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A Concern about Illegitimate Mining and Environment

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Abstract

This paper highlights the environmental impact of mining activity and the need to attain sustainable development. A glimpse of the stages involved in the mining activity and the legislations applicable to the mining industry has been discussed. The paper aims to emphasize on the importance of Rehabilitation programs and the significance of Environment Impact Assessment.

"Minerals are treasure of nation"

- By Kautilya

In line with the wise saying "*You can't make an omelet without breaking egg*" it is ironical that the mining activity cannot be carried out without any negative impact on the environment. The contribution of mining activity in the progress of any country is significant as besides economic development, the communities derive huge benefits from it. Mining makes a country rich. It gives employment, business, wealth and everything to a country which the country needs for its development. It is one of the core sector industries which play a significant role in the economic development of a country. The minerals which are extracted from mining activity are essential foundation of life and are continually used by the society. Needless to say that the list of benefits arising out of the mining activity is long, but the fact that a just balance between mining activity and sustainable development is indispensible cannot be overlooked. Mining affects the natural environment, cultural heritage, health and safety of people and loss of natural resources. The supplies that are provided to the mine site, the roads which are accessed to ship the processed products and the activity of constructing roads to facilitate the inflow of heavy vehicles to the mine site have irreversible adverse impacts on the environment. As the mine sites are usually located in under developed and remote areas, the trees may be needed to be cut down in order to make way for installation of equipments and transportation of mined materials.

Balancing the need of modern society while not affecting the environment adversely has always been a big challenge. Like all the other industrial developments, mining activity has the potential to adversely impact the environment. The mining industry and its impact on the environment has been particularly highlighted in the recent years as its effect has been better understood and the general

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public has become aware and has started raising concerns over the effects mining activity has on the environment. The fact that mining activity is intrinsically harmful cannot be denied therefore there is need to develop and implement the practical ways to protecting the environment.

The Stockholm Conference of 1972 opened eyes of the world community by raising the 'Environmental Issues' globally. This was followed by an International Round Table Conference on 'Mining and Environment', held in the year 1981 in Berlin. Later, 'Earth Summit', 1992 was organized in Rio De Janeiro, Brazil which was intensely devoted towards the concept of Environment and Development. Keeping in view the need for the intensive growth and development, the environmental degradation is now recognized as a survival issue for developing countries which was earlier seen largely as a problem of the industrialized nations. Therefore a need has arisen to maintain a balance between Development, Environment and Mining. This balance was also recognized as a theme of World Bank Conference, 1994 held at Washington DC and also at Round Table Conference on Artisanal Mining, 1995.

The mining industry is the backbone of the industrial development in India and it contributes extensively to the world economy. The practice of mining in India is ancient but as India gained independence in 1947, the mining industry transformed alongside the rest of the world. Also, the rising international demand has fuelled the mining sector of India. But on the other hand, mining can also be a major source of degradation to the physical and social environment, if not managed properly.

Sustainable development

Sustainability is an essential pre-requisite of a mining activity. Sustainable mining is possible only if before undertaking the mining activity, its potential environment and social impacts are thoroughly assessed and taken care of. Also, due weightage needs to be given to the concept of sustainability even in the after-mine-closure plan as well. This will ensure that the biodiversity on the site where the mining operation was completed be properly restored and brought back to its original form.

Companies making huge benefits should be endowed with the responsibility of contributing towards the rehabilitation and resettlement of the land. In the recent years it has been seen that the companies are improving their policy objectives aiming at maintaining economic viability along with their social and environmental responsibility. There have been several initiatives taken by some companies to ensure that the mining corporations meet the requirements of sustainable development. For instance, Mining Association of Canada has established a program in 2004 and participation in this program is mandatory for all the members of Mining Association

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of Canada. The objective of this program is to meet the need of the society for minerals in a way which is socially economically and environmentally responsible. Regular assessments, performance reporting, consultations with the affected communities are some of the features of this program. In Australia, many sustainability projects have been undertaken to reduce the environmental impact caused due to mining operations. For instance, a solar plant is built at De Grussa Mine, located about 900 km north of Perth to meet the power needs so that there can be an increase in the renewable energy.

The duty to ensure proper reclamation of land should be put on the managerial-level as well as worker-level too. In any company, if the senior management is focused to find sustainable solutions, everyone including people at the operator level would understand the importance of it. A harmonious partnership between the companies and their respective governments is also a contributory factor in maintaining focus on sustainability. They should be given the authority to hire the environmental specialists which would ensure reclamation of land. Also the companies which seek to undertake mining activity must be put to strict proof to demonstrate the attempts made for reclamation. The workers should also be given basic level education towards their duty in protecting the mother earth. Sound environmental management practices would ensure future sustainable development. Though this green initiative seems to be a little costly, but in the end reduction and recycling of waste helps the companies to gain a competitive edge.

According to a news article published in a daily, to facilitate Sustainable Development Goals in India, an authority should be formed by the Parliament similar to the Office of Surface Mining Reclamation and Enforcement, US. The office in US ensures that the coal mines are operated in such a manner that the local community and environment are protected as well as rehabilitation is undertaken to make the land beneficial for most mining use.[1]

Legislations in India

The laws governing the relation of mining industry and environment in India are: Mines and Minerals (Development and Regulation) Act, 1957, The Environment (Protection) Act 1986, The Forest (Conservation) Act 1980, The Water (Prevention and Control of Pollution) Act 1974, The Air (Prevention and Control of Pollution) Act 1981. To regulate the activities affecting the environment generally, dedicated regulatory bodies like Ministry of Environment Forest and Climate Change (MoEF) and the Central and State Pollution Control Board are also formed under law. The

[1]R Srikanth, "How to make coal mining sustainable" *The Hindu*, Nov 25, 2019.

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Indian Bureau of Mines is specifically responsible to regulate the mining activity and to systematically and periodically inspect the mines.

Stages of Mining Activity

A mining activity is broadly categorized into four stages i.e. Exploration stage, Development stage, Extraction of minerals, Beneficiation Stage. Activities carried out at each individual stage affect the environment in its peculiar way. Even before the actual commencement of the mining operation, the mere preparation of the mine site and its related activities result in destruction of the natural biodiversity. For the mining process itself, variety of fuels, oils and aerosols are required which could themselves be potentially dangerous. These chemicals sometimes leak in the environment due to human error or failure of equipment. The dust generated during the mining activity causes air pollution and disturbs the aquatic life by penetrating into the nearby water bodies.

The exploration stage begins with the compilation and examination of geological information, maps and information gathered by satellites and aircraft. It mainly involves the identification of the minerals followed by drilling at the target area and demarcation of the ore bodies. The satellite-based devices like low flying aircrafts cause disturbance to the people inhabiting in the area and drilling results in surface water and groundwater pollution.

Development stage includes preparation of the mine site and building of roads etc. for the movement of heavy vehicles involved in the transportation of materials. Due to this, the wildlife and aquatic life in the area is majorly affected.

After the site preparation is completed and the equipments are placed suitably, the actual process of extraction and concentration begins. Usually, the method of extraction involves the removal of waste rock, which infact is the hard layer of soil, covering the metal ores and separation of ore from its deposit while disposing of the waste material. During extraction of ore, rock are drilled and blasted and the final product is shipped to the market which considerably disturbs the surrounding environment. If this is not properly managed, then the effect on wildlife, environment and the natural resources will be irreversible. Sometimes while separating the metal from the ore, accidental spills occur resulting in their leakage in the natural environment thus creating imbalance in ecosystem.

After the mineral ore is extracted the next step would be grinding the same into any fine particles. Generally the good grade metal is only in a small percent qua

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the complete ore. To maintain the power of machinery used in the mining process,, fuel, oil and greases are required to be used.

The useful metallic ore is then shipped to its destination while huge waste deposits are dumped near the mine sites and ignored. The transportation of the final product outside the mine site also disturbs the environment.

Finally, after the minerals are extracted from the ore, waste products are generated.

Waste generation

Mining activity generates huge waste which can be brought to use in things like building materials but a large amount of waste needs to be safely discarded to avoid any risk to the environment and human health. Sometimes chemical like cyanide are used in the processing stage and the waste generated from it, if is left unattended, can be highly toxic and lead to environmental devastation. Usually cyanide is used in extraction of gold as it dissolves gold in an aqueous solution. However if the waste is not treated properly, then even a very little amount of cyanide can cause permanent damages to humans and animals. Waste is generated during all the stages of mining activity and it can be broadly classified into three heads i.e. the tailings, waste rock and mine water.

Waste rock is generated when ore is extracted from the rock and the amount of waste rock which needs to be removed to reach the ore mainly depends on the location of ore, the method which is used for mining and the constituents of the rock. Stripping ratio is a method used to estimate the volume of waste rock and the ore. For instance if stripping ratio is 2:1, that means the mine 1 tonne of ore, 2 tonnes of waste rock need to be mined. Since the composition of waste rock can be different, they need to be managed and treated separately. The highly toxic waste rocks contain cyanide, ammonia etc. which can cause harmful effects on the environment even if they are released in very small concentration. Some waste rocks contain less toxic elements such as zinc or copper but they may cause considerable loss if they are present in higher concentrations. Furthermore phenomenon's like weathering pose a serious threat to the environment. Weathering occurs when air and water start to breakdown the rock. The larger chunks of rocks takes a long time to weather whereas the smaller chunks undergo this process quite quickly. Yet another parameter for separating the waste rocks is dividing the potentially acid generating rocks from the non-acid generating rocks.

Tailings are generated when during the processing of ore, the valuable minerals are separated and all fine-grained slurry is left behind. Tailings are usually generated in large quantities. If the tailings are left unattended, then there are

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reasonable chances that toxins are generated and they affect human health and surrounding ecosystem. The grade of an ore decides the amount of tailings which will be generated during its mining. For instance, usually iron ores have higher grades, therefore less tailing are generated. On the other hand sulfide and gold ores are low grade, resulting in high tailings. Mostly the tailings are stored by conventional impoundment storage method where dams are built specially engineered to retain them to avoid their contact with the air and water. Similar to the weathering of waste rocks, when tailings come in contact with air, they weather too and in fact there weathering is on a higher side as their surface area is more than the surface area of a waste rock. The situation worsens when the tailings contain sulfide minerals as when they come in contact with the air, they oxidize. To prevent this, the method of subaqueous deposition is employed in which the tailings containing sulfide minerals are kept under water. In the South African Gold Mining Industry, a method known as 'sub-aerial deposition' is employed in which tailings are not deposited under water but rather they are deposited in thin layers of water and these depositions are regularly rotated. The regular rotation ensures that the tailings get dry and reduced in density before the next layer of tailings is deposited.[2]

Water contamination occurs at nearly all the stages of this activity and its treatment is intrinsically important while carrying out a mining activity. For instance, in the process of milling, water is used in large quantities causing its potential contamination. However after the process is over, it is usually left abandoned. This untreated water comes in contact with environment and the results in environmental degradation. It is possible to treat the mine water by simple ways like treating it with materials like limestone and caustic soda which helps in settling of the dissolved metal in the water and increasing its pH level. Other methods which can be used to treat water are filter systems, sedimentation ponds and passive water treatment methods using plants or soil to filter the contaminants.

Rehabilitation program

After the mining operation is completed, rehabilitation programs are undertaken in order to restore the land. The primary aim of the rehabilitation process is bringing the land back to its original value or better than what it was. It is essentially important that the post mining land use should be clearly defined in order to undertake an effective mine rehabilitation program. Consultations with the local community and landowners along with Mining activity involves clearing the vegetation which leads to change in topography and damage to the vegetation resulting in soil erosion, clogging the waterways and piles of dust at the mine site.

[2] D.E. Daniel (ed.), *Geotechnical Practice for Waste Disposal* (Springer Science Business Media, B.V., UK, 1993)

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Besides the on-site damage, it also causes damage off site by discharge of contaminated materials and chemicals in the environment. Mining companies are accountable and responsible for land rehabilitation being the temporary custodian of the mined land. The rehabilitation methods are generally aimed at compatibility of the mining operation with the present and future use of the mined land. To bring the mined land back to its agricultural and conservation uses, rehabilitation programs like backfilling of open areas, reshaping of landforms, planting of rich species and cattle grazing trials are done. Regular monitoring of these programs ensures their timely completion and success. Monitoring the success rate of rehabilitation program is yet another aspect which needs attention. For instance, in Australia the success of rehabilitation of mine site is not only measured by the number of plants are planted on the mine site, but also by measuring the ecological processes which indicate the success of the rehabilitation level. An example for this is the bio-indicators. The plant and animal species which are important in the ecosystem give a general health indication of the ecosystem. One of the most popular bio-indicator is the ant. In Australia, ant monitoring program help in assessing and evaluating the performance of the rehabilitation program. The changes in the ant species from the mining sites are compared to the reference sites, which are untouched by mining operations. In New Zealand, rehabilitation is done replacing the topsoil with the one loaded with nutrients. This helps the vegetation to grow at an accelerated rate promoting use of land in forestry or grazing purposes thereby reducing the prolonged ill effects of mining operation on the environment.

Environment Impact Assessment

The answer to the above stated outpouring concern is 'Environment Impact Assessment'. The role of environment impact assessment assumes importance even before clearance and a green nod to the mining activity is given by the authorities. During the planning and designing stage of the mining operation, a proper and regulated environment impact assessment ensures a proper and effective rehabilitation of the mined area. The plan for environment impact assessment includes identifying the environmental, social, safety and health issues, the proposal for conservation of areas rich in biodiversity and wildlife, practical viability of a mining project and interaction with the local community likely to be affected by mining activity. In India, the concept of Environment Impact Assessment has gained importance lately and a mining lease is granted only after Environment Impact Assessment under the EIA 2006 notification has been conducted and an environment management plan is submitted based on which environmental clearance is granted. The Environment Impact assessment is required to be conducted after holding public consultations which is then reviewed by an appraisal committee. With the help of the assessment, it is possible to identify the impact of a proposed mining project on the environment and

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suggest measures to mitigate the same. It also ensures an optimum usage of the available resources. The environment clearance is granted or refused on the basis of potential damage which the mining industry could cause and after consideration of the proposed plan to remediate and reclaim the environment. In order to control and prevent the effects of mining operations on the environment, certain conditions like compensating the displacement of forests by compensatory afforestation may also be levied while grating environmental clearance. A mining plan involving a forest land is required to obtain clearances for diverting the forest land as well.

It is crucial that the mining companies realize that they owe a responsibility towards the reclamation of the mined area from where they did derive piles of profits. A well drafted plan would also enable the companies to make an informed choice about investing in a particular mining project. Thus it would be a win-win situation for all.

To sum up, the mining companies cannot ignore their duty to protect and preserve the environment and 'Environmental Management Costs' should have a considerable share in the profits made by them. Also, the government should not be allowed to turn a blind eye towards its responsibility of protecting and preserving the environment while ensuring sustainable development with an effective implementation of rehabilitation and reclamation programs.