmarks of responsible mining (Baum & Benschaul-Tolonen, 2021).

Implementing these recommendations requires commitment and coordination across stakeholders. Policymakers must be willing to enforce and incentivise change, companies must invest resources for long-term gains, and communities and civil society must remain engaged to hold both accountable. The experience of Jharkhand's iron ore mining sector – with its mix of problems and pioneering attempts at solutions – offers valuable lessons. It shows that when gender and sustainability considerations are sidelined, mining can perpetuate inequality and environmental harm; conversely, when they are prioritised, mining can contribute to inclusive growth and community well-being.

CONCLUSION

Achieving gender-inclusive, sustainable mining presents both significant challenges and transformative opportunities. Historically, the mining industry, exemplified by Jharkhand's iron ore sector, has often overlooked gender equality and sustainable environmental practices, causing ecological degradation and socio-economic disparities. However, a paradigm shift has begun, integrating gender equity with sustainable mining practices to address these interconnected issues effectively. Recent initiatives demonstrate how the inclusion of women in mining roles, coupled with focused community engagement, significantly enhances local economic and social development outcomes. Additionally, strengthened environmental management practices by companies such as Tata Steel further illustrate how sustainable approaches can coexist with industrial productivity.

This article emphasises that mining sustainability transcends environmental compliance, incorporating equitable social development and gender inclusivity as vital components. Policy reforms, effective enforcement, corporate responsibility initiatives, and meaningful community participation are essential mechanisms to ensure long-lasting positive outcomes. Jharkhand's mining experiences provide crucial insights into successfully merging ecological stewardship with social inclusivity, guiding industry-wide practices toward holistic development. The transition towards gender-sensitive, sustainable mining requires collective action among policymakers, industry leaders, and community stakeholders. Ultimately, embedding gender inclusivity within sustainable mining practices is essential for fostering resilient communities and ensuring the mining industry's long-term viability and social acceptance.

REFERENCES

1. Ahmad, N., & Lahiri-Dutt, K. (2006). Water scarcity in coal mining areas: Issues and challenges. *Economic and Political Weekly*, 41(31), 3397–3403.
2. Areeparampil, M. (1996). Displacement due to mining in Jharkhand. *Economic and Political Weekly*, 31, 1524–1528.
3. Arellano-Yanguas, J. (2011). Aggravating the resource curse: Decentralisation, mining and conflict in Peru. *Journal of Development Studies*, 47(4), 617–638.
4. Arsel, M., Akbulut, B., & Adaman, F. (2015). Environmentalism of the malcontent: Anatomy of an anti-coal power plant struggle in Turkey. *Journal of Peasant Studies*, 42(2), 371–395.
5. Azapagic, A. (2004). Developing a framework for sustainable development indicators for the mining industry. *Journal of Cleaner Production*, 12(6), 639–662.
6. Azim, S. (2009). Impact of environmental degradation on women. In *Environmental Concerns and Sustainable Development: Some Perspectives from India* (pp. 156–162). New Delhi: Concept Publis-

hing.

7. Bainton, N. A., Banks, G., Ballard, C., & Gillies, A. (2018). The social implications of mining in Papua New Guinea. *The Extractive Industries and Society*, 5(1), 219–226.
8. Bashwira, M. R., Cuvelier, J., Hilhorst, D., & van der Haar, G. (2014). “Not only a man’s world”: Women’s involvement in artisanal mining in eastern DRC. *Resources Policy*, 40, 109–116.
9. Baum, S., & Benschaul-Tolonen, A. (2021). Extractive industries and gender equality. *Review of Environmental Economics and Policy*, 15(2), 195–215.
10. Bhanumathi, K. (2002). The status of women affected by mining in India. In *Tunnel Vision: Women, Mining and Communities* (pp. 20–25). New Delhi: Mines, Minerals and People.
11. Cernea, M. M. (2000). Risks, safeguards and reconstruction: A model for population displacement and resettlement. *Economic and Political Weekly*, 35(41), 3659–3678.
12. Downing, T. E. (2002). *Avoiding new poverty: Mining-induced displacement and resettlement*. London: International Institute for Environment and Development.
13. Eftimie, A., Heller, K., & Strongman, J. (2009). *Gender dimensions of the extractive industries: Mining for equity*. Washington, DC: The World Bank.
14. Guimbeau, A., Ji, J., Menon, N., & van der Meulen Rodgers, Y. (2020). Mining and gender gaps in India. *IZA Discussion Paper No. 13881*. Bonn: IZA – Institute of Labor Economics.
15. Hilson, G., & Murck, B. (2000). Sustainable development in the mining industry: clarifying the corporate perspective. *Resources Policy*, 26(4), 227–238.
16. Hinton, J., Veiga, M. M., & Beinhoff, C. (2003). Women and artisanal mining: Gender roles and the road ahead. In G. M. Hilson (Ed.), *The Socio-Economic Impacts of Artisanal and Small-Scale Mining in Developing Countries* (pp. 149–188). Lisse, Netherlands: A.A. Balkema.
17. Jenkins, H., & Yakovleva, N. (2006). Corporate social responsibility in the mining industry: Exploring trends in social and environmental disclosure. *Journal of Cleaner Production*, 14(3–4), 271–284.
18. Jenkins, K. (2014). Women, mining and development: An emerging research agenda. *The Extractive Industries and Society*, 1(2), 329–339.
19. Keenan, J., Kemp, D., & Ramsay, R. (2016). Company–community conflict in Papua New Guinea’s extractive industries: Considering the business case for grievance resolution. *The Extractive Industries and Society*, 3(2), 282–292.
20. Kitula, A. G. N. (2006). The environmental and socio-economic impacts of mining on local livelihoods in Tanzania: A case study of Geita District. *Journal of Cleaner Production*, 14(3–4), 405–414.
21. Lahiri-Dutt, K. (2007). Roles and status of women in extractive industries in India: Making a place for a gender-sensitive mining development. *Social Change*, 37(4), 37–64.
22. Lahiri-Dutt, K. (2012). Digging women: Towards a new agenda for feminist critiques in mining. *Gender, Place & Culture*, 19(2), 193–212.
23. Macintyre, M., McDermott, L., Tynan, A., & Gerrick, C. A. (2016). The health impacts of extractive industry transnational corporations: A study of Rio Tinto in Australia and Southern Africa. *Globalization and Health*, 12(1), 64.
24. Ministry of Mines. (2019). *National Mineral Policy 2019*. New Delhi: Government of India.
25. Mukherjee, S. (2014). Mining and women: The case of the Maria of Chhattisgarh. *Social Change*, 44(2), 229–247.
26. Owen, J. R., & Kemp, D. (2013). Social licence and mining: A critical perspective. *Resources Policy*, 38(1), 29–35.

27. Parmenter, J. (2011). Experiences of Indigenous women in the Australian mining industry. In K. Lahiri-Dutt (Ed.), *Gendering the Field: Towards Sustainable Livelihoods for Mining Communities* (pp. 67–86). Canberra: ANU E Press.
28. *Tata Steel's new workforce initiative breaks stereotypes - Manufacturing Today India*. (2024, December 17). Manufacturing Today India.
29. United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. New York: United Nations.