

A case study on socio-economic and environmental impacts of mining ban in Goa

The pristine State of Goa is abundantly endowed with natural mineral resources. Ores of iron, manganese, and bauxite are the minerals utmost of economic significance. A large number of people are reliant on mining for carrying their livelihoods as iron ore mining is one of the utmost economic activities after tourism, agricultural and fishing practices. The mining sector of Goa contributes to the state exchequer, employment and physical development while, on the other hand it has led to some legal, social and environmental conflicts. The result of which, the mining practices of the state were banned and this led to the worst socio-economic conditions of the poor livelihood of the rural areas. This paper examines the socio-economic and environmental impacts of the state due to the mining. The data was collected and later compiled through a set of questionnaires concentrating primarily on the impact of the mining ban in the state of Goa. Sample size comprising 500 respondents were taken accordingly, who were affected directly or indirectly by the mining ban in the state and the data was thoroughly analyzed. It is revealed from the study that if systematic and scientific mining practices are taken place with sustainable manner, mining practices as well as environmental restoration and socio-economic development can go parallel.

Keywords: Mining, Goa, mining ban, impacts of mining ban, socio-economic, environmental impacts, iron ore mining.

1.0 Introduction

Agriculture and mining have been established as the two basic development criteria of the human civilization over the centuries. Agriculture has some elasticity to choose the location, however, mining activities can be taken place only where the minerals are available with economic viable to exploit (Mohanty and Goyal, 2012). During the aftermath of commodities boom, owing to the rapid

growth of mining sector led to the transformation of livelihoods and landscapes in extractives regions of both commodities-exporting and industrializing countries (Beatriz and Bisht, 2020). The effect of mining activities on groundwater level, silting of surrounding water bodies and land is also felt to be a great concern (Goswami, 2015). Mining is the process of taking out minerals from the earth's crust. A mineral is an inorganic substance, which is freely occurring in nature (Jakati, 2021).

The mineral extraction involved both surface (open pit) and underground mining techniques. The selection of methods depends on a variety of physical and chemical factors included the nature and location of the deposit and the shape, size, depth, and grade of the deposit (Noragate and Haque, 2010). Mining has a potential to provide numerous economic benefits to a community, which includes employing local residents, utilizing local services, and contributing much needed funds to the regional developmental projects (Gomes, Giorgio and Paulo, 201-206). The prospering of Indian economy is supported with the abundance of natural resources of several significant minerals and their large to the small-scale mining activities. The mining segment in India alone witnessed with contribution of around 2.3 per cent to the gross domestic product (GDP) in the year 2010, which has weakened from 3 per cent in the year 2000 for the various factors (Singh and Singh, 2016). The uneven distribution of mine around the worldwide witnessed with disproportionately effect of the communities or ecosystems nearby to them (Sonter, Ali and Watson, 2021). Modern mining techniques are readily illustrious by the manifestations of the various surface features such as waste rock dumps, opencut pits, water storage ponds, tailings dams, milling, access roads and processing infrastructure, supporting infrastructure and also in some cases, heap leach pads, block cave areas, or quarries (Werner, Bebbington and Gregory, 2019).

The impacts of underground mining are directed on the health of those working underground, but on the other hand opencast mining gives a wider footprint on air quality associated with dust and gaseous pollutants in and around the mining complexes. The dust has the potential to also pollute the nearby surface waters and inhibit growth of crops by shading and clogging the pores of the plants (Singh and

Blind peer reviews carried out

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Pal, 2010). In comparison with other segments, the potential impact on social and environmental issues associated with mining operations for extraction and processing of mineral are both significant in nature and complex to manage. The activity for obtaining naturally occurring substance such as discovery, extraction, and processing of the mineral resources is broadly observed as one of the most socially and environmentally disruptive actions undertaken by the industries (Barve and Muduli, 2011). The degradation of several environmental factors significantly could magnify the health problems amongst the workers and the people residing in the direct vicinity of the mining area (Stewart, 2019). Mining has always been playing a very substantial role in the history of economics and foreign exchange revenue of Goa. The mining belt of Goa is generally concentrated in the parts of Sattari and Bicholim, in North Goa and Dharbandora, Quepem and Sanguem, talukas in South Goa (Sarupriya, Manjare and Girap, 2019). Mine closure may result from various reasons. Mine closure caused by depletion of resource is defined as the mature closure of mines, while mine closure precipitated by economic, social or policy reasons is called premature closure (Laurence D., 2011). Sustainability is essential for a straightforward reason: the quality of life and the Earth's ecosystems' prosperity cannot be maintained if it is not addressed (Szabo, Szádóczi, Bozóki, Stănculescu and Szabo, 2021). Therefore, sustainability is one of the world's ultimate goals, driving the vision and establishing the policies and treaties for sustainable development worldwide (Szabo, Szádóczi, Bozóki, Stănculescu and Szabo, 2021). Nowadays, the paradise state, Goa is facing with an extensive sustainability challenge, leads to a great concern to the government as well as civil society of the state (TERI, 2012).

In the context of Goa, the state as a whole has understood with two distinct phases: one, a radical growth of the mining activities to encounter the mounting demand from the market in China in the last decade; secondly, an abrupt ban in the mining operations as a result of the Supreme Court Order in September 2012 and the recent order on February 2018. This has had an unprecedented impact on the socio-economic standards of the households concentrated in and around the mining areas. This particular study is aimed at meeting the following objectives: (i) to analyze the socio-economic physiognomies of the livelihood in the mining belt; (ii) to study the financial position of the households concentrated in the mining belts; (iii) to identify the quality of the environment in the mining areas on perception of household and (iv) to access the socio-economic characteristics of the households on mining belt due to the ban.

The draft structure of the paper is given as follows: section 2 presents the related work, section 3 presents the current study and section 4 comes with the conclusion.

2.0 Related work

(Sati, 2015) examined with impact of environmental and socio-

economic parameters on ban in the stone mining located in Shivpuri district. The study was conducted by collecting data through a house to house level survey mainly on five villages during the years 2009-2011. The study penetrated the exclusive solutions for campaigning and driving of large-scale plantation that support both the activities, such as mining for carrying livelihoods and for restoration of environment.

(Dubey, 2017) surveyed the effect of Government Mining Policy in the major mining areas situated in Vindhyan Region of Uttar Pradesh, by studying the mining activities and the socio-economics characteristics of indigenous people on mining for the sustainability of their livelihood. They further concluded the environmental impact of activities related to mining on the vegetation and the further closure options towards the reclamation by the perceptions of the local peoples and their selections for post mining land use.

(Talule & Naik, 2017) conducted a study to analyze the effects of mining halts on state economy of Goa. Mainly the study was built on the primary data obtained from the two talukas namely Sanguem and Bicholim respectively one each from the South and North Goa districts where the mining was in full swing before banned by the Shah Commission on September 2012. The primary data for the study was obtained from a total of 204 households from the above respective talukas of two districts in the vicinity of which the iron ore mines were situated.

(Manerkar, 2015) focused on the impacts of the mining ban in Goa. The data were collected through a questionnaire, sample size comprising of 50 respondents were taken who were directly or indirectly affected by the sudden mining ban in the state and the data were analyzed. They further concluded that since mining constitutes a main pillar of the economy in Goa and contributes the main source of livelihood of the people, therefore the resumption of mining operation with the sustainable practices is the need of the hour.

(Arondekar & Murthy, 2017) assessed the impact in the socio-economic characteristics of the households due to the mining in mining region of State Goa. For this purpose, they conducted opinion of 256 respondents in the mining area. The outcomes of the paired sample t-test presented with considerable variance in the financial position of the livelihoods in the mining regions. Standard deviation displayed the wide inequalities in the incomes. The change in the occupational structure were also revealed in the study. The study further suggested to educate the people about their transition of occupations and thus to move in alternate income for long term avenues is needed instead of entirely trusting on the industry which is temporal.

The studies conducted by authors have limited to only a few respondents, there is a need to survey more people in mining areas to identify the social-economic and environmental conflicts in detail. The authors only focused on two taluks Sanguem and Bicholim; however, there is a

necessity to enclose the complete mining areas as mining was practiced actively in all of the five talukas after the year 2000. In addition, the studies mostly analyzed the social-economic impacts of mining; but the environmental aftermath of mining in the Goa in context of recent years still needs to be evaluated thoroughly. So, the three interrelated factors namely the social, economic, and environmental are known to be the basic pillars of sustainability are need to be evaluated for understanding the economy sustainability in the mining regions. Here, an attempt is made by the researcher in the present study to cover the unexplored impacts of mining in the context of the state of Goa. The survey is conducted with a maximum of 500 people by covering five talukas namely Sattari and Bicholim, in the North Goa District and Quepem, Sanguem and Dharbandora talukas in the South Goa District.

3.0 Research methodology

The current study is conducted based on both primary as well as the secondary data sources. Primary data was collected through the pre-determined questionnaire which was scheduled and administered to the people who were involved either directly or indirectly in mining activity. The survey was conducted to a random sample of 500 households of the age of 18 years and above from mining villages in the five talukas. Of these 468 were found suitable for the purpose of analysis. The secondary information was collected from the various mode of source such as government reports, online data sources, publications, newspaper articles and books and journals. Frequency tables' mean and standard deviations were used to analyze the socio-economic variables using the

TABLE 1: DEMOGRAPHIC PROFILE OF THE PARTICIPANTS

Demographic characteristics	Frequency (N)	Percentage (%)
Age		
18 to 24	65	13.89
25 to 34	145	30.98
35 to 44	138	29.49
45 to 60	98	20.94
Above 60	22	4.70
Gender		
Male	279	59.62
Female	199	42.52
Marital status		
Single	169	36.11
Married	299	63.89
Educational qualification		
Illiterate	48	10.26
Upto primary	123	26.28
Upto secondary	118	25.21
SSLC	90	19.23
HSC	42	8.97
Graduation	35	7.48
Post graduation	12	2.56

statistical package SPSS 16. The demographic profile of the surveyed participants is given in Table 1.

The variables used to describe the demographic profile of the surveyed participants are as follows: age, gender, marital status, and educational qualification. The primary data was collected from 468 respondents; out of which 59.62% were women and the rest 42.52% were men. Out of the 468 respondents, 145 respondents, 30.98% are of the age group of 25 to 35 years, 29.3% of the respondents are married, 36.11% of respondents are unmarried or single, 10.26% of the respondents are illiterate, 26.28% have obtained their primary education, 25.29% have obtained secondary education, 19.23% have studied up to SSC, 8.97% have obtained HSC, 7.48% are graduates and 2.56% are postgraduates. A series of questions were asked to the respondents about the impacts of the mining ban and their responses are shown in Table 2.

From the above analysis, it is observed that the above 3/4th of respondents i.e. around 84% are affected directly due to the mining ban, and the remaining which is only around 16.67% of respondents are found not affected by the mining ban. Therefore, it can be concluded from the analysis, that majority of the respondents of mining belts are affected due to the mining ban. Because of the mining ban, 9.62% of the respondents are currently unemployed, 30.34% are mainly contracted labours, 24.79% of the respondents are still in service in the mining firms but are offered less salary, 21.15% of the respondents are committed to agricultural activities, 6.41% are doing business, and 7.69% are felt to migrate from the current place. The analysis shows that 82.48% of the respondents feel that the mining is advantageous for Goa and only 17.52% of the respondents are not in a favour of mining activity citing the mining in extensive has caused a serious impact on the environment. In total, 42.30% of the people felt that mining is advantageous for Goa because it is one of the

TABLE 2: IMPACTS OF MINING BAN

Whether mining ban has affected the people's life?		
Yes	390	83.33
No	78	16.67
What is the status of people's job after mining ban?		
Currently unemployed	45	9.62
Agriculture and allied activities	99	21.15
Business/Profession	30	6.41
Labour	142	30.34
Services	116	24.79
Intended to migrate	36	7.69
Whether mining is beneficial for Goa?		
Yes	386	82.48
No	82	17.52
What are the benefits of mining activity in Goa for people?		
Better Income	217	46.37
Employment	198	42.30
Others	53	11.32

major sources of employment generation, 46.37% of the respondents felt that mining is favourable for Goa because it plays a major role for income generation and 11.32% felt that mining should be reopened because it is indispensable for growth and prosperity of Government revenue, etc. The results clearly show that the mining process has indeed affected the economic life of the Goan people. The analysis concludes that the opinion of majority of the respondents are aligned towards sustainable mining and that mining should be resumed at the earliest possible because it is indispensable for growth and prosperity of the people and the Government in terms of generating the employments and provides a basic source of livelihood to the people besides generating revenue to the Government.

Table 3 shows the earning of monthly income by the people in the mining area. It was demonstrated that 26.28% of the households earned a total monthly income in the income group of up to Rs.10000, 19.66% earn an income in between 10001 to 20000, 18.38% earned an income in the income group of between 20001 to 30000, 11.75% earn an income in between 30001 to 50000, and 23.93% of respondents earn a high income of more than 50000. It is indicated by the study that the presence of the mining industry has had a constructive impression on the earning of the households in the mining belts.

Understanding of household expenditure trend is one of

TABLE 3: MONTHLY INCOME OF PEOPLE FROM ALL SOURCES IN MINING BELTS

Total income	Number of respondents	Percentage (%)
Upto 10000	123	26.28
10001 to 20000	92	19.66
20001 to 30000	86	18.38
30001 to 50000	55	11.75
Above 50000	112	23.93

TABLE 4: MONTHLY HOUSEHOLD EXPENDITURE

Monthly expenditure	Number of respondents	Percentage (%)
Upto 8000	132	28.21
8001 to 10000	108	23.08
10001 to 12000	96	20.51
12001 to 15000	68	14.53
15001 to 20000	41	8.76
Above 20000	23	4.91

TABLE 5: TYPE OF LOAN TAKEN BY THE PEOPLE

Type of loan taken	Frequency (N)	Percentage (%)
Vehicle loan	56	11.97
Agricultural loan	69	14.74
House loan	98	20.94
Others	45	9.62
No loan	128	27.35

the useful criteria in defining the socio-economic status of the households. The higher monthly expenditure indicating the capacity for spending more due to high income. Table 4 displays the expenditure of monthly household of the households in the mining belts. The table shows that 28.21% of the households in the mining areas incur monthly household expenditure up to Rs.8000, 23.08% spend 8001 to Rs.10000, 20.51% spend Rs.10001 to 12000, 14.53% spend 12001 to Rs.15000, 8.76% spend Rs.15001 to 20000, and the remaining 4.91% spend an amount of more than Rs.20000.

The other most important variable to be measured to understand the trend of socio-economic status of the households is the loan liability. Table 5 shows the types of loan taken by the people in the mining areas. It was observed that 280 households out of 468 understudies had loan liabilities in the mining areas. In total, 69 households had taken loans for agricultural purposes, 98 for house repair/renovation, 56 for a vehicle loan, and 45 for other purposes. The graphical illustration of Tables 4 and 5 is shown in Fig.1.

Table 6 shows the total number of respondents asserting that the mining companies are benefiting to the people in the areas in terms of various schemes and the percentage of families who have availed of these benefits. The data shows that out of 468 respondents, 108 households that are 23.08% agreed for improvement in medical facilities in their respective areas provided by mining companies, 31.84% stated that the mining companies provided jobs to the people in their respective areas, 24.79% agreed that the educational support provided by the mining company, 11.11% said that mining companies offer compensation to people, and 9.19% said that they are benefitting from other services of mining companies.

The graphical illustration of Table 6 is shown in Fig.2.

Table 7 shows the problems faced by the households because of mining. It is indicated in the table that the traffic

TABLE 6: REPRESENT THE BENEFITS IN MINING AREAS

Benefits of mining areas	Frequency (N)	Percentage (%)
Improved medical facilities	108	23.08
Job preferences	149	31.84
Educational support	116	24.79
Compensation	52	11.11
Other benefits	43	9.19

TABLE 7: OTHER IMPACTS OF THE MINING ACTIVITIES

Mining Impacts	Frequency (N)	Percentage (%)
Traffic congestion	123	26.28
Health problems	75	16.03
Affected agricultural lands	109	23.29
Water problems	115	24.57
Disability due to accident	8	1.71
Death in family due to accidents	6	1.28
Others	32	6.84

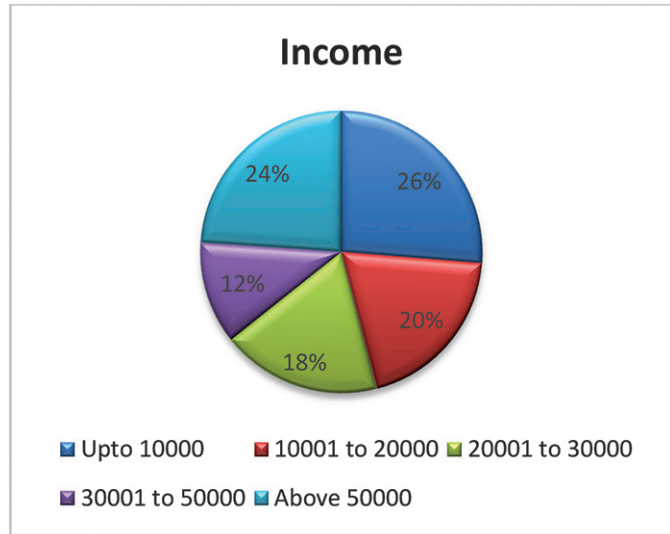
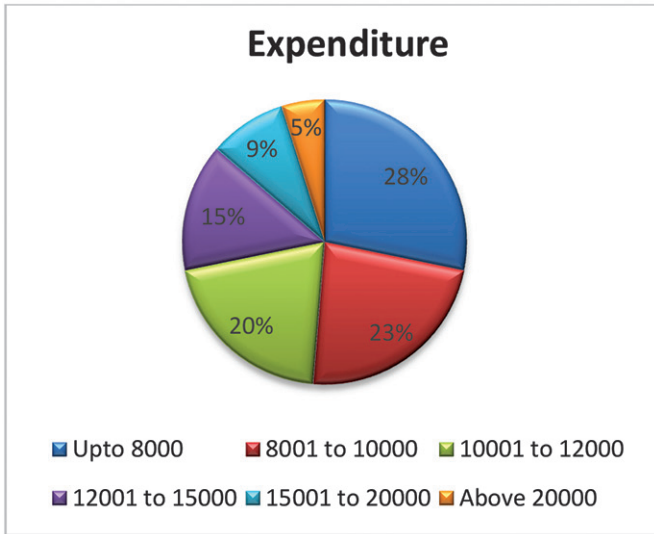


Fig.1: Graphical representation of expenditure and income

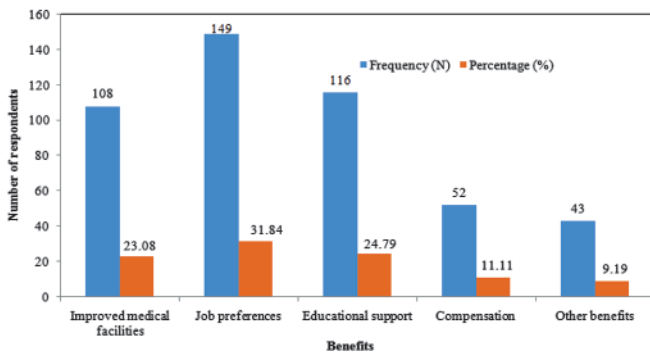


Fig.2: Benefits of mining in respondents

congestion, water problems, and the destruction of agricultural lands are the most prominent difficulties encountered by the households in the mining areas. In total, 123 respondents in the mining areas criticized the traffic congestion occurring due to the mining activities in their vicinity, 115 respondents complained about the water problems faced and 109 respondents were felt distressed with the damage to their agricultural land. 75 out of the total respondents complained of health problems faced by their family members. Moreover, 32 respondents had other problems such as availability of local foods items at high priced, combat due to the migrants of locals, the anxiety of the kids for learning and to make concentration on their studies causing noise by the mining activities, and other such glitches.

Fig.3 shows the perceptions on environmental contamination of the respondents in the mining belts across the respective talukas which were

covered in this study. It was observed that the perception of air pollution of the respondents is highest with 3.85 mean score in Bicholim taluka in north Goa, followed by the taluka Quepem with 3.72 in south Goa district. Other three talukas scored as Sattari with 3.68, Dharbandora with 3.45, and Sanguem with 3.25. However, the mean scores of perception of water pollution of the respondents is highest in Sattari taluka at 3.89, followed by Quepem taluka at 3.56 and score of other three talukas, Bicholim at 3.34, Sanguem at 2.85, and Dharbandora 2.63. Further, with respect of degradation of land, Quepem taluka scored with the highest mean of 3.69, followed by Sattari taluka with 3.43, Bicholim with 3.36, Dharbandora with 3.32, and Sanguem with 2.63.

When analyzing the noise pollution results, the mean score is highest in Quepem with 3.63, followed by Sattari with 3.42, Bicholim with 3.21, Dharbandora with 3.45, Sanguem with 2.69. With respect to the perception of the respondents on the overall pollution, the Sattari taluka observed to be with

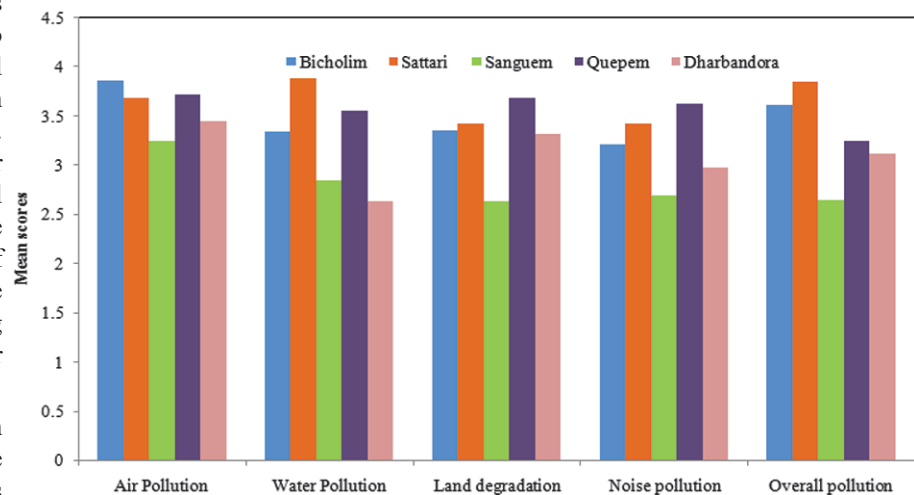


Fig.3: Perception of respondents about environmental pollution

highest mean score of 3.85 demonstrates that the taluka has more affected as compared to the other four talukas under study. The survey results show that air pollution has persisted as serious nuisance, which needs to be remedied by the mining industry. The heavy transportation of iron ore by trucks is observed to be major cause for the air pollution. Pollution by means of any activity in any area, it has impact on the society and economic prosperity of the residents. By understanding the people's perceptions and views about the pollution on environment caused by the mining activities will certainly be helped to address their problems and will subsequently improve their living conditions.

4.0 Conclusions

The current study analyses with three dimensional impacts of the mining ban in the state of Goa, India. The impacts, such as social, economic, and environmental impacts on ban in mining areas are studied. This had many footprints both, positive as well as negative impacts of living of the people in the regions. After the ban, most people have chosen different kinds of occupations for their livelihood, such as agriculture, labour, services, etc. However, the mining industry delivered as a good source of income to the people, most of the people preferred to do business related to mining or work in association of a mining firm, it provided much needed employment to them irrespective of their educational background and specialities. The survey results show that most of the people within the mining belts were affected as a consequence of the mining ban because they depend on mining for earning their livelihood. As mining activities in an extensive scale with inadequate structure, causes various negative effects mainly on health, environment, etc. Therefore, the opinion of the most respondent of the survey on mining are that if the mining activities is started at all it should be carried out in sustainable scale. It was found from the study that the majority of the surveyed participants agree that mining is helpful for healthier prosperity of Goa because it supports in providing better income to the people, generating employment and is also a significant source of revenue to the Government.

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