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Local Perception on Environmental Impact of Coal Mining in Odisha, India

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ABSTRACT

Coal mining contributes significantly to a nation's growth and development but also threatens the environment and health. This research examines local perceptions of coal mining's impact in Odisha. A household survey was conducted in five villages surrounding the Bhubaneswari, Bharatpur and Lingaraj coal mining regions. The research draws on the local community's views on environmental degradation due to coal mining. Findings revealed that 82 per cent of respondents reported changes in forest cover, 78 per cent believed air and water quality had deteriorated, and 59 per cent reported wildlife and biodiversity loss. Water issues in the mining area are a serious concern. 78 per cent reported poor water quality. This study used a logistic regression model to analyse the relationship between air quality status and forest resource loss, biodiversity loss, fuel use and dust pollution. Biodiversity loss is a significant predictor. Although Mahanadi Coalfield Limited has adopted measures under CSR and sustainable development initiatives, only a minority of households report satisfaction with their effectiveness. The results highlight the paradox of coal mining in Odisha: economic benefits are widespread, but environmental externalities burden local communities, reflecting elements of the resource curse hypothesis. The study underscores the need for stronger institutional frameworks, transparent governance, and coordinated policies among local communities, the state government, and coal mining companies to mitigate long-term ecological problems. This research work contributed to the broader theoretical discourse on natural resource governance by linking the findings to the resource curse hypothesis.

Keywords: Coal mining, Environmental impact, local perception and Logit model

INTRODUCTION

Coal mining and combustion significantly affect the natural environment and health, driven by air and water pollutants such as PM, NO₂, SO₂, and heavy metals (Finkelman et al., 2020; Pawar et al., 2022; Munawar, 2018). These pollutants cause respiratory illnesses, cardiovascular diseases, and increased mortality (Cheung et al., 2020; Landen et al., 2011; Anderson, Thundiyil & Stolbach, 2012). In India, opencast mining activities release SPM and RSPM into the atmosphere, exacerbating health issues such as asthma, tuberculosis, and skin diseases among local populations (Pandey, Agrawal and Singh, 2014; Nayak & Chowdhury, 2018). Moreover, mining affects natural resources and ecosystems, causing deforestation, soil degradation, and biodiversity loss (Ranjan, 2019; Jia et al., 2009; Mensah et al., 2015). However, mining offers economic benefits such as employment, infrastructure development, and income generation (Ivanova et al., 2007). Coal mining in India contributes to local economic development by creating jobs, building infrastructure, and stimulating industrial activity. It has led to the establishment of schools and hospitals and improved roads, enhancing physical and financial capital in mining regions (Hota & Behera, 2016). Additionally, coal mining has diversified livelihoods by creating opportunities for farming, artisanal mining, and livestock management, thereby improving income for many local communities (Das & Mishra, 2015). In some areas, mining has contributed to economic growth and development, with increased output and international trade (Tang & Peng, 2017). Furthermore, the coal mining industry has supported national economies by boosting foreign earnings and revenue (Mishra, 2009). This study examines local people's opinions on the environmental impact of coal mining.

Odisha is one of the best-performing states in the country (PCD-DES, 2022). It holds an important position on India's mineral map, which has accelerated rapid industrialisation in the state. The state's industrial sector has grown faster and contributes more GVA than the national average (PCD-DES, 2021). Odisha has 92 per cent of India's nickel, 96 per cent of chromite, 43 per cent of manganese ore, 51 per cent of bauxite, 33 per cent of iron ore and 24 per cent of coal reserves. Odisha contributed about 25 per cent of the country's total major minerals (Planning and Convergence Department, Directorate of Economics and Statistics, 2021). Coal mines are often studied as a separate category, distinct from non-coal minerals such as iron ore, chromites, manganese, graphite, etc. In production, Odisha ranks 3rd in the country. The state has a coal mineral belt in Sundergarh, Jharsuguda, and Angul districts

(Mahanadi Coalfields Limited, 2021). As for mineral revenue, coal accounts for nearly sixty per cent of total mineral revenue. In 2011, around 1000 tonnes of coal were dispatched daily to power stations in West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, and other parts of India. However, the rising coal demand would result in increased mining activities and negative impacts on biodiversity, ecology, air, water, noise pollution and agricultural production (Mishra and Das, 2017).

In the state, coal mining offers clear economic benefits, such as job creation, infrastructure development, and diversified livelihoods, but it also brings significant environmental challenges, like air and water pollution, dust, and the loss of vital ecosystem services—burdens that local communities must bear in the long term. In response, coal companies in Odisha undertake many corporate social responsibility (CSR) activities to reduce these impacts. These include adopting green mining technologies, eco-friendly rail transportation, and dust-suppression techniques such as mechanical sweepers and mobile water tankers (Mahanadi Coalfields Limited, 2021). Additionally, funds from the District Mineral Fund in Angul are directed to high-priority development areas such as healthcare, education, and environmental preservation. However, many projects remain delayed, with significant portions of allocated funds still unused (District Mineral Foundation Trust, Angul, 2021). Although Odisha collects the highest district mineral development funds among India's mining states, its utilisation rate is only 50%, which is lower than that of states like Chhattisgarh, Tamil Nadu, and Jharkhand (Ministry of Mines, GOI, 2021).

Coal mining can bring benefits, but its long-term detrimental effects can also be a curse. This may reflect a resource curse in the study area. This study conducted a household survey on local perceptions of the impact of coal mining, providing empirical evidence. This research calls for policy intervention to adopt more environmentally sustainable mining practices. This research work contributed to the broader theoretical discourse on natural resource governance by linking the findings to the resource curse hypothesis. Against this background, this paper analyses local perceptions of coal mining and its environmental impacts in Odisha. This study is based on a household survey covering five mining villages.

REVIEW OF LITERATURE

This section reviews literature on the economic benefits and negative consequences for ecology, society and health due to mining activities in general and coal mining in particular. Mineral industries contribute to economic development and provide employment.

The coal mining sector also contributes to the local economy by providing employment and improving the economic condition of local people (Ivanova et al., 2007), while also helping create diversified livelihoods in local areas (Das and Mishra, 2015). Moreover, it creates many benefits, such as foreign exchange earnings, revenue and the provision of schools, colleges, hospitals and better roads in mining areas (Mishra, 2009). A major socio-cultural shift from agricultural economics to national and industrial economics has been witnessed after the beginning of the coal mining sector in India (Sen, 2013). Maximum coal production yields more profits in China (Tang & Peng, 2017) and Romania (Batrancea et al., 2019). Additionally, mining countries perform better than non-mining countries in Africa (Ericsson & Lof, 2019).

Open-cast coal mining activities, such as blasting, drilling, transporting and dumping, are a major source of air pollution. They emit toxic elements such as SPM, RSPM, NO_x and SO_x into the environment (Pandey, Agrawal and Singh, 2014; Nayak & Chowdhury, 2018; Munawer, 2018; Mwaanga et al., 2019) and negatively affect the environment (Goswami, 2015). High PM concentrations increase morbidity and mortality (Higginbotham et al., 2010; Landen et al., 2011; Anderson, Thundiyil & Stolbach, 2012). In India, diseases such as gastric disease, asthma, cold, cough, tuberculosis, joint pain, eye disease and skin disease are common due to coal mining (Hota & Behera, 2015; Nayak & Chowdhury, 2018). Coal burning and consumption cause pollution that affects human health (Finkelman et al., 2020; Pawar et al., 2022) and coal mining activities negatively impact the environment (Dai et al., 2014; Mishra and Das, 2017). Consequently, mining activity has negatively influenced local people, ecology and the sustainable livelihoods of local communities, with adverse effects on natural, social and human capital (Hota & Behera, 2016). It also adversely affects air and water quality, soil erosion, wildlife habitat and forest and landscape change (Chabukdhara & Singh, 2016). However, countries like the US and Western Europe are gaining substantial health benefits from reduced coal use, while in India, China, Russia and other Asian countries, coal use has increased, negatively affecting health (Finkelman et al., 2020).

Coal mining districts in India have also seen sizeable forest change compared with non-coal mining districts (Ranjan, 2019). Mishra (2009) pointed out that the local community bears the costs of coal mining over a longer period. Apart from this, several challenges faced by the local people include lack of health facilities, bad roads, the spread of contaminated diseases, human and wildlife disturbances, untrained miners, inadequate safety equipment

and fewer mining ventures (Mwakumanya et. al., 2016), and mining areas have been adversely affected in terms of social evils like displacement of people, morbidity due to HIV/AIDS and air and water pollution (Kitula, 2006). Sometimes illegal mining activities impact water, soil, vegetation, landscape and the ecosystem (Mensah et al., 2015).

Many studies also found that displacement and resettlement are another adverse impact of mining and coal mining. Owen and Kemp (2015) found a close association between societal risk and physical displacement, resettlement and relocation. Mining-induced displacement and resettlement adversely affect land-based resources, property, livelihoods and jobs in Africa (Wilson, 2019). Similarly, in Australia, coal mining displacement pushed communities into uncertainty and ambiguity (Askland, 2018).

METHODOLOGY

Study area

The study area's problems are captured through the lens of the primary study. The primary data were collected in June 2021. The questionnaire includes mining and environmental problems like mineral resource loss, biodiversity loss, land loss, air quality and water quality. It also includes people's perceptions of pollution from mining activities and the measures adopted by the authorities. Talcher has fourteen approved coal mining projects and eight coal mining areas, namely Bhubaneswari, Jagganath, Bharatpur, Hingula, Kaniha, Lingaraj, Subhadra and Talcher area (underground) (MCL, 2021). Simple random sampling selected the Bhubaneswari, Bharatpur and Lingaraj coal mining areas, and five mining villages in the vicinity of these three areas were selected. Raghunathpur and Arakhpal villages have been judgmentally chosen in the vicinity of Bhubaneswari opencast coal mining. Similarly, Talabeda and Kandhal villages were purposefully selected near Lingaraj opencast coal mining. Moreover, Jamubahali village was judgmentally selected near Bharatpur opencast coal mining. These villages were selected because MCL has not rehabilitated them, although they fall within active mining areas. I then judgmentally selected 40 households from each of the five villages. I selected an equal number of households from each study village (Gupta, 2008; Adhikari, 2012; Nayak & Chowdhury, 2018). Additionally, the study held discussions with residents of rehabilitated villages, such as Biraramchandrapur and Kalamchuin, to gain broader insights into the impacts of displacement. Notably, some

households in these areas refused to relocate because they were dissatisfied with the rehabilitation packages provided.

Model

The Logit model is used when the dependent variable is binary. In this study, the dependent variable is air quality, coded as a dummy variable, and regressed against several independent variables such as forest resource loss, land resource loss, biodiversity loss, wood, coal and kerosene (woodck), and dust pollution. The general form of the logistic regression model is:

$$P_i = E(Y=1/X_i) = \beta_1 + \beta_2 X_i \dots \dots \dots (1)$$

where Y is the dependent dummy variable, taking the value 1 if the respondent perceives deterioration in air quality, and 0 otherwise.

For estimation, the model can be reformulated as:

$$L_i = \ln(P_i/1-P_i) = Z_i = \beta_1 + \beta_2 X_i \dots \dots \dots (2)$$

Here, L_i represents the log-odds, which is linear in both the independent variables (X_i) and the parameters. This transformation, known as the logit, provides the basis for the Logit model.

In this study, household-level responses were coded such that $P_i = 1$ if the respondent answered “Yes” (indicating perceived air quality problems) and $P_i = 0$ if the response was “No.” The model parameters were estimated using Maximum Likelihood Estimation (MLE) (Gujarati & Sangeetha, 2007).

RESULT AND DISCUSSION

The study captures people's perceptions of awareness of environmental problems caused by coal mining activities. The respondents are sensitive to the environmental problems caused by mining. Table 1 presents households' opinions on irreversible environmental damage from mining activities. The environmental problems narrated by the respondents include water pollution, air pollution and the loss of land, wildlife, forests and biodiversity. Respondents strongly reported resource loss. 82 per cent of respondents expressed that forest cover has changed due to mining activities. 78.5 per cent of respondents believed that air and water quality had decreased. A further 69 per cent favoured a reduction

in land resources. Moreover, 68.5 per cent believed mineral resources have diminished; 67 per cent and 59 per cent supported wildlife and biodiversity loss.

The sources of water in the mining villages are mainly tube wells, wells, ponds and MCL water. In the mining villages, most people use wells, open wells and tube wells for drinking water. Few households use MCL water for drinking and bathing. In all sample villages, most households complained about poor-quality drinking water (70.5%). Some even express their anguish over bathing water (72%). Many households also report bad water colour and taste (Table 2). The Mahanadi Coalfield Limited (MCL) has taken various measures to control environmental pollution and provide many benefits to the local people. Therefore, I collected information on respondents' satisfaction with the measures adopted by MCL. Nearly 36 per cent of respondents from the sample villages are satisfied with the measures taken by MCL. These measures include employment opportunities for local people, rehabilitation packages for mining-affected villages, plantations and other environmental measures.

Table 1: Resource Loss (All figures are in percentage)

Mining Village	No. of HHs	Forest		Land		Mineral resource		Water		Air		Wildlife		Biodiversity	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Kandhal	40	92.5	7.5	37.5	62.5	62.5	37.5	80	20	82.5	17.5	72.5	27.5	52.5	47.5
Raghunathpur	40	95.0	5.0	87.5	12.5	87.5	12.5	90	10	87.5	12.5	85	15	75	25
Jamubahali	40	62.5	37.5	62.5	37.5	57.5	42.5	72.5	27.5	70	30	52.5	47.5	52.5	47.5
Arakhpal	40	87.5	12.5	87.5	12.5	72.5	27.5	80	20	82.5	17.5	75	25	65	35
Talabeda	40	72.5	27.5	70	30	62.5	37.5	70	30	70	30	50	50	50	50
Total	200	82.0	22.0	69.0	31.0	68.5	31.5	78.5	21.5	78.5	21.5	67.0	33.0	59.0	41.0

Source: Field Survey, 2021

Table 2: Water Quality

Mining Village	No. of HHs	Drinking		Bathing		Colour		Taste	
		Good	Bad	Good	Bad	Pure	Impure	Good	Bad
Kandhal	40	2.5%	97.5%	12.5%	87.5%	12.5%	87.5%	17.5%	82.5%
Raghunathpur	40	25%	75%	20%	80%	22.5%	77.5%	22.5%	77.5%
Jamubahali	40	35%	65%	32.5%	67.5%	40%	60%	40%	60%
Arakhpal	40	47.5%	52.5%	37.5%	62.5%	37.5%	62.5%	42.5%	57.5%
Talabeda	40	37.5%	62.5%	37.5%	62.5%	32.5%	67.5%	35%	65%

Total	200	29.5%	70.5%	28%	72%	29%	71%	31.5%	68.5%
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Source: Field Survey, 2021

Similarly, 21 per cent of respondents are satisfied with sustainable development measures taken by MCL, such as environmental protection measures and CSR activities in the mining villages, and 18 per cent of households are happy with the eco-friendly technology adopted by MCL (Table 3).

Table 3: Measures taken by MCL

Mining Village	No of HHs	MCL took measures	Sustainable Development measures taken MCL	Eco-friendly technology adopted by MCL
Kandhal	40	60%	40%	30%
Raghunathpur	40	47.5%	17.5%	22.5%
Jamubahali	40	27.5%	15%	10%
Arakhpal	40	27.5%	7.5%	10%
Talabeda	40	17.5%	25%	17.5%
Total	200	36%	21%	18%

Source: Field Survey, 2021

Based on the opinions of the sample respondents, this study attempts to capture the extent of environmental damage from air pollution due to mining activities. A logistic regression model was used to show the relationship between air quality and forest resource loss, land loss, biodiversity, wood (wood, coal, kerosene), and dust pollution. Diagnostic tests are important for robust results, using post-estimation techniques such as specification error, multicollinearity and goodness-of-fit tests (Pradhan, Kumar and Sharma, 2024). Additionally, I plot the LOWESS smoother plot and the Breusch-Pagan leverage. Biodiversity loss (OR) is 20.92, and the coefficient is 3.04, significant at the 1 per cent level; the constant is significant at the 10 per cent level (Table 4).

Table 4: Logistic regression results

Air Quality	Odds Ratio	Coefficients
Forest loss	2.077 (1.268)	0.731 (0.610)
Rloss	1.46 (0.871)	0.384 (0.593)
Landloss	0.866 (0.480)	-0.142 (0.553)

biodiversity	20.920*** (14.078)	3.040*** (0.672)
Woodck	1.763 (0.948)	0.567 (0.538)
Dp	1.922 (0.922)	0.653 (0.479)
_cons	0.249* (0.150)	-1.387* (0.603)
Number of observations = 200		
Pseudo R2 = 0.3675		
Log likelihood = -65.841588		

Source: Authors' estimation

(Robust standard errors in parentheses)

***p < 0.01, **p < 0.05, *p < 0.1

The R-squared value is greater than 0.05, indicating the model is a good fit (Table 5). All VIF values are less than 5. The model shows no significant multicollinearity. (P-values are greater than 0.05). The model is a good fit (Tables 6 & 7).

Table 5: Diagnostic check for specification error in the model

Air	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
hat	0.906	0.342	2.65	0.008	0.237	1.575
hatsq	0.033	0.106	0.31	0.758	-0.175	0.241
cons	-0.021	0.241	-0.09	0.930	-0.493	0.450
Pseudo R2 = 0.3680						
Log likelihood = -65.794325						
Number of observation = 200						

Source: Authors' estimation

Table 6: Diagnostic test statistics

Variable	Multicollinearity
forest	2.02
rloss	1.83
landloss	1.77
biodiversity	1.59
dp	1.23
woodck	1.10

Source: Authors' estimation

The LOWESS smoother plot shows leverage values below 0.1 and relatively uniform, indicating a good model fit (Figure 1A & B). The leverage plot for the response variable

shows the spread of leverage values. The leverage values are less than 0.15, which implies the observations have little influence. Hence, the model is a good fit.

Table 7: Logistic model for air, goodness-of-fit test

Number of observations 200
Number of groups=7
Hosmer-Lemeshow $\chi^2(5)=1.41$
Prob> $\chi^2= 0.9234$
Source: Authors' estimation

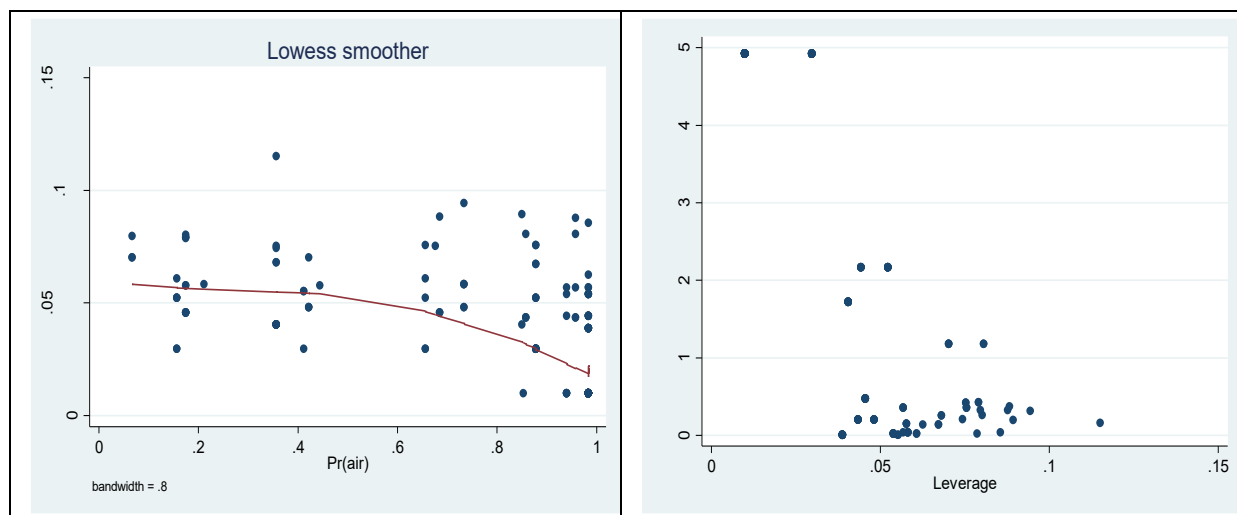


Figure 1: A) Lowess smoother plot, B) Pregibon leverage plot

LIMITATION OF THE STUDY

The study is based on a relatively small sample size (200 households). A larger sample would have strengthened the findings. The study relies on local perceptions, and adding quantitative data on pollution and health diary data would make it more robust. The regression model could include more socio-economic variables such as income, age, sex and education, and it could also focus on health impacts, which would enhance the study's effectiveness. Future research will cover more diverse households, socio-economic variables, health aspects and a wider geographical region to strengthen the robustness of the findings.

CONCLUSION

Respondents in the study area report a decline in forest resources, biodiversity, wildlife habitat, land resources, and mineral resources due to mining activities. Air and water

quality have also deteriorated due to rapid coal exploration and transportation. Most people express deep concern about coal mining companies' adherence to these measures. Measures such as sustainable development, eco-friendly practices, and CSR activities need to be rigorously enforced. Local communities bear the costs through environmental externalities, but the benefits are spread across the state. The environmental externalities can be attributed to market, policy and institutional failure (Hota & Behera, 2015). The relevance of the market failure and resource curse hypothesis can be realised in the context of the current environmental problems.

Different types of pollution in Odisha's coal-mining areas affect local communities. The price mechanism was absent between the polluters and the affected parties. Coal mining companies cannot internalise the externalities society bears. On the other hand, while local communities may benefit, the long-term costs borne by society from air and water pollution can be a curse on the community. Sometimes these externalities undermine the benefits. By considering these facts, a well-coordinated policy framework between local coal mining companies and the government should be developed to address these issues. From a policy perspective, this research suggests that environmental degradation requires stronger environmental regulations and better mechanisms in mining regions. The study also emphasises the proper coordination between mining companies, local communities, and the state government to minimise environmental degradation and the problems faced by local communities.

REFERENCE

- Adhikari, N. (2012). *Measuring the health benefits from reducing air pollution in Kathmandu Valley*. The South Asian Network for Development and Environmental Economics (SANDEE), Working Paper, No. 69-12. Available at: https://www.sandeeonline.org/uploads/documents/publication/983_PUB_Working_Paper_69_Naveen_Adhikari.pdf
- Anderson, J. O., Thundiyil, J. G., & Stolbach, A. (2012). Clearing the Air: A Review of the Effects of Particulate Matter Air Pollution on Human Health. *Journal of Medical Toxicology*, 8, 166–175. doi: [10.1007/s13181-011-0203-1](https://doi.org/10.1007/s13181-011-0203-1)
- Askland, H. H. (2018). A dying village: Mining and the experiential condition of displacement. *The Extractive Industries and Society*, 1-7. <https://doi.org/10.1016/j.exis.2018.02.007>
- Batrancea, I., Batrancea, L., Nichita, A., Gaban, L., Masca, E., Morar, I. D., ... & Moscviciov, A. (2019). An econometric approach on production, costs and profit in Romanian coal mining enterprises. *Economic research-Ekonomska istraživanja*, 32(1), 1019-1036. doi.org/10.1080/1331677X.2019.1595080
- Chabukdhara, M., & Singh, O.P. (2016). Chabukdhara, M., & Singh, O. P. (2016). Coal mining in northeast India: an overview of environmental issues and treatment approaches. *International Journal of Coal Science & Technology*, 3(2), 87–96. <https://doi.org/10.1007/s40789-016-0126-1>
- Cheung, C. W., He, G., & Pan, Y. (2020). Mitigating the air pollution effect? The remarkable decline in the pollution-mortality relationship in Hong Kong. *Journal of environmental economics and management*, 101, 102316. <https://doi.org/10.1016/j.jeem.2020.102316>
- Dai, G. S., Ulgiati, S., Zhang, Y. S., Yu, B. H., Kang, M. Y., Jin, Y., ... & Zhang, X. S. (2014). The false promises of coal exploitation: How mining affects herdsman well-being in the grassland ecosystems of Inner Mongolia. *Energy Policy*, 67, 146–153. <https://doi.org/10.1016/j.enpol.2013.12.033>
- Das, N., & Mishra, N. (2015). Assessing the impact of coal mining on diversified sources of rural livelihoods: A case study in the Ib Valley coalfield area of western Odisha, India. *International Research Journal of Social Sciences*, 4(6), 83-88. Available at <https://www.isca.me/IJSS/Archive/v4/i6/14.ISCA-IRJSS-2015-116.php>
- District Mineral Foundation Trust, Angul. (2021). *Annual report 2021*. District Mineral Foundation Trust, Angul. Available at https://dmf.odisha.gov.in/district/anugul/publication/annual_report
- Ericsson, M. & Lof, O. (2019). Mining's contribution to national economies between 1996 and 2016. *Mineral Economics*, 32(2), 223–250. <https://doi.org/10.1007/s13563-019-00191-6>
- Finkelman, R. B., Wolfe, A. L. & Hendryx, M. S. (2020). The Future Environmental and Health Impacts of Coal. *Energy Geoscience*, 2, 99–112. <https://doi.org/10.1016/j.engeos.2020.11.001>

- Goswami, S. (2015). Impact of coal mining on environment. *European Researcher*, (3), 185–196. doi:[10.13187/er.2015.92.185](https://doi.org/10.13187/er.2015.92.185)
- Gujarati, D.N. & Sangeetha (2007). *Basic Econometrics*. Tata McGraw-Hill Publishing Company Limited. Available at: https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ECO/1.pdf
- Gupta, U. (2008). Valuation of urban air pollution: a case study of Kanpur City in India. *Environmental and Resource Economics*, 41(3), 315–326. <https://doi.org/10.1007/s10640-008-9193-0>
- Higginbotham, N., Freeman, S., Connor, L., & Albrecht, G. (2010). Environmental injustice and air pollution in coal-affected communities, Hunter Valley, Australia. *Health & Place*, 16(2), 259–266. <https://doi.org/10.1016/j.healthplace.2009.10.007>
- Hota, P. & Behera, B. (2015). Coal mining in Odisha: An analysis of impacts on agricultural production and human health. *The Extractive Industries and Society*, 2(4), 1–11. <https://doi.org/10.1016/j.exis.2015.08.007>
- Hota, P. & Behera, B. (2016). Opencast coal mining and sustainable local livelihoods in Odisha, India. *Mineral Economics*, 29, 1–13. <https://doi.org/10.1007/s13563-016-0082-7>
- Ivanova, G., Rolfe, J., Lockie, S. & Timmer, V. (2007). Assessing social and economic impacts associated with changes in the coal mining industry in the Bowen Basin, Queensland, Australia. *Management of Environmental Quality: An International Journal*, 18(2), 211–228. <https://doi.org/10.1108/14777830710725867>
- 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. <https://doi.org/10.1016/j.jclepro.2004.01.012>
- Landen, D. D., Wassell, J. T., McWilliams, L., & Patel, A. (2011). Coal dust exposure and mortality from ischemic heart disease among a cohort of US coal miners. *American journal of industrial medicine*, 54(10), 727-733. <https://doi.org/10.1002/ajim.20986>
- Mahanadi Coalfields Limited (2021). Annual report & accounts 2020–21. Available at <https://www.mahanadicoal.in>
- Mensah, A. K., Mahiri, I. O., Owusu, O., Mireku, O. D., Wireko, I., & Kissi, E. A. (2015). *Environmental impacts of mining: A study of mining communities in Ghana*. *Applied Ecology and Environmental Sciences*, 3 (3), 81–94. <https://doi.org/10.12691/aees-3-3-3>
- Ministry of Mines, Government of India. (2021). *DMF status report*. Ministry of Mines, Government of India. Available at <https://dmfindia.mines.gov.in/login>
- Mishra, N., & Das, N. (2017). Coal Mining and Local Environment: A Study in Talcher Coalfield of India. *Air, Soil and Water Research, Sage*, 10, 1–12. <https://doi.org/10.1177/1178622117728913>
- Mishra, P. P. (2009). Coal mining and rural livelihoods: Case of the Ib Valley coalfield, Orissa. *Economic and Political Weekly*, 117–123. <https://doi.org/10.2307/25663741>

- Munawer, E. M. (2018). Human health and environmental impacts of coal combustion and post-combustion wastes. *Journal of Sustainable Mining*, 17, 87-96. <https://doi.org/10.1016/j.jsm.2017.12.007>
- Mwaanga, P., Silondwa, M., Kasali, G., & Banda, P.M. (2019). Preliminary review of mine air pollution in Zambia. *Heliyon*, 5, 1-10. <https://doi.org/10.1016/j.heliyon.2019.e02485>
- Mwakumanya, M. A., Maghenda, M. & Juma, H. (2016). Socio-economic and environmental impact of mining on women in Kasigau mining zone in Taita Taveta County. *Journal of Sustainable Mining* 15, 197-204. <https://doi.org/10.46873/2300-3960.1190>
- Nayak, T., & Chowdhury, I. R. (2018). Health Damages from Air Pollution: Evidence from Opencast Coal Mining Region of Odisha, India. *Ecology, Economy and Society—the INSEE Journal*, 1 (1), 43–65. <https://doi.org/10.37773/ees.v1i1.9>
- Owen, J. R., & Kemp, D. (2015). Mining-induced displacement and resettlement: a critical appraisal. *Journal of Cleaner Production*, 87, 478–488. <https://doi.org/10.1016/j.jclepro.2014.09.087>
- Pandey, B., Agrawal, M., & Singh, S. (2014). Assessment of air pollution around coal mining area: Emphasizing on spatial distributions, seasonal variations and heavy metals, using cluster and principal component analysis. *Atmospheric Pollution Research*, 5, 79-86. <https://doi.org/10.5094/APR.2014.010>
- Pawar, N. D., Harris, S., Mitko, K. & Korevaard, G. (2022). Valorization of coal mine effluents — Challenges and economic opportunities. *Water Resources and Industry*, 28, 1-12. <https://doi.org/10.1016/j.wri.2022.100179>
- Planning and Convergence Department, Directorate of Economics and Statistics (2022). *Odisha Economic Survey 2021-22*. Government of Odisha. Retrieved from <https://pc.odisha.gov.in/publication/economic-survey-report>
- Planning and Convergence Department, Directorate of Economics and Statistics (2021). *Odisha Economic Survey 2020-21*. Government of Odisha. Retrieved from <https://pc.odisha.gov.in/publication/economic-survey-report>
- Pradhan, K. C., Kumar, S., & Sharma, R. (2025). Adopting digital financial technology in Madhya Pradesh, Central India: opportunities, challenges, and determinants. *Journal of the Knowledge Economy*, 16(2), 10599-10638. <https://doi.org/10.1007/s13132-024-02190-7>
- Ranjan, R. (2019). Assessing the impact of mining on deforestation in India. *Resources Policy* 60, 23–35. <https://doi.org/10.1016/j.resourpol.2018.11.022>
- Tang, E., & Peng, C. (2017). A macro- and microeconomic analysis of coal production in China. *Resources Policy*, 51, 234–242. <https://doi.org/10.1016/j.resourpol.2017.01.007>
- Wilson, S. A. (2019). Mining-induced displacement and resettlement: The case of rutile mining communities in Sierra Leone. *Journal of Sustainable Mining*, 18, 67–76. <https://doi.org/10.1016/j.jsm.2019.03.001>

Yun-jia, W., Da-chao, Z., Da-jun, L., Yong-feng, L., & Xing-feng, W. (2009). Environmental cumulative effects of coal exploitation and its assessment. *Procedia Earth and Planetary Science*, 1(1), 1072-1080. <https://doi.org/10.1016/j.proeps.2009.09.165>