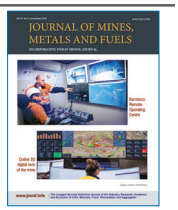
Journal of Mines, Metals and Fuels, *70(11) : 617-622; 2022. DOI: 10.18311/jmmf/2022/32610*

Print ISSN : 0022-2755

Journal of Mines, Metals and Fuels

Contents available at: *www.informaticsjournals.com/index.php/jmmf*



Impact of Mineral Extraction on Agriculture: Evidence From Chromite Mining Region in Odisha, India

Minati Sahoo and Niharika Samal

Department of Economics, Central University of Odisha, Koraput - 764021, Odisha, India; minati.sahoo@gmail.com

Abstract

Mining through the extraction of minerals provides an important structure for the development of countries that are endowed with rich minerals. Odisha occupies a prominent position in the mineral map of India. The state enjoys the distinction of being the principal producer of chromite in India. More than 96% of the resources of chromite are located in Odisha. But mineral extraction cannot be done without unduly interfering and damaging the environment, thereby negatively contributing to the livelihood assets like agricultural land. Hence an attempt has been made in the present study to analyse the impact of chromite mining activities on agriculture in the Jajpur district, the premier chromite-producing region of Odisha. A comparative approach with and without mining has been used in the present study. It is based on a primary survey of 100 households i.e. 50 from mining and 50 from non-mining villages respectively. It has been found that mining has affected farming as a source of livelihood. It is seen that people in mining villages have given up farming and have mostly shifted towards mining-related work. Further, those few people who are doing cultivation are cultivating for their home consumption only and not for selling. The production and productivity of different crops in the region have been affected and are comparatively less than in the non-mining region. This implies that mining activities are also degrading the quality of the soil. Thus, it can be concluded that the extraction of minerals has led to negative spillover effects on agriculture in the region, thereby raising the issue of sustainable development. Therefore it is highly required that some policy measures should be taken by the government and mining companies to address the negative impact of mineral extraction on agriculture in the mining region.

Keywords: *Agriculture, Chromite, Livelihood, Minerals, Mining*

1.0 Introduction

Countries endowed with minerals are generally considered to be blessed and fortunate[1]. Mining that involves the extraction of minerals plays an important role in economic development by providing raw materials to many heavy and basic industries[2]. It also generates employment opportunities and contributes to national production. It also helps the economy in earning income through tax revenue and export earnings thereby boosting economic growth. All the above contribution of mining to an economy leads to its socio-economic development[3-5].

India is endowed with vast reserves of key metallic and non-metallic minerals including iron ore, bauxite, coal, limestone and manganese. The country is among the top ten producers of these ores globally. Odisha has long been recognized as a state well-endowed with mineral resources. The mineral belt is spread over an area of more than 6000 square km. The major minerals found in the state are coal, iron, bauxite, chromites, manganese, nickel, manganese, limestone, dolomite, platinum group metals, nickel, vanadium, graphite, gemstones, diamond, dimension and decorative stones. The state holds a key position in the Indian mining sector. Its importance can be seen in its contribution to total mineral production and the total value of mineral[6]. It accounted for 96 per cent of chromite, 92 per cent of nickel, 53 per cent of bauxite, 25 per cent of coal, 35 per cent of iron ore and 45 per cent of

**Author for correspondence*

manganese in the respective totals for the country during 2016-17[7].

The Government of India has set an ambitious target of increasing the contribution of manufacturing output to 25% of the Gross Domestic Product by 2025 from 16% as of 2017[8]. This growth in the manufacturing sector will also lead to the growth of the mining sector as the outputs of the mining sector act as inputs for the manufacturing sector. As the manufacturing sector expands, it is expected that even the mining sector will expand because of the domino effect. But mining activities in the process of extraction of minerals greatly damage, degrade and deteriorate the environment and ecological resources like water, air and soil. Without hampering the environment, mining activities cannot be done[9]. It destroys the soil surface and structure as well as leads to a decline in the nutrient status of agricultural land[10], thereby destroying the conditions necessary for healthy agricultural activities. Soils in the mining region are found to be highly acidic, have a coarse texture, high bulk density and have high contents of minerals that cause an adverse effect on the soil system[11]. Hence, the literature shows that mining operations affect the agricultural activities of the mining region through their negative impact on the environment. Thus, an attempt has been made in the present study to investigate the impact of mining on agriculture in the Jajpur district, the premier chromite-producing region of Odisha. The study seeks to answer two main questions:

- How agriculture as an occupation has been affected by mining operations?
- What is the impact of mining activities on agriculture production and productivity in the region?

2.0 Research Design

Jajpur district, the premier chromite-producing region of Odisha is the study area for the present research. Two villages namely Kaliapani and Talangi from the mining region i.e. Sukinda block and two villages namely Kaina and Bankipal from the non-mining region i.e. Binjharpur block have been chosen by simple random sampling method. The mining villages are located near Kaliapani chromite mines. The sample size for the study is 100 households i.e. 50 from mining villages and 50 from non-mining villages respectively.

The study is based on both primary and secondary data. Primary data has been collected from the household during 2018 using a structured scheduled questionnaire. For secondary data, sources like the Indian bureau of mines, the Ministry of steel and mines, the Economic Survey of Odisha, and the Economic Survey of India have been used. Data collected has been summarized and portrayed in statistical tables, graphs and charts. Other relevant mathematical and statistical techniques such as averages, and percentages have been used in order to analyse the impact of chromite mining activities on agricultural production and productivity.

3.0 Results and Discussion

3.1 Socio-Economic Profile of Sample Household

3.1.1 Gender Composition

Gender composition is one of the important social indicators. It indicates the ratio of males and females in society. Figure 1 shows that 53% are males and 47% are females in the mining region whereas 48% are males and 52% are females in non-mining areas.

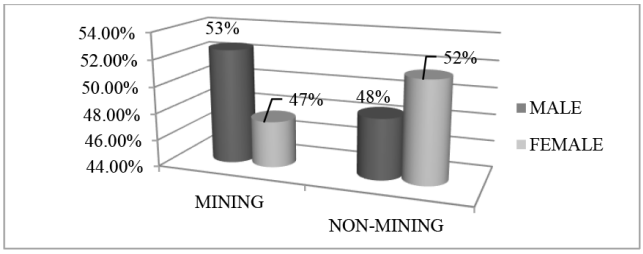


Figure 1. Gender composition of sample households.

3.1.2 Educational Status

Education plays an important role in society. It shows the overall socio-economic condition of society. A good quality education provides a good quality lifestyle and a complete awareness of society. Literacy level is one of the determinants of education. Figure 2 shows the literacy level in mining and non-mining region. It can be seen that percentage of literate in the mining region (81%) is

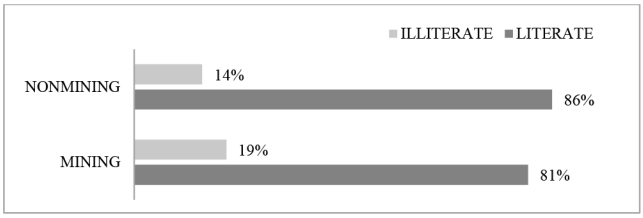


Figure 2. Literacy level in mining and non-mining region.

less than in the non-mining area (86%). The educational status is shown in Figure 3.

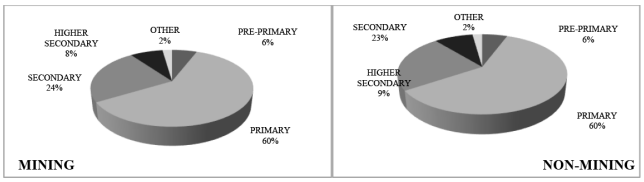


Figure 3. Educational status of households in mining and non-mining area.

3.1.3 *Type of Houses, Availability of Electricity and Cooking Fuel*

The type of house generally shows the standard of the living condition of a household. The study has considered three types of houses that are kacha, pacca and mixed houses. Figure 4 shows the distribution of households according to their type. It can be seen that pacca houses (66%) are more in non-mining areas than in mining areas (32%). And kacha houses in the non-mining area are about 10% and in the mining area, it is about 30%.

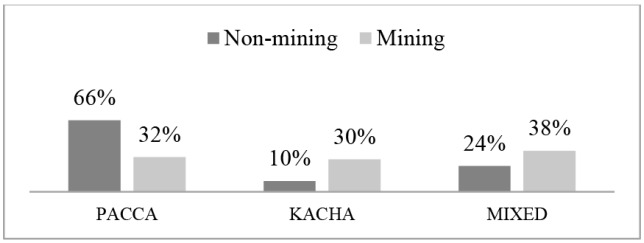


Figure 4. Distribution according to the type of houses of the sample household.

Now a day's electricity facility becomes very essential for people to survive. With regard to the availability of electricity facilities, Figure 5 shows the distribution of sample households according to their access to electricity. There is 93% of households have electricity facilities in mining areas whereas 95% of households have electricity facilities in non-mining regions.

Cooking fuel is an essential indicator of socio-economic condition. The present study has taken two categories of cooking fuel i.e. modern and traditional. Modern cooking fuel includes LPG gas whereas traditional cooking fuel includes wood, kerosene and cow dung. It can be seen from Table 1 that 64% of households are using modern cooking fuel and 36% of households are using traditional cooking fuel in the non-mining area. In the mining area, 48% of households are using modern cooking fuel and 52% of households are using traditional cooking fuel.

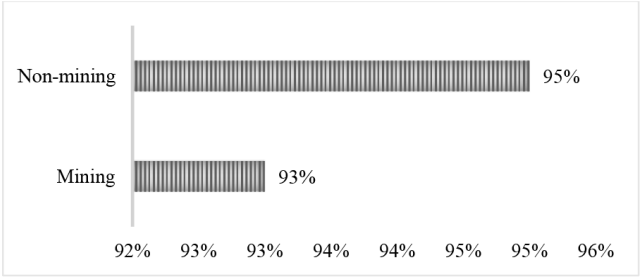


Figure 5. Electricity access of sample households.

3.1.4 *Employment Level and Occupational Distribution of Mining and Non-mining Region*

Occupation means the activity of people for the purpose of livelihood. In the non-mining area, most people are engaged primarily in farming activities whereas, in the mining area, most people are engaged in mining activities like mining service, mining labour and business related to mining activities. The employment status in mining and non-mining region is shown in Figure 6. It can be seen that 29% are employed and about 71% are dependent. This is mostly because of less size of the working class and the large size of the non-working class. The employment level in the mining area is about 27% of people are employed and about 73% of people are dependent upon working people.

The occupational distribution of these employed people in mining and non-mining region is depicted in Table 2. The occupational structure of the mining area shows that primarily about 72% of people are engaged in mining activities as labour and the rest are in other occupations like casual industrial labour, casual agricultural labour, government service, and private

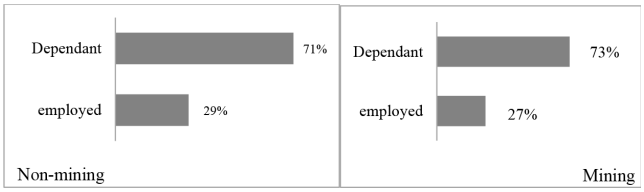


Figure 6. The employment level in mining and non-mining area.

Table 1. Distribution of household according to use of cooking fuel

Region	Modern	Traditional
Non-Mining	64%	36%
Mining	48%	52%

service. Some households are involved in secondary activities like farming, business and MGNREGA (an employment scheme by the Government of India). In the non-mining region, agriculture is the primary occupation as 75% of people are engaged in agricultural activities. Some secondary occupations in this region are casual agricultural labour, business and MGNREGA.

3.2 Impact of Mining Activities on Agriculture

3.2.1 Agricultural Production and Productivity

The main crop that is cultivated by farmers in mining areas is paddy. Besides, a few households are also producing turmeric, and corn but only for their consumption. Whereas in the non-mining region, most farmers are producing mostly paddy. Besides, they also cultivate moong for selling as well as for their consumption. Vegetables are also being cultivated but only for their consumption. Paddy is the main crop grown in mining as well as the non-mining region. The average land used for the production of paddy is 3.9 acres in the mining region and 4.1 acres in the non-mining region. For moong, it is about 2.595 Acer. The average production of paddy is 2170 Kg in the mining region whereas it is 3,384 Kg in the non-mining region (Table 3).

With regard to the comparison of agricultural productivity of crops in mining and non-mining region, paddy has been taken into consideration as it is the main crop in both regions. It can be seen from Figure 7 that the agricultural productivity of paddy is lower in the mining region (587 kg) than in the non-mining region (771 Kg).

3.2.2 Average Price, Cost and Revenue From Agriculture

Although in mining areas agricultural activity is a secondary occupation to local people, some households are still growing crops mostly for their self-consumption. A few households in the mining region are selling in the market. To analyze the impact of mining on agricultural cost and revenue, Table 4 shows the average output, price, cost and revenue of crops in the mining area. Compared to regard to paddy in mining and non-mining region, it can be seen that paddy brings more profit to the non-mining community because of higher output and lower cost. This is also despite of lower price of paddy.

Table 2. The occupational structure of mining and non-mining region

Occupation	Mining Region		Non-mining Region	
	Primary Occupation	Secondary Occupation	Primary Occupation	Secondary Occupation
Farming	-	67%	75%	14%
Mining labour	72%	-	-	-
Casual Industrial Labour	14%	-	4%	-
Government Service	3%	-	4%	-
Private Service	9%	-	18%	-
Business	-	18%	-	37%
MGNREGA	-	14%	-	20%
Casual Agricultural Labour	2%	-	-	29%

Table 3. Agricultural production in mining and non-mining area

Type of production	The average size of land (in acres)	Average output (in Kg)
Mining area		
Paddy	3.9	2,170
Turmeric	2.9	414
Non-mining area		
Paddy	4.1	3,384
Moong	2.6	214

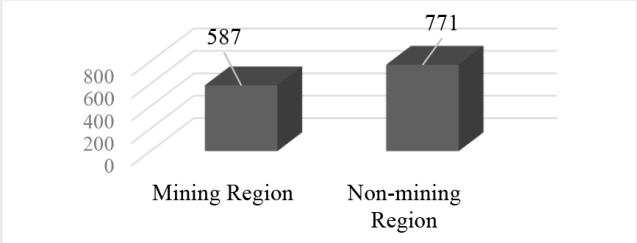


Figure 7. The agricultural productivity of paddy (in Kg per acre).

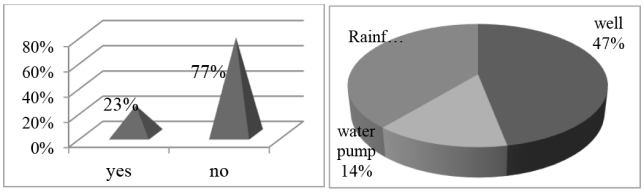


Figure 8. Availability and Source of irrigation facility in the mining area.

3.2.3 *Irrigation Facility of Agricultural Land*

Proper irrigation facility for agricultural land increases the productivity of the land. From the study, it has been observed that most farmers in mining areas are facing the problem of irrigation (Figure 8). Only 23% of farmers have irrigation facilities like well and water pumps. They mostly depend upon rainfall for watering their crops. In the non-mining area almost, all have proper irrigation facilities (Figure 9). 72% of the farmers for irrigation facilities depend on canals, 16% on the water pump and the rest 12% on river water.

3.2.4 *Perceptions Whether Mining Activity affects Agricultural Activity or Not*

All most all respondents agree that mining activity affects agricultural productivity. 88% of respondents say that mining activity affects agricultural activity and about 12% of respondents say that mining activity doesn't affect agricultural activity (Figure 10). It is also found that

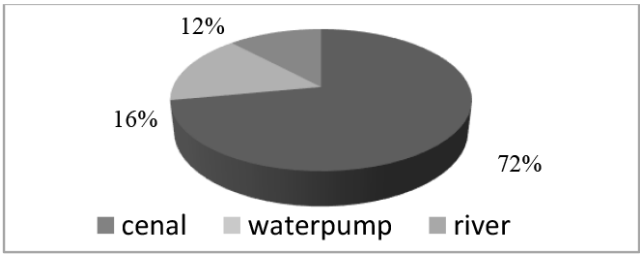


Figure 9. Source of irrigation facility in the non-mining area.

some farmers left agricultural activities. They left their agricultural activities many years before totally and now again they started cultivation about 2 years back due to some agricultural support from the mining company. Still, some farmer left their cultivation activity. The above diagram shows that people who have farming as their primary occupation left farming due to the negative impact of mining activity. About 30% of people left farming activity totally, about 44% of people left cultivation partially which means they have own land but they don't cultivate and about 26% of people who don't leave cultivation.

3.2.5 *Purpose of Agricultural Production in Mining and Non-mining Areas*

Here the study will explain the purpose of agricultural production in non-mining and mining areas whether cultivation is done for selling purposes or for their consumption or both. It can be seen from Figure 11 that 62% of the farmer in the mining area are cultivating for their consumption, it is in the non-mining area about 4%. 22% of farmers are doing cultivation for sealing purposes in mining areas whereas in non-mining areas it is about 36%. For both sealing and own consumption 16% of the farmer in the mining area are cultivating and in the non-mining area, it is about 60%.

3.2.6 *Soil Quality and Livestock*

It has been found from the study that mining has negatively affected agricultural activity. Mining has resulted

Table 4. Average output, cost, price and revenue of crops in the mining area and non-mining area

Type of product	Average output (in Kg)	Average cost	Average price (in Rs per Kg)	Average Revenue (in Rs)	Profit
Mining Area					
Paddy	2,170	22,530	16	34,720	12,190
turmeric	414	9096	79	32,706	23,610
Non-mining Area					
Paddy	3,384	20,898	15	50,760	29,862
moong	214	883	35	7,490	6,607

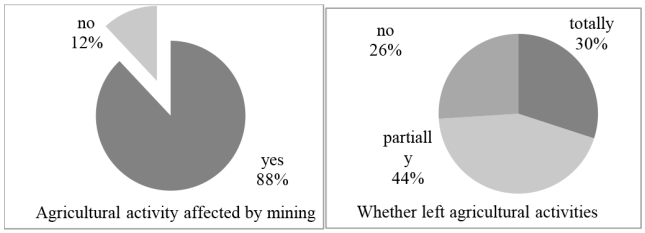


Figure 10. Perception of respondents regarding the impact of mining on agriculture.

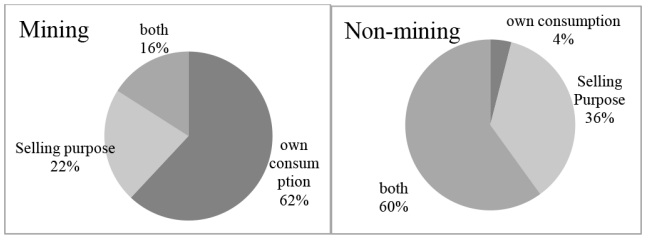


Figure 11. Purpose of agricultural production in mining and non-mining area.

in a decline in groundwater levels, and water pollution due to the drain of wastewater into agricultural land which has affected the fertility of the land. Besides, air pollution due to dust generated by mining has also affected the health of livestock thereby adversely affecting agricultural activities.

4.0 Conclusion and Policy Suggestions

The study concludes that mining in the study area has not only caused a shifting of occupation from agriculture as the primary occupation to mining-related works but also has negatively affected the production and productivity of crops particularly paddy in the mining region. As Kaliapani chromite mines are located in rural tribal areas, before mining most people were primarily engaged in agricultural activities. But not most people have left agriculture or have taken it as their secondary occupation. This is also mostly for their home consumption purpose. Further, it is also found that the average annual production, area and productivity of paddy, the most grown crop is significantly lower in the mining region than in the non-mining region. This has been mostly due to mining activities like blasting that generate dust, polluted water being drain-out to land by the mining company and a decrease in groundwater level which dried out agricultural land.

Further mining has a specified lifetime. In this case, after the closure of mining operations, even agriculture will not be in a condition to take up as an occupation. Hence it is both the Government and Mining Company have to bear the responsibility and should take various initiatives to encourage people to take up agriculture in the mining region. Further steps must be taken to improve agricultural productivity in the region. Mining companies should provide various agricultural inputs at a subsidized price. To encourage the people in the mining region to agriculture, the government should step in to provide irrigation facilities, and training to the farmer community and arrange for soil testing for increasing yield.

5.0 References

1. Saadat W. "Impact of Mineral Resources on Economic Growth of Pakistan". *Journal of Resources Development and Management*. 2016; 20:105-111. https://iiste.org/Journals/index.php/JRDM/article/viewFile/30724/31552
2. Davis GA, Tilton JE. "The Resource Curse". *Natural Resources Forum*. 2005; 29:233-242. https://doi.org/10.1111/j.1477-8947.2005.00133.x
3. Mensah EAO. "Gold mining and the socio-economic development of Obuasi in Adanse". *African Journal of History and Culture*. 2011; 3(4):54-64.
4. Bogdetsky V, Karybek I, Jyldyz A. *Mining Industry as a Source of Economic Growth in Kyrgyzstan*. Project implementation Unit of the World Bank, (IDF Grant No. TF053432). 2005. https://pdfs.semanticscholar.org/eb95/67f7c406d37c2f6dacb178a193fb4bbcd321.pdf?_ga=2.84199451.384233909.1584294734-866225990. 1563605705
5. Akabzaa T, Darimani A. *Impact of mining sector investment in Ghana: A study of the Tarkwa mining region*. A Draft Report) Prepared for South Asia Policy and Research Institute (SAPRI). 2001. http://www.saprin.org/ghana/research/gha_mining.pdf
6. Ministry of Mines 2018. *Annual Report 2017-18*. Government of India. https://mines.gov.in/writereaddata/UploadFile/Mines_AR_2017-18_English.pdf
7. Government of Odisha. *Economic Survey of Odisha-2017-18*. Planning and Coordination Department, Directorate of Statistics and Economics. 2018. http://pc.odisha.gov.in/Download/Economic_Survey_2017-18.pdf
8. Premji, Preetha. *Rebooting India through practical integral humanism*. Chennai: Notion Press. 2018.
9. Panwar S, Sinha RK, Singh G. "Time sequential surface change analysis of Talcher Angul Region of Orissa using Remote Sensing and GIS". *International Journal of Geomatics and Geosciences*. 2011; 1(4):828-838.
10. Adetayo KA. "Effects of Sand Mining Activities on Land in Agraian Communities of Ogun State, Nigeria". *Continental Journal Agricultural Science*. 2012; 6 (1):41-49.
11. Ezeaku PI. "Evaluating the influence of open cast mining of solid minerals on soil, land use and livelihood systems in selected areas of Nasarawa State, North-Central Nigeria". *Journal of Ecology and the Natural Environment*. 2011; 4(3):62-70. https://doi.org/10.5897/JENE11.032

Printed by Pradip Kumar Chanda at The Indian Press Pvt. Ltd. 93A Lenin Sarani, Kolkata 700 013 and published by him for Books & Journals Pvt. Ltd. from 62 Lenin Sarani, Kolkata 700 013.