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## HEALTH IMPACT OF IRON ORE MINES: A COMPARATIVE STUDY ON MINING AND NON-MINING INHABITANTS OF KEONJHAR DISTRICT OF ODISHA

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**CUTTACK**

### ABSTRACT

Minerals resources of a country play an important role in the growth of industrial sector as they constitute an important source of raw materials for most of the basic industries necessitating their exploration from earth. They represent the wealth of a region where they exist. The mines act 1952 defines a mine as "any excavation where any operation for the purpose of searching or obtaining minerals has been or being carried on". Thus mining is essentially a destructive development activity where ecology suffers at the cost of economy. The extraction and processing of ores and minerals lead to widespread environmental pollution. As a result people in that area have to suffer many environmental and occupational health hazards. Endowed with vast mineral deposits, Odisha occupies a prominent place in the minerals map of the country both in terms of deposits and production and Keonjhar District is considered to be the mining belt of Odisha. Mineral exploitation cannot be done away with as they are the basic raw materials for development. An attempt has been made in present study to examine the impact of mining activities on the health status of the people through a comparative study of mining and non mining areas based on the primary survey data that was carried out in 2001-12 and contribution of mining to the difference with some policy recommendation to the mining authorities and mining companies to control environmental pollution and mitigate its ill effect on health of people.

### JEL CODE

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### KEYWORDS

environmental pollution, health hazards, mining.

### INTRODUCTION

Mineral resources development is an essential condition for successful economic development of an economy (Bogdetsky V, Ibraev K., Abdyrakhmanova J, 2005; Ofosu-Mensah E.A, 2011). It generates employment opportunities to the people, income to state exchequer and foreign exchange to the mineral producing country (Akabzaa T and Darimani A, 2001; Bogdetsky V, Ibraev K., Abdyrakhmanova J, 2005; Ofosu-Mensah E.A, 2011). Thus mining contributes significantly to the development of the mining region and the entire nation (Ofosu-Mensah E.A, 2011). Odisha is a very rich mineral bearing state of India. Odisha is the leading producer of chromites, graphite, bauxite, manganese ore, iron ore, sillimanite, quartzite, pyroxenite and dolomite. The mining and quarrying sector has been contributing about 7 percent towards Odisha real GDP at 2004-05 prices (Economic survey of Odisha, 2011-12). This is also a source of revenue to the state exchequer in terms of royalty collected from the lease holders. State government earns Rs 1029 million in 2010-11 as royalty collection in minerals (Indian Bureau of mines). In terms of value of output of minerals, Odisha ranks highest enjoying 11.89 percentage share of total value of mineral output in India in 2010-11 (Economic Survey of Odisha, 2011-12).

Odisha is having a lion share of 37 percent of all India iron ore production and value of iron ore in 2010-11 (Indian mineral yearbook, 2011). There has been an increase in production of iron ore in Odisha from 77.2 million Metric Tons (MT) in 2008-09 to 81.14 million Metric Tons 2010-11. Not only from production front but also from trade area iron ore is the most important mineral in the export basket of all minerals in Odisha. In 2010-11 its share in total exports of minerals stood at 24.1 million tones which is 97.3 percent. Iron ore mine is the largest employment provider in mining sector in Odisha in 2010-11. 20,071 workers are engaged in the iron ore mine which is 38.7 percent of total employment in mining sector (Economic Survey of Odisha, 2011-12).

Iron ore extraction is mostly confined to Keonjhar district which is considered to be the mining belt of Odisha accounts for 63.8 percent of total extraction. It is having second highest extraction rate of 1.62 percent after chromites having the highest extraction rate of 2.59 percent (Economic survey of Odisha, 2011-12). Apart from direct employment benefits from mining activity, there has been also a realization of benefits in form of a number of indirect employment opportunities like running workshop cum garage, shops, provision of stores and other allied activities; area infrastructural development. A study in Keonjhar districts of Odisha reveals that household closer to mines report higher income from wage employment and better access to infrastructure (Pattanayak S K et al, 2010). This shows that mining gives a lot of economic benefits to the people, state and country. Mining cannot be done without degrading land and without disturbing the existing environment. Degradation of environment has not left the lives of people untouched. Damage to river, field, well, flora and fauna in one way or other has badly affected the people themselves. Thus what price the people has to pay to realize this benefit from mining.

### REVIEW OF LITERATURE

There are studies which corroborates the argument that mining is important as an economic activity and provide a major edifice upon which the overall development of any economy endowed with rich natural resources rests (Ejdemoand soderholm, 2011; Ye, 2008; Brunnschweiler, 2006; mcmohan and remy, 2001; Stilwell et al, 2000; clements et al., 1996). In spite of economic and other benefits that accrue due to mining there is almost a unanimous agreement that this activity is beset with a number of problems. The impacts of mining are felt at every stage of the mining cycle from exploration to mine disclosure. It is one such activity that has highly adverse consequences not only on natural ecosystem but also on the local communities dependent on them (Vagholikar N et al, 2003). The villages closest to mines appear to bear a greater environmental cost (Pattanayak S K et al, 2010). The adverse impact of mine on environment can be seen in form of pollution of air, water, land and noise. Mining activity result in land degradation and as a consequence there was change in land use pattern with increase in wasteland and decrease in land for agriculture and forest (Chauhan S S, 2010; Panwar S et al, 2011). Huge overburdens generated from mines are found to be the major source of landscape change of mine area (report by Environment & Development Team, Vasundhara, 2008). Major mining activities contribute directly or indirectly to air pollution (Kumar et al, 1994; CMRI, 1998). Some activities (i.e. drilling, blasting, loading-unloading of materials, overburden etc.) in mines area created some fine particles which can suspended in air and results in air pollution. Mine water pump out during drainage operation, spent water from handling plants, effluents from beneficiation plants and wash off from waste tailing dumps create both surface and ground water pollution (Patnaik and Ray, 1988). Effluents from mines which results in the deterioration in the quality of ground water causes water hardness (Malm O, 1990; Donkor A. K., 2006; Suresh S et al, 2007; Ezeaku P I, 2012). Thus the increasing distance from the pollutant source (mining areas) is one of the main factor for decrease in pollution level in water bodies (Delgado J, 2009). Noise is almost ubiquitous in mining areas. It is generated by drilling, blasting, cutting, materials handling, ventilation, crushing, conveying and ore processing. The impact of high-pitched and other noises is known to include damage to the auditory system, cracks in buildings, stress and discomfort (Akabzaa T and Darimani A, 2001).

Further a study Noronha and Nairy (2005) shows that though mining region has a lower Quality Of Life relative to the non-mining villages but people in the mining region reported lower satisfaction levels only in the environmental domain. This finding was evidenced by a study which shows villages closer to mines have poorer health, education and production assets (Pattanayak S K et al, 2010).

Mining has been most hazardous of occupation and hazards of working in mines vary greatly on such factors as the type of mineral being mined, related geological formation, mining techniques employed and general health of workers (Cho K.S and Lee S.H, 1978). The mining effect on health of residents in the communities is related to distance from the mines. That is, proximity to mine site is very crucial in determining the prevalence of mining related diseases such as malaria, respiratory infections and skin diseases (Yeboah J Y, 2008). Incidence of illness, expenditures on illness, and total cost of illness are all higher in mining region and negatively correlated with distance to mines. Households who live closer to mines do report significantly more days that household members are too ill to work (Pattanayak S K et al, 2010). Moreover, prolonged inhalation of dust from mining operations is another concern, due to potential lung damage and respiratory disease (Coggon & Taylor, 1998). A positive correlation has been established between dust concentrations with tuberculosis infection (Mohapatra H et al, 2010). HIV, tuberculosis, and silicosis have a multiplicative interaction. As miners continue to age and work for longer periods, the burden of silicosis and its associated diseases will continue to rise (Nelson G et al, 2010). Cancer rates are also significantly higher in mining areas than non mining (Hendryx M et al, 2011). Water rich in manganese may cause excessive manganese intake and can increase bacterial growth in water which may result in Manganism among miners as proved in a study in Keonjhar District of Odisha (Goswami S et al, 2009). The miners in iron ore had an increased risk for respiratory symptoms including recurrent wheeze, longstanding cough and for physician-diagnosed chronic bronchitis (Hedlund U et al, 2004). Excess mortality from lung cancer has been observed among iron-ore miners indicates a real occupational hazard (Boyd J. T et al, 1970; Kinlen L. J and. Willows A. N, 1988, Isco J, 1994).

### IMPORTANCE OF STUDY

The comparative advantage of Odisha in terms of rich mineral resources has helped the state to attract investment by many mining companies. The mining districts have contributed immensely to the financial stability of the state. Now Question arises as to what extent mining sector has contributed to the overall economic development of the state. How mining districts have fared in terms of human development indicators. Has the benefit of mining trickle down to the people in the mining districts? Table 1 show that the mining districts lag behind the non mining districts in respect of literacy, education, gender disparity, health and human development.

**TABLE 1: HUMAN DEVELOPMENT IN MINING VIS-À-VIS NON-MINING DISTRICTS OF ODISHA**

	Literacy rate (%)	Education index	Education deprivation index	Average gender disparity	Health index	HDI
Mining districts	55.56	.67	81.13	0.72	0.45	0.56
non-mining districts	65.29	0.74	NA	0.55	0.51	0.59
Odisha	63.61	0.72	74.05	0.49	0.47	0.58

Source: Odisha Human Development Report, 2004.

Hence there is an increasing disparity between mining and non mining districts by means of percolation of development. Keonjhar district which contributes a sizeable percentage of iron ore produced in Odisha has had fortune of imparting a string of benefits to its people –thanks to mining. Mining cannot be done without degrading land and without disturbing the existing environment. Degradation of environment has not left the lives of people untouched. Damage to river, field, well, flora and fauna in one way or other has badly affected the people themselves (Monjezi M. et al, 2008; Ezeaku P I, 2012). Moreover dust and other forms of pollution deter the environment which ultimately leads to deterioration of health of people. Thus mining is bound to have significant impact on the environment and health status of the people and Keonjhar district which is the hub of iron ore mining is not an exception. Odisha continues to be one of the industrially backward states despite its vast mineral resources. Though the district under study is rich in mineral and forest resources there is no major large scale industry in the district except Kalinga iron works of Barbil, ferromanganese plant of Joda and sponge iron plant at Palaspanga. The Keonjhar district is considered as a relatively backward district among 30 district of the state occupying 24<sup>th</sup> position in the Human Development Index. The per capita income in the district is just above the state average. Human Development Index (HDI) along with the income takes into account education and health aspect of the people. Keonjhar district though enjoy a high per capita income but is ranked 24th among the thirty districts in Odisha according to HDI (Odisha human development report, 2004).

Global Iron-ore demand is set to double to around 3.5-billion tons a year by 2030, with recent investigations by Data Analysts Raw Materials Group (RMG) in 2012. The National Steel Policy 2005 has envisaged the target of steel production at 180 million tons by 2019-2020 which will be requiring approx 500 million tons of iron ore against current production levels of 220 million tons a year. Thus the present level of Iron-ore reserves in India is unlikely to be sufficient to meet projected demand by 2019/20 (Indian Bureau of Mines report, vision 2020 on Iron and steel). With high –grade Iron ores reserves under the threat of depletion, it is obligatory on the part of mining industry to consider exploitation and utilization of low grade Iron ores. This will result in more exploration.

### STATEMENT OF PROBLEM

The optimistic demand for iron ore in future will necessitates vigorous exploration of iron ore to meet export and domestic needs. As evidenced from the literature the result of this activity will lead to environmental degradation which definitely will have an impact on the health of people living in and nearby area. Thus the issue that cries for attention is the price that these people have to pay for the benefits of mining. This raises a question whether economic benefit generated from mining in the district is higher than the external cost the people have to pay for it?

### OBJECTIVE OF STUDY

An attempt has been made in present study to check the impact of mining activities on the health status of the people through a comparative study of mining and non mining areas based on the primary survey data that was carried out in 20011-12 in Siljora, a mining village and Gobindpur non- mining village.

### METHODOLOGY

Regarding methodology, a simple random sampling method has been used to collect information with the help of Schedule questionnaire. 5% of the total households is selected.

### SAMPLE HOUSEHOLD ANALYSIS

Siljora has been selected as a mining area for case study where Mangilal Rungta Iron and Manganese mine is operating. It is one of the major potential areas for exploitation of iron and manganese ore occurring in the mining lease over 715.639 hectare in Keonjhar district of Odisha. The area is held under mining lease since 1946. It is one of the oldest mine in Barbil area. Siljora is having a population of 1824.

Gobindpur is selected as non mining area for the case study. Here more than 60% of the total households are engaged in agricultural activities. The village is having a population of 1645 and about 500 acre of cultivable land where people are growing paddy, vegetable and wheat. Thus the comparative study of economic and health status in both the villages are analyzed below.

Environmental problems due to mining are more common in open cast mine compared to underground working. An opencast mine cause most of the environmental damages and attracts public agitation to mining activity.



TABLE 2: AWARENESS OF THE PEOPLE IN MINING REGARDING CONTROL MEASURE TAKEN BY MINING COMPANIES FOR POLLUTION CONTROL IN MINING AREAS

Control measures	No. of responses	%
1.sprinkling of water to control dust pollution	30	100
2.maintenance of machinery to control noise pollution	12	40
3.treatment of rejects to control water pollution	10	33.33
4.1)afforestation to control soil pollution	21	70
2)land management to control soil pollution	8	26.67

Figures in bracket are percentage

Source: primary data

Opinions elicited from sample households in the mining areas to gauge their awareness levels regarding the steps taken by mining companies to control pollution are shown in table 2.It appears that people are aware of measures taken by mining companies to mitigate dust,noise,water pollution and soil degradation.

TABLE 3: DISTRIBUTION OF POPULATION AS PER TYPE OF DISEASE SUFFERED

Type of disease	Adult		children	population	Adult		children	population
	Male	female			male	female		
	MINING AREA				NON- MINING AREA			
waterborne disease*	22(17.32)	17(18.88)	34(25.37)	76(21.65)	10(14.28)	11(19.29)	16(18.6)	37(17.37)
Acute respiratory infection(ARI)	26(20.47)	12(13.33)	4(2.98)	42(11.96)	5(7.14)	2(3.5)	3(3.48)	10(4.69)
typhoid	18(14.17)	8(8.88)	27(20.14)	53(15.09)	12(17.14)	6(10.52)	16(18.6)	34(15.96)
tuberculosis	7(5.51)	3(3.33)	1(.74)	11(3.07)	1(1.42)	-	-	1(0.4)
jaundice	3(2.36)	2(2.22)	3(3.13)	8(2.27)	4(5.71)	2(3.5)	8(9.30)	14(6.57)
malaria	23(14.96)	24(26.67)	25(18.65)	72(20.51)	18(25.71)	14(24.56)	26(30.23)	58(27.23)
Cough & cold	32(25.19)	24(26.67)	40(29.85)	96(27.35)	20(28.57)	22(38.59)	25(29.04)	72(33.8)
total	127(100)	90(100)	134(100)	351(100)	70(100)	57(100)	86(100)	213(100)

\*Waterborne disease consist loose stool, cholera and diarrhea

Figures in bracket are percentage

Source: primary data

The distribution of population as per type of diseases suffered among adults and children is shown in table 3.Table reveals that cough and cold, malaria, jaundice, typhoid are the disease which people in both the areas suffers but people in mining areas are more prone to disease like Tuberculosis,ARI,waterborne disease. It may be because of poor quality of water in mine area as a result of which people in mine area are more victim to many water borne disease. A marked difference has been found in case of ARI and TB where a higher percentage of people Vis a Vis non mining people has been found. Here working in mine and living nearby could be one of the main reasons for such result.

TABLE 4: AVERAGE FREQUENCY OF THE OCCURRENCE OF DIFFERENT TYPE OF DISEASE

disease	Average frequency of the occurrence	
	MINING AREA	NON MINING AREA
waterborne disease	8	4
Acute respiratory infection(ARI)	7.5	2
typhoid	3	2
tuberculosis	1	-
Cough & cold	7	8
jaundice	2	3
malaria	6	5

Source: primary data

Comparison of the average frequencies of occurrence of the disease in mining and non mining strata shows that frequencies are higher in the former than in the latter. This is shown in table 4.disease wise it is observed that in case of water borne disease and ARI frequency of occurrence gap is more relative to other disease.

**SUMMARY AND POLICY IMPLICATION**

**MAIN FINDING**

Most of the people in mining are aware that mining activities are creating a lot of environmental pollution and measures are also being taken by mining company to mitigate its ill effects. Mining has negative impact on health of people living in mining area as it is seen that frequency of sickness is higher in mining than non mining area. Even a marked difference has been found in case of ARI (Acute respiratory infection) and TB where a higher percentage of mining people vis a vis non mining people has been found. Both the disease is the result of mining activity as both are mainly because of dust inhalation.

**POLICY IMPLICATIONS**

The negative impact of mining on health, land, water, air, plants and animals can be reduced by careful planning and implementation of mining activities. Provision of medical facilities to the people in the mining areas especially to those who have no employment link with mining companies should be the responsibility of government. Medicines that is necessary in case of environment related diseases need to be made available at these mining peripheral areas on a priority basis.

Awareness campaign of the dangers to the health posed by mining activities can be effectively carried out through educational programmes. Abatement measures to control environmental pollution are a must in order to reduce the likelihood of sickness. A major issue regarding hazardous waste is dumping which pose a threat to environment. Biological reclamation of overburden dumps and wastelands is also desirable. Department of forest, government of Odisha, has initiated afforestation on these dumps. Alternatively government can solicit and entrust the help of mining companies to take care of the abandoned pits and mines.

Of all environmental hazards in the mining area, dust is the most prevalent. Restriction of trucks/dumpers speed and overloading, and regular road cleaning are essential in order to control dust pollution from transportation, together with regular water spraying on roads. The welfare measures for the benefit of the mine worker and their dependents initiated by the office of the assistant welfare commissioner need to be overhauled. The problem can be sorted out by having an industry specific wage limit rather than a general one.

A holistic plan for environmental protection to decline all types of pollution and create a amiable atmosphere for the growth of the flora, fauna and the micro organism is an urgent need. Formation of village level committees, blending outside expertise grass root political leadership can go a long way in excising an effective check on environmental degradation.

**CONCLUDING OBSERVATIONS**

Though mining might have brought a lot of economic benefits to the people in the region and as a consequence, the economic status of the people may have enhanced. But a better economic status does not end up in a better health status for the people. The study shows that those not benefitting from mining activity in the mining area are in worse position as they are affected from the adverse environmental consequences of mining. Even those who are reaping the benefit from mining industry have to pay dearly in terms of adverse effect on their health. The negative impact of mining on health and environment can be reduced by careful planning and implementation of best management practices in mining which could result in profitability besides brining in social and environmental credibility. It is important that local community health should be taken into account while planning and investing in economic development.

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