An Analysis of the Present Status of Coal Mining Projects under Eastern Coalfields Limited: A Case Study of Jamuria Block in Bardhaman District and Mejhia Block in Bankura District

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Abstract:

This paper looks into the current situation of three coal mining projects undertaken by Eastern Coalfields Limited (ECL) at Jamuria Block in Bardhaman District and at Mejhia Block in Bankura District of West Bengal. The experiments, such as Satgram (shaft mining), Kalidaspur (inclined shaft mining), and Sonepur Bazari (open-cast mining) have been selected as they present different methods of extraction and different socio-environmental consequences of that process. The study adopts the mixed-methods approach which will be based mainly on the primary data which are provided during field trips, interviews, and observation, as well as secondary data in form of production reports, accident studies, and environmental evaluation. The results indicate that there has been a continuous decrease in coal production in underground establishments such as Satgram and Kalidaspur mainly because of safety risks, emissions of gas, and the use of obsolete technologies. On the other hand, the Sonepur Bazari open-cast project which is due to raise productivity by a large margin shows great concern in the aspect of environmental damage and displacement. Another problem faced by workers is also expressed in the study: long working hours, low salaries, low education levels, and even exposing them to occupational health hazards. The issue of gender inequality is vivid, and illicit mining remains a social and economic predicament. In as much as they are important in energy provision to India, these projects face challenges in the form of inefficiency in operations, socio-economic disparity and environmental degradation. The results highlight the necessity of the policy reforms to establish environmental sustainability, more protections to workers, and labor inclusiveness.

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An intelligent orientation, using modernization, enforcement and community development, is vital in the securing viability and ethical practice of coal mining in these areas.

Keywords: Coal Mining Projects, Eastern Coalfields Limited (ECL), Environmental Impact, Socioeconomic Conditions, Illegal Mining Activities

Introduction:

The coal mining has been the foundation of the industrial development in India, and it has acted as the source of the energy market and prosperity of India. Eastern Coalfields Limited (ECL) is the subsidiary of Coal India Limited (CIL) and it operates quite a number of coal mines in the Raniganj Coalfields of West Bengal, one of the first and productive coal mining area in India. In this situation the Jamuria Block in Bardhaman District and the Mejhia Block in Bankura District are being the most acute spheres of the ECL activity. Both underground and open-cast mining methods are these regions that have now been incorporated into the coal supply of India but are ridge with a series of criticism due to the complications posed on the safety, sustainability of the environment as well as the social and economic outcomes. The main objective of the present research to study the status quo of these coal mining projects under ECL in these areas based on 3 main coal mining projects, viz. the Satgram Shaft Mining Project, the Kalidaspur Inclined Shaft Mining Project and the Sonepur Bazari Open-Cast Mining Project. These projects symbolize the diversified mining approaches implemented by ECL each one of them with diverse operational interactions, safety issues, and environmental consideration (Eastern Coalfields Limited, 2023). Although these projects are very important in the production of coal, the issue on the sustainability of mining activities, the welfare of the workers as well as environmental degradation have been of concern (Ghosh & Bhattacharya, 2019). The study focuses on some of the main areas on coal mining activities such as the trends of coal production, safety level during coal mining, socio-economic life of the mining personnel and the impacts on the environment of coal mining operations. The study aims at evaluating the health and safety hazards to the miners, especially in the underground mining of the miners since this mining is affected by the emission of gas and the occurrence of accidents (Singh & Patil, 2021). Moreover, the research will assess the working conditions of employees and in particular gender inequality, wage gap, and the consequences of mining on communities (Roy, 2025). The other important aspect of the study is environmental sustainability. The mining activity of Jamuria and

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Mejhia blocks has led to interest in standards of air quality, water pollution, and forestry pollution (Ghosh & Bhattacharya, 2019). The paper will examine the scope of these environmental impacts in addition to determining the success of existing environmental management practices. Moreover, illicit mining still continues to be a problem in these countries. Unlicensed coal extraction does not only aggravate risks to safety and to the environment but also disrupts the economic and social structures of the local communities (Eastern Coalfields Limited, 2023). The paper shall address this illicit practice that has continuously impacted on the formal mining sector, as a source of depreciating both resources and the well being of the people.

Background of the Study

Eastern Coalfields Limited (ECL) is a subsidiary company of coal India limited (CIL) and the main tenor in coal mining industry in India especially in raniganj coalfields in the state of West Bengal. Historically the place where coal mining was started in India, Raniganj coalfields are the focus of the Indian energy production (Ghosh & Bhattacharya, 2019). The mining activities run by ECL that cover various districts such as Bardhaman and Bankura are essential in satisfying the rising energy needs in India because coal is still the major form of energy generation. However, the coalfields have also been linked to the major adversities such as the safety hazards, environmental impairment and the socio-economical inequality among the mining employees. Locations that are the subject of analysis in this research, the Jamuria Block of the Bardhaman District and the Mejhia Block of Bankura District, have been hot spots of coal mining ever since a couple of decades. Mining activities at these blocks are marked with a mix of open-cast mining, underground shaft mining and inclined shaft mining methodology (Eastern Coalfields Limited, 2023). The mentioned techniques differ by the complexity of their operations, employee safety, and environmental effects, which is one of the reasons that this topic should be further discussed regarding the current stage of these mining projects. One of the oldest underground coal mines in the area is the Satgram Shaft Mining Project that started its operations in 1984. Being an underground shaft mine, it is specifically affected by the problems associated with the exploitation of deep coal deposits, and such dangers as gas emission and roof may be too dangerous to the safety of miners (Singh & Patil, 2021). Like the case with Kalidaspur Inclined Shaft Mining Project which has been in operation since the year 1981 and it is one of the largest inclined shaft mines in the area. Being as big and significant as it is, the safety of the Kalidaspur also suffers since it emits a lot of methane gas, which necessitates the presence of constant

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ventilation and gas drainage systems to reduce the threats of the explosion and health complications (Eastern Coalfields Limited, 2023). On the other hand the Sonepur Bazari Open-Cast Mining Project started its operation in 1995 and represents the transition between underground and open-cast mining as the main coal extraction technique in the region. Open-cast mining entails the massive excavation of land leading to adverse effects to the environment like deforestation; soil erosion, and chemicals contaminating water. Relatively, the Sonepur Bazari mine is one of the largest open-cast works in West Bengal and besides providing the high rate of coal production, it has resulted in the displacement of local communities and massive land use changes (Ghosh & Bhattacharya, 2019). Even though these projects contribute immensely towards coal production, a number of problems have pardoned and these include the issue of safety, health hazards, labor conditions, and environmental sustainability. Workers in mining usually work under unfavorable and hazardous environments; thus, are susceptible to several health implications, including respiratory diseases and accidents caused by insufficient safety precautions (Singh & Patil, 2021). Also, pollution of the environment through mining activities has contributed to poor quality of air and water, this impacts not only the mining employees but the local communities as well. In addition, the challenge of illegal mining remains spread throughout the area, and uncontrolled coal extraction again increases social-economic and environmental issues (Eastern Coalfields Limited, 2023). In view of the complexity involving these matters, the present study aims at determining the operational and socio-economic pulse of coal mining enclaves in Jamuria and Mejhia blocks. This research will give an in-depth knowledge of the facing challenge and opportunities to such mining operations by reviewing the trends of coal production and analyzing the safety measures taken, their social-economic and environmental effects.

Study Area

This paper concentrates on three large coal mining initiatives owned by Eastern Coalfields Limited (ECL) at Jamuria Block of Bardhaman District in West Bengal and Mejhia Block of Bankura District in West Bengal in India. They comprise a part of the Raniganj coalfields, and one of the first coal mining belts in India, which is considered a critical source of energy to India (Eastern Coalfields Limited, 2023). The three mining locations chosen, Satgram, Kalidaspur and Sonepur Bazari have different types of mining which are shaft mining, inclined shaft mining, and open-cast mining respectively. Satgram is a shaft underground mining project that was formed in 1984 and is situated in the Jamuria Municipality and is

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about 8.4 km away from Asansol. Kalidaspur is another large inclined shaft mine which was begun in 1981 and it is situated south of the river Damodar and it has high emissions of methane gas and it is a three degree gassy mine. One of the largest projects, open cast in the state is Sonepur Bazari, which was established in 1995 and covers about 1200 hectares of land, located about 24 km away in Asansol, this project is very large and characterized by a great rate of coal extraction and land-use alteration (Roy, 2025; Ghosh & Bhattacharya, 2019). The chosen sites were based on the fact that they cover the dynamism characteristics of operation that is accompanied by socio-environmental consequences that are evident in modern mines in this active industrial and historically rich area.

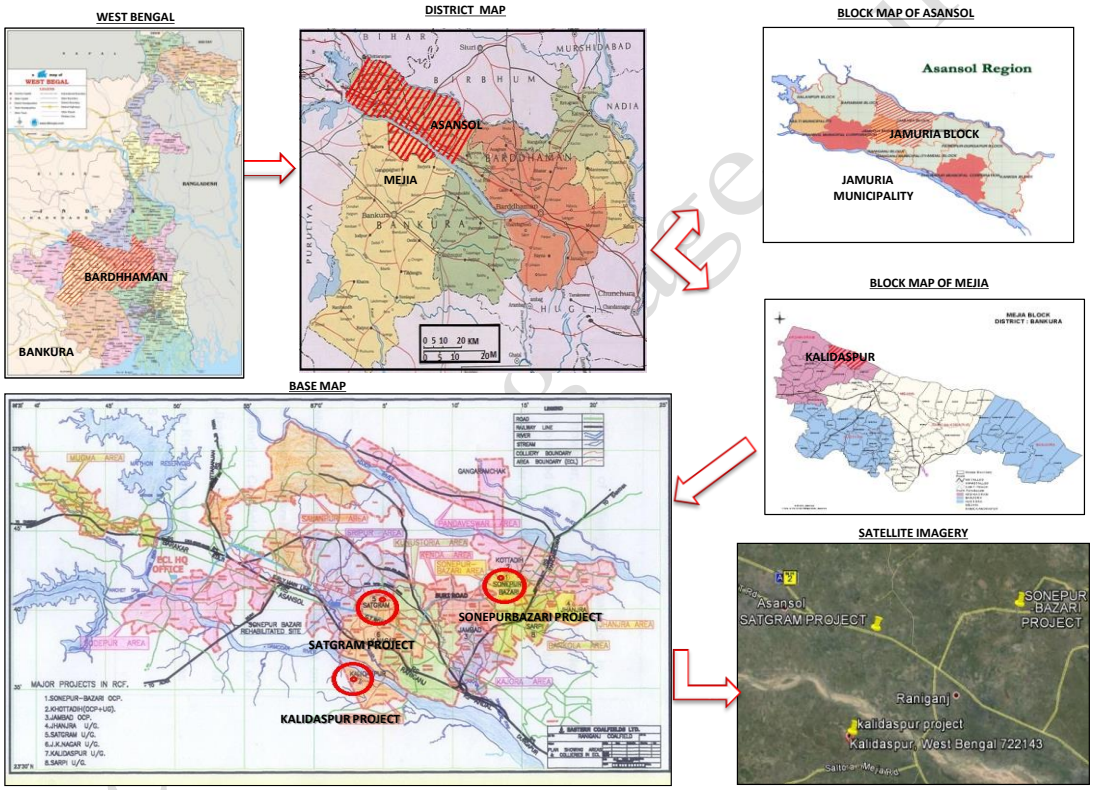

Figure 1: Location Map of Study Area

Materials and Methods:

In this research, the mixed approach allows combining qualitative and quantitative methods of data collection. This is to provide a complete review of the present status of coal mining projects under the Eastern Coalfields Limited (ECL), Jamuria Block, (Bardhaman District) and Mejhia Block, (Bankura District)). The process of data collection was based on the main aspects of coal production trends, safety, socio-economic status of the miners, environmental effects, and illegal mining.

Data Collection

The primary data was gathered with the help of field visits to the chosen mining projects in a Jamuria block and Mejhia block which consisted of Satgram Shaft Mining Project, Kalidaspur inclined Shaft Mining Project, and the Sonepur Bazari Open-Cast Mining Project. Semi structured interviews were carried out with management people, workers and local residents during the visits. The interviews were based on mining practices, safety guidelines and procedures, working environment, socio economic and environmental issues. Other than interviews, observational research concepts were used in the mining sites in order to tap qualitative data regarding working and living conditions of the miners. The field observation also gave firsthand information on the working conditions of the mines such as safety requirements, dust and gas emission, as well as the disposal of waste products.

Secondary information was gathered and included in publicly available publications such as government publications and industry publications together with information submitted by ECL. These sources were: the production records, safety records, environmental surveillance reports and the statistical data on the rates of production of coal, accident reports and worker data. These secondary sources have made it possible to analyze and provide the general contextualized look of historical and the current situation of mining operations in the study area. Also, there was the use of satellite image in their study to determine the state of the environment in the mining sectors such as loss of trees, land degradation, and pollution of water bodies. Spatial patterns of environmental impact were analyzed with the means of Geographic Information System (GIS), which allowed visualizing the scope of environmental degradation associated with mining over time (Roy, 2025).

Sampling Techniques

Purposive sampling was used in the research to identify three mining projects, which reflect the key mining techniques employed by ECL in the area underground shaft mining (Satgram), inclined shaft mining (Kalidaspur) and open cast mining (Sonepur Bazari). Such projects were selected because they contribute greatly to coal production and the difference in the ways they work and the environment. In interviews, a purposive sampling method was employed to sample the participants among the mining workers, their supervisors, and the local inhabitants who were assured to be having different perspectives in the study. The miners of different experience level, supervisors of the work conducting knowledge, and members of the local community that had to be impacted by the mining processes were

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chosen to acquire the broadest picture of the concerns of the socio-economic situation, safety measures, and environmental issues in the area.

Results and Discussion:

Coal Production and Operational Trends

- **Satgram Project**

The plot shows annual coal (in tonnes) produced in the Satgram Project in 2009 to 2015. The trend shows that there was a decreasing trend in the production over the years to about 80,000 tonnes in 2014-2015 when production was highest in the period of 2011-2012 with a production of almost 100,000 tonnes. The regression line with negative slope approximate -3061.4 indicates a slow decline in coal production and the data presents a moderate decline in coal production. The value of R 2 in 0.154 suggests that the linear model is not an exact one and therefore the other factors might be affecting the trends in production. This modest yet steady decrease during the years might be explained by inefficiency of operations, resource losses or modification of mining methods but, to isolate the specific reasons, it is important to conduct further research.

- **Kalidaspur Project**

The graph provides the year-on-year production of coal (in tonnes) in the Kalidaspur Project and the data is taken in a yearly context between 2010-2011 to 2014-2015. The trend shows that coal production is gradually reducing with the years. The production begins at approximately 120,000 tonnes in 2010-2011 after which it declines in a unique pattern with some slight ups and down annually to reach approximately 100,000 tonnes/yr in 2014-2015. The regression curve has a negative slope, which is around -7948.6 indicating that there is a gradual decrease in the coal production, implying that this decrease is due to a problem in the operations, loss of resources or even change in mining methods. The R 2 of 0.6491 is also an indication that the linear model slightly fits the data hence trend is partly predictable though it is also dependant on other variables. This downward pattern may communicate the necessity in the improvement of mining techniques or resource management plans to at least secure the production rates at its current level.

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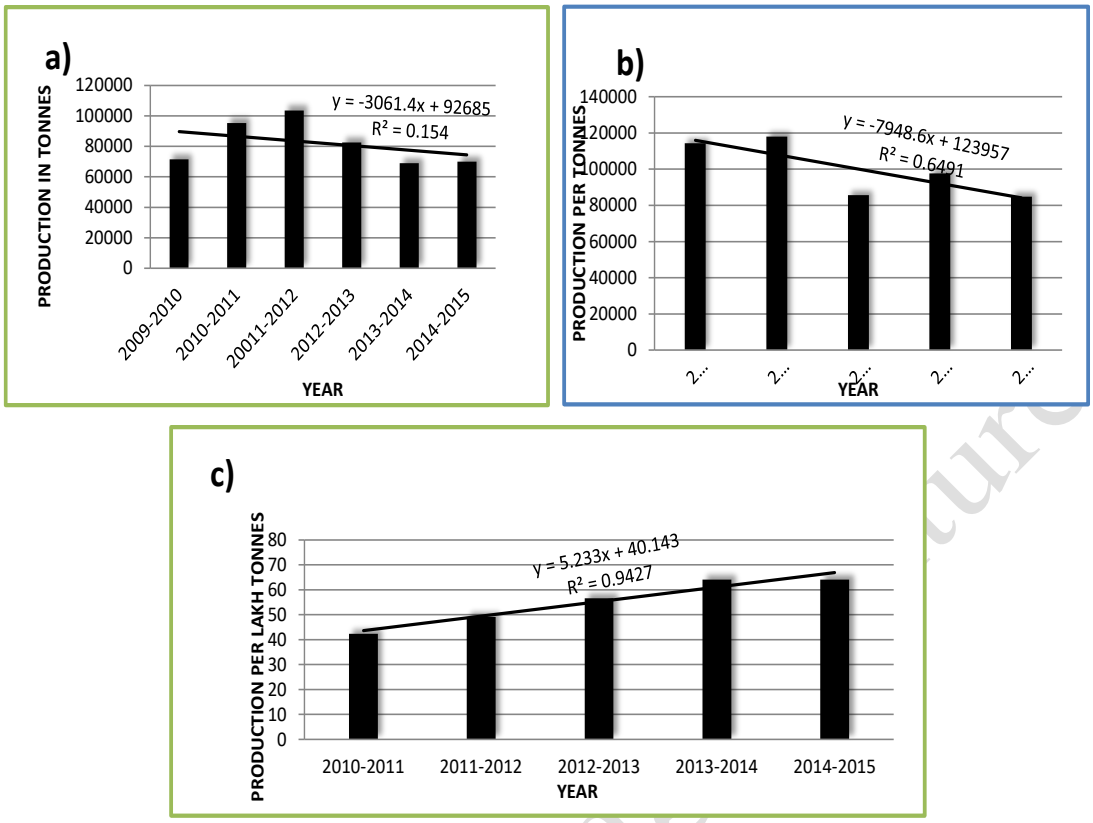

Figure 2: *Yearly coal production in tonnes. (a) Satgram Project, (b) Kalidaspur Project, (c) Sonepur Bazari Project*

- **Sonepur Bazari Project**

The graph indicates the coal production per lakh tonnes in the Sonepur Bazari Project in every year 2010-2011 to 2014-2015. The trend is increasing steadily with a base picture of about 40 lakh tonnes production by 2010-2011 and an ultimate end of about 60 lakh tonnes production by 2014-2015. The regression line has a positive slant of about 5.233x that implies that the production has been steadily increasing with years. The value of R 2 is 0.9427 which implies that the linear model is appropriate to explain the data and the trend is strong and consistent upwards. This growth in coal output may perhaps be due to better mining techniques, more service capacity, or more demand of coal during these few years as taking stock of this many operations in this region the Sonepur Bazari Project was the more successful mining.

Educational Level and Health Status

Comparative study of the educational level of coal mine workers in Jamuria Block, Jamuria Municipality and Mejhia Block would show the trend towards lower educational level. Most of the working population (36.67 per cent) have only primary-level education, whereas 21.67 per cent of them have completed a secondary-level education. Fewer persons have a higher secondary degree (13.33%) or have been involved in professional education related to the field of mining where 16.67 have a mining diploma and only 11.67 a degree in mining engineering. This learning discourse shows that limited access to higher learning, to a large extent, inhibits an opportunity of mobility in the job sphere and also affects consciousness of the occupational health and safety.

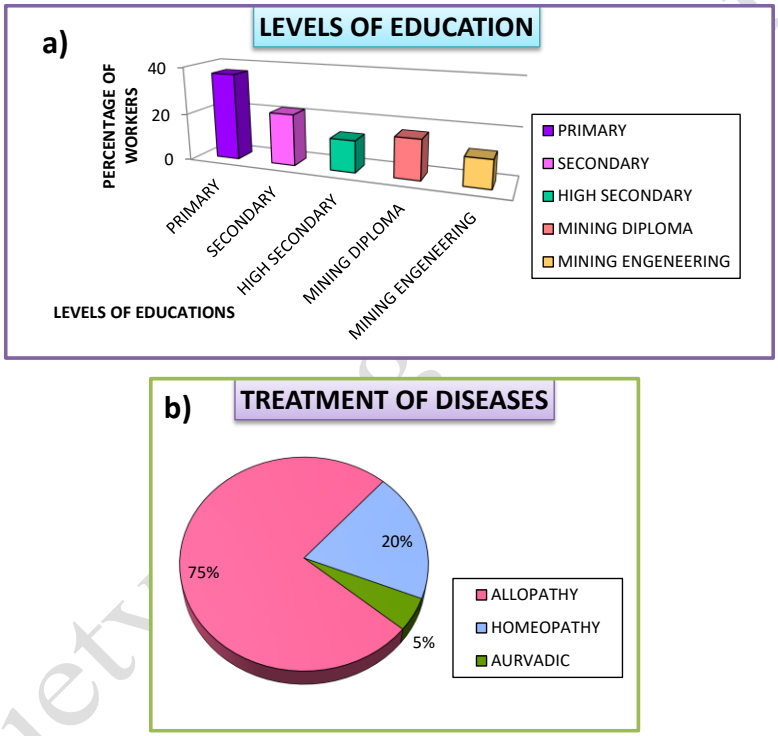

Figure 3*: (a)Level of Education, (b) Treatment of Diseases*

Existence of conventional medical systems is also evident through health status indicators. Majorities (75 percent) of the miners embrace the allopathic medicine suggesting a move towards contemporary clinical management, although 20 percent depend on homeopathy, and only 5 percent lean to Ayurveda. This allocation implies a limited knowledge regarding available treatment methods, but also the possibility of low usage of alternative systems due to accessibility and availability problems. The health effects are especially grave in the areas of the open- cast projects like Sonepur Bazari, where degradation of the environment is leading to an increase in the occurrence of respiratory diseases. In aggregate, these observations are a testament to the importance of a more active educational outreach

implemented on a systematic basis and to the health-oriented interventions specific to the mining communities, which will guarantee better health outcomes and healthy understanding of occupational activity.

Living Condition

Living conditions of the coal mine workers in the regions of the study can be characterized as relatively satisfactory and there also are areas that warrant improvement. Housing information also reveals that most of the workers (53.33 percent) live in their house hold which shows a certain degree of housing security. Nevertheless, 33.33 percent dwell in quarters offered by Eastern Coalfields Limited (E.C.L.), and 13.33 percent rely on the rented houses, which indicate unequal access to housing and support offered by the employer. Regarding sources of fuel, 75 percent of the workers adopt the combination of coal and LPG gas, showing an intermediate model of energy utilization that intertwines the old and the new sources. The coal is still entirely used only in 11.67 percent of the workforce, and only 13.33 percent of the workforce can use induction ovens, a significant discrepancy in using clean or safe cooking technology. As far as the drinking water is concerned, the availability of safe water is quite high where 91.67 percent of the workers drink safe water whereas 8.33 percent continue taking the unsafe water which is still a continued health problem. All these indicators point to the fact that most workers have access to basic housing, utilities and there is still need in infrastructural development especially increasing access to clean cooking energy and provision of potable water to all people.

Working Conditions

Through the working conditions of the coal mining projects surveyed, labor intensive nature of the working environments and much practice within the industry in the hands of the laborers is established. Most of the miners (43.33) workforce have an experience of over 30 years in the working field and 36.67 have a working experience of between15 and 30 years and 20 percent of the workers have an experience of less than 15 years therefore a highly experienced work force. The given long term involvement could be indicative of employment consistency, and it is also indicative of long term exposure to job related risks. Regarding the number of working hours per day, 60 workers follow a standard 8 to 10 working hours schedule, as opposed to 15, who are put into overtime (more than 10 working hours) and the risk of fatigue-related complications may worsen, causing diminution of the well-being of workers over time. Income statistics shows a fairly balanced pay scales; majority of the workers have their wages between the scales of 30,000 to 50,000 with a lower

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percentage in 50,000 to 70,000 and >70,000 scales. Very few are lower than 30,000 and this proves that although the tiers of income are not dangerously low, they are not lavish in comparison to the amount of labor and health hazards that the profession subjects the work force to. On the whole, working environment can be described by high length of services, challenging time line and medium pay structure directing to the prospects of new labor protection policies, fatigue/fatigue policy and remuneration pertaining to job exposure.

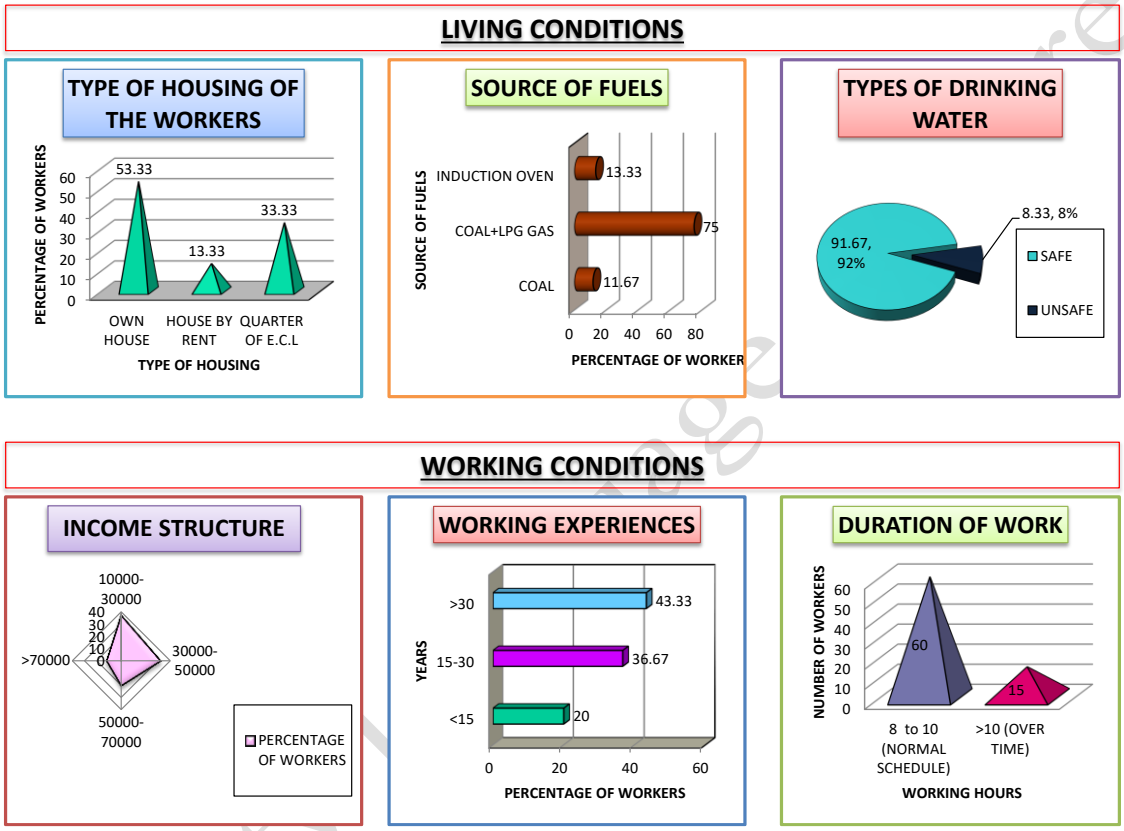

***Figure 4**: Living and Working Conditions in the Coal Mining Area*

Associated Issues in Eastern Coalfield Limited

Environment issues are also huge especially regarding methane emissions during the mining process. The trend in the methane emission during the period 2008-2014 indicates that there is a progressive decrease in the number of methane released compared to 2009 to 2014 where the number of methane released decreased by 0.36 Mm 3 /year (Figure 1). Though this decrease suggests certain improvements, methane is a damaging by-product, causing not only health issues to the miners but also contributing to environmental problems, including greenhouse gases emissions (Singh & Patil, 2021). A score of unremitting socio-economic, legal, and infrastructural issues complicate the operational environment of Eastern Coalfields Limited (ECL). The issue of the widespread illegal mining activity is one of the most urgent

ones. The numbers reveal the varying though considerable figure of FIRs registered in both West Bengal and Jharkhand since 2006 to 2010 with West Bengal logging in maximum (41) FIRs in 2008-09 and Jharkhand logging in (49) FIRs in 2006-07. Though the numbers have since fallen, the frequent occurrences of the crimes point to the fact that there are loopholes in the systems of law enforcement and management of resources. Together with this, there is still gender inequality in the organization. Gender disparities can be overly evident when we look at female participation in Coal India subsidiaries in terms of comparative workforce composition wherein ECL boasts one of the lowest percentages of female involvement with more than an overwhelming majority of staff formulated by the male gender. Production wise, ECL experiences huge losses through disruptions in operations. The worst factors are water logging (0.491 million tonnes lost in 2014), absenteeism and machine breakdowns. Interestingly, machine failures solely led to a lost of 0.285 million tonnes in 2013 and absenteeism and labour unrest continue to be reoccurring problems. The issues of land acquisition, which are not as common, still hamper project implementation and加 improves output shortages. All these findings indicate a mixture of administrative nightmares, poor technological maintenance, job discontent and regulatory failures. Such problems require a complex approach to the issue, including legal improvement, gender integration, modernization of infrastructure, and enhancement of labor relations.

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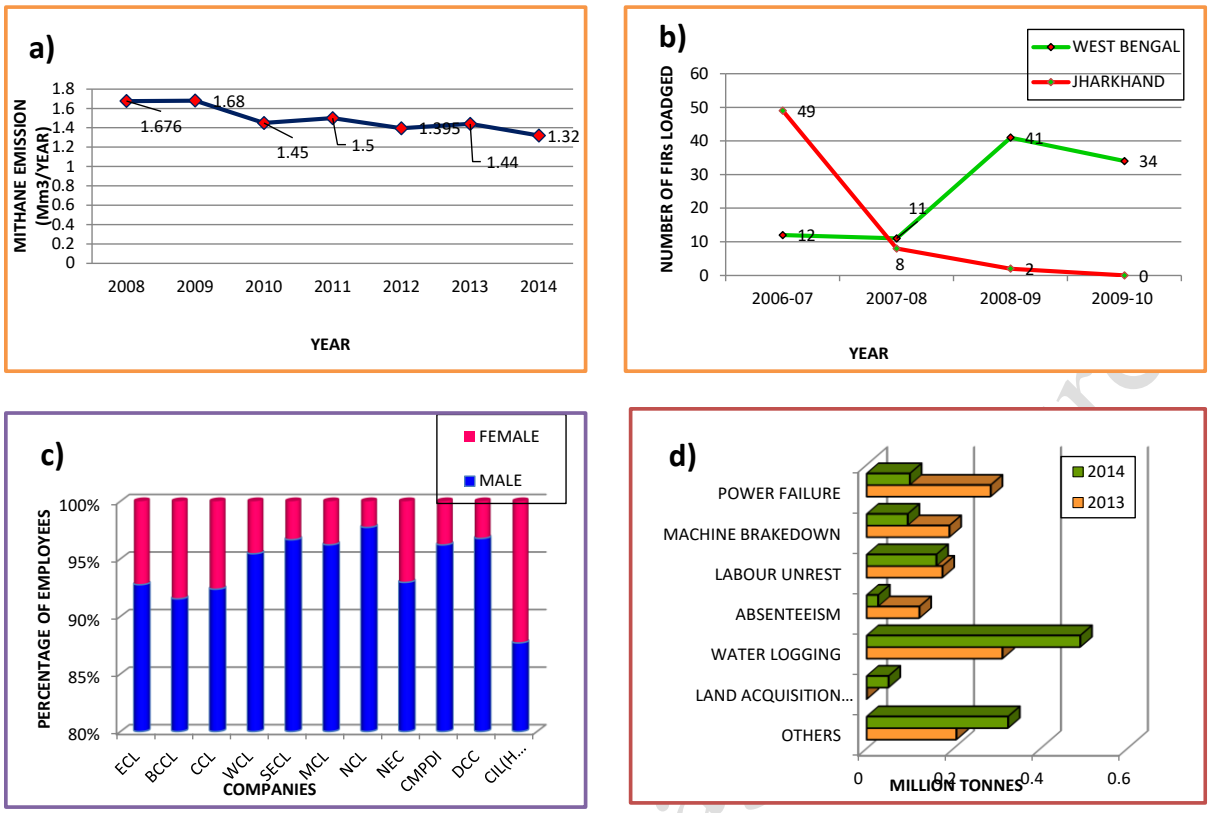

Figure 5: Associated Issues in Eastern Coalfield Limited: (a) Methane emissions in the Kalidaspur Project, (b) Number of FIRs lodged for illegal mining in West Bengal and Jharkhand under Eastern Coalfield Limited, (c) Gender discrimination among employees of various companies of Coal India Limited, (d) Cause-wise production loss.

Conclusion

This paper mainly gives a detailed study of operational, social and environmental dynamics of three high profile coal mining safari projects, such as Satgram, Kalidaspur, and Sonepur Bazari under Eastern Coalfields Limited (ECL) in West Bengal. It can be observed that over these years, the coal production, especially in the open type of mining, such as the Sonepur Bazari, proved to be steadily increasing, but it can be also noted that the underground and inclined shaft construction schemes were on the decline as the result of safety issues, technology weaknesses, and loss of the resources (Eastern Coalfields Limited, 2023). Workers socio environmental factors indicate significant differences in terms of education and health awareness in that, a major part of the workforce is basically enrolled in primary education and allopathic treatment is mostly used by them to cure common medical problems (Roy, 2025). On the one hand, living conditions are rather well-developed, but that does not

exclude infrastructural deficiencies concerning fuel availability and water security. Besides, long work shifts, average pay, and protracted working hours characterize the working environment, which increases health and safety hazards further (Singh & Patil, 2021). Other structural deficiencies in the study such as illegal mining, gender imbalance in work force, and frequent losses in the production due to disruptions in the operation in terms of water logging and equipment malfunction are also raised by the study (Ghosh & Bhattacharya, 2019). The above results indicate why it is necessary to use a multifaceted approach that includes technological modernization, enhanced regulatory control, labor policies sensitive to gender, and mining operations that are sustainable. These two problems, though they are interrelated, are essential to be addressed both to improve coal production performance and ensure the welfare of workers and prevent environmental degradation in one of the most problematic areas in India concerning energy production.

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