



(RESEARCH ARTICLE)



Environmental, social and health impacts of stone quarrying in Mitrapur panchayat of Balasore district, Odisha

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Abstract

Excessive demand for stones due to rapid infrastructure development led to uncontrolled stone quarrying in Mitrapur panchayat of Balasore district causing serious environmental degradation and socio-economic conflict. A large numbers of tribal people of this area are dependent on stone quarrying activities for carrying their livelihood. Methodology include field observation, photo documentation and interview of local people through a predesigned structured questionnaire to know the local people perception about the impacts of quarrying. This current study was conducted through collection of data from local people of five villages namely, Chatrikhunta, Chandipur, Patana, Kathagochhi and Jamudiha of Mitrapur panchayat of Balasore. Majority tribal people of study area (53%) depends upon quarrying activity for their livelihood. Many local people complained about various negative effects of stone quarrying activities. A vast majority of respondent stated that they suffered severely from the noise pollution caused from the stone quarry related activities (83%). Major source of noise pollution were stone crushers (54%), transport of material by truck/dumper/ tractor (24%) and use of dynamite in blasting operation in quarry (22%). About 40% respondent complained about the impact of dust pollution on agriculture. The availability of water resources in the study area varied from site to site. Many health impacts like bodily pain, eye infection, sleepless nights, headache, cough and chest pain have been reported due to engagement in stone quarrying. In spite of its contribution towards development, quarrying is also responsible for several negative environmental and socio-economic impacts, particularly when quarrying activity is carried out haphazardly.

Keywords: Stone quarrying; Environment; Socio-economy; Pollution; Mitrapur panchayat

1. Introduction

Stone quarrying is the open cast excavation of hard and soft rocks [1]. According to UKpong, 2012, quarrying is a form of land use method concerning with the extraction of non-fuel and non-metal minerals from rock. Rock drills and explosion of dynamite are common methods used for open cast quarrying [2]. It has many negative environmental impacts like disruption of animal habitat, vegetation destruction, soil erosion, river siltation, noise pollution due to blasting of mountain, transport of rocks by truck, dumper etc., and dust pollution [3]. Quarrying activities induced serious pressure on soil and water resources [4]. It also disturbed normal hydro-geological cycle and pre-existing ecosystem. It alter substratum, transform landscape pattern, disrupt natural habitat and change genetic resources of the local biodiversity. Further quarrying activities aggravate dust emission, noise pollution and water contamination. Dumping of waste rocks block natural drainage system result in diversion of stream and river to other area result in flooding of crop fields [5].

Quarrying has long term social challenges like bad impacts on health, safety issues, displacement of communities, damaged to local area and formation of quarrying village to change local people occupation. Through quarrying

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activities, Government and big companies take biggest share of profit while village people suffer from negative impacts of this activities. This leads to conflict between mill owner and local people of quarrying area [6].

The areas where quarrying and agriculture co-exist, there is a chance of conflict over traditional uses of land. Clearing land for construction of road causes habitat destruction for wild animals, and reducing grazing areas for cattle, sheep and goats [7]. Noise pollution from blasting and transport of rocks in quarry area caused migration of people from surrounding areas and affecting ecological balance [8]. Lack of adequate mitigation measures further aggravate environmental problem. Darwish et al, observed that in many developing countries, many quarries are left without rehabilitation at the time of closure of quarrying [9]. This decrease aesthetic value of the quarrying area and generate waste lands.

In this current study, we selected five villages of Mitrapur panchayat, Kathagochhi, Chatrikhunta, Chandipur, Patana, and Jamudiha. From 2021 to till now stone quarrying is operating only in Kathagochhi village and there are many stone crusher and stone cutting areas developed in many nearer villages of Mitrapur panchayat. So people of all nearer villages of stone quarrying site is affected by the bad impacts of quarrying activities. Current study examine environmental, social and health impacts of stone quarrying on people of five villages of Mitrapur panchayat of Balasore district.

2. Material and methods

2.1. The study area

Balasore district is located in the northern most part of Odisha state. Its geographical area is about 3,634 km². Out of total area, 348 km² land is forest cover. The district is located at 20.48 to 21.59 North latitude and 86.16 to 87.29 East Longitude. Kuldhia wild life sanctuary is located in Balasore district close proximate to Mitrapur area. Mitrapur area is one of the tribal area of Balasore district (77.7% tribal population). The tribal community mainly constitute Bhumija, Kolha, and Santala community. Stone quarrying is the largest engagement occupation and a major source of livelihood of this area. The economical sound people own quarrying site and crusher mill whereas tribal people working in these field for various allied quarrying activities like stone cutting, stone polishing, loading stone on truck and dumper etc. as daily labour. There are around 15km long stone belt spread from Mitrapur in the west to Sajanagada in East. But quarrying activity permitted only for Kathagochhi village of Mitrapur Panchayat. But many stone crusher mills developed in nearer villages. In this present study we selected five village namely Chatrikhunta, Chandipur, Kathagochhi, Patana and Jamudiha that are actively engaged in quarrying activities and negatively impacted by it.



Figure 1 India map showing study area

2.2. Data collection

Data were mainly collected from local people through interview of five villages, Chatrikhunta, Chandipur, Kathagochhi, Patana, and Jamudiha. Many tribal people of these village engaged in stone quarrying activities. A structured questionnaire was prepared for survey. Further 20 household of each village were surveyed to know their economic activities and sources of income. Impacts of stone quarrying activities on local people, forest and environment also accessed through interview.

2.3. Statistical analysis

Data was collected and entered in a Microsoft excel worksheet for the purpose of analysis and percentages.

Informed consent was obtained from all individual participants included in the study.

3. Results

There are many socio-economic and environmental impacts of stone quarrying. In Mitrapur panchayat of Balasore district, stone quarrying is one of the major livelihood occupation of many local people. Mitrapur panchayat primarily a tribal area (77.7% people belong to various tribal communities) of Balasore district. Majority unskilled tribal people engaged various activities of stone quarrying. Stone quarrying site that is khadan area present in Kathagochhi village of Mitrapur panchayat. It causes severe environmental degradation like dust pollution, noise pollution, forest depletion, ecological degradation, water contamination etc. in local area. Many local people suffer from several health issues like respiratory problem, mood swing of engaged worker in this field, irritation due to noise pollution, allergy, increase heartbeat, eye infection due to dust pollution etc.

3.1. Field observation

Quarrying areas in Kathagochhi village were observed many times from May, 2022 to January, 2023. There is only one side protective wall present in one side periphery of quarry sites and no protective wall present in other side. There is no warning sign boards around the quarries that leads to serious threat to the life of human and animals. The quarries are surrounded by agricultural land and houses of local people. In this area, quarrying activities causes sandblasting and release of various chemicals to environment causes soil, water and air pollution. More than 20 stone crusher mills were located in nearer villages. The stone crushers are major source of dust and noise pollution. In Kathagochhi village, due to constant quarrying activities water contamination observed because of surface run off water from quarry site to nearer ponds. And in many places water is stored which is the birth place of several water and insect borne diseases like malaria, filarial, typhoid, cholera, dysentery etc. It was noticed that blasting activities leads to vibration of nearer houses creates cracks on the wall and roof. One of the major concern about the quarrying activities is the safety of people around the quarries, because various allied activity of quarrying taking place close proximate to the houses and dwelling, the locals are more prone to accidents. In the past years nine people are injured due to stone hit during blasting in the quarrying. There is no information was available about the current status of stone quarrying that is total estimated material was to be removed. How much exactly remove till date, up to what depth the excavation is permitted and done, what regulations are to be followed and in case of violation what actions are taken against the concern parties. How many illegal quarries activities taken place there, their current status etc., what are the current standard about the permissible height, hill cutting angle, maximum depth of the quarry allowed etc. This indicate the serious and permanent negative impacts of quarrying on local environment.



Figure 2 Stone quarrying site in Kathagochhi village



Figure 3 Hill cutting for stone extraction in Kathagochhi village



Figure 4 Agricultural land closer to quarrying area



Figure 5 Contaminated water stored near quarrying area



Figure 6 Water pollution near quarrying site at Kathagochhi village



Figure 7 Huge depth quarry near Kathagochhi village



Figure 8 Crusher emitting dust near Chatrikunta village



Figure 9 Child labours working in stone crusher in Chandipur village



Figure 10 Tribal people engaged in various allied activities of stone quarrying.

3.2. Socio economic impact of stone quarrying

Mitrapur is primarily a tribal area of Balasore district. Now a days, stone quarrying is one of the major source of livelihood for many tribal people. In the current study areas, a large proportion of landless unskilled tribal people are engaged in stone quarrying activities and it is one of the major engagement and occupation. 100 people were interviewed in Kathagochhi village where their main occupation is stone quarrying activities, agriculture and collection of forest product from local forest areas. In our present study area, 7% people who has not any income source, 37% people engaged in agriculture, 3% people collected forest products from near forest for carrying their livelihood and 53% people working in stone quarrying activities have annual income 30000-35000 (figure 11). Table 01 showed % of people of the study area engaged in different occupation and their annual income. Income from stone quarrying is more than other occupations. There are many areas where stone mining is not permitted. Only in Kathagochhi village of Mitrapur panchayat stone quarrying is permitted and stone crushers are present in many nearer village. Five villages were selected for current study. In Kathagochhi village, household survey showed that many male and female tribal people engaged in different activities of stone quarrying. More than 1000 tribal people engaged and many tribal children both boys and girls engaged in this activities. This is the main reason for their school absent and dropout. They earned 300-500 rupees per day. There are more than 100 trucks per day transform rocks from Kathagochhi area. In Jamudiha more than 10 trucks of stone crushed daily and more than 250 workers engaged daily. There daily income counted by number of baskets of stone they cut in a day. For one basket they earned 7 rupees.

Table 1 % of people engaged in different occupation and their yearly income

Occupation	% of people engaged	Yearly income (in Rupees)
Agriculture	37%	20,000-25,000
Stone quarrying	53%	30,000-35,000
Collecting forest product	3%	10,000-15,000
Not engaged in any work	7%	Nil

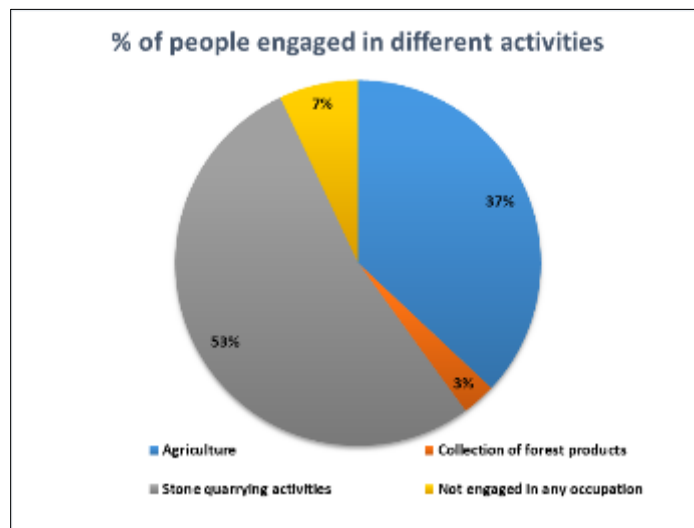


Figure 11 % of people engaged in different occupation in study area

3.3. Respondent perception about environmental impacts

Impact of stone quarrying on local environment determined through interview. It revealed that more than 34% of respondent were illiterate. Among the literate 28% reached primary education, 14% secondary education, 11% higher secondary education and 5% graduate. 7% diploma and 1% post graduate. Within the surveyed area respondents were engaged in diverse occupation like agriculture, service, business and stone quarrying activities. Many unskilled tribal people (53%) engaged in quarrying activities. Most respondent of this area belong to lower to lower middle class with 53% had their monthly income between 3,000 to 4,000 Rupees , 37% had it between 2,000-3,000 Rupees and 3% is below 2000 Rupees per month and 7% does not have any constant income source.

It was reported that majority of the respondent experienced many negative effects of the dust pollution by stone crushing, cutting, polishing and other quarrying related activities (62%). The responses were stronger in decreasing order Kathagochhi, Chandipur, Chatrikhunta, Patana and Jamudiha villages.

The negative impacts of dust pollution due to quarrying activities on health revealed by respondent information were respiratory problem (37%), eye infection (60%), cough (37%), sneezing (22%), allergy (55%), chest pain (46%), headache (55%), accumulation of dust on home (33%) and slow growth of fodder for cattle and goats (16%). About 40% people complained about negative effects of dust pollution on crop productivity. Two major effects were reduction of agricultural yield due to deposition of dust on crop (71%) and secondly availability of ground water and water contamination (29%). Another problem we noticed through interview was many agricultural labour were faced difficulty to work in dusty environment therefore resulting in reduction of agricultural yield indirectly (75%). Many fruit trees also affected by dust pollution resulting in stunted growth and decreased fruit yields. There are also reduction in appearance of insect pollination like butterflies, bees, moths etc. due to dust pollution.

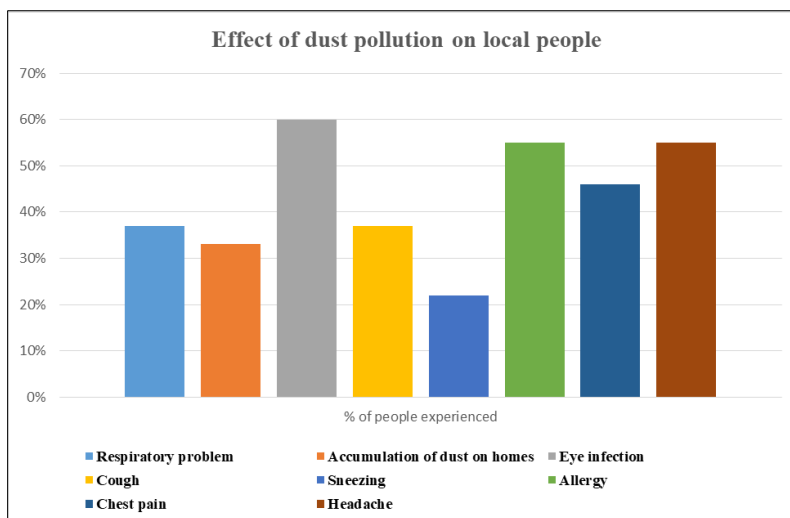


Figure 12 Various effects of dust pollution on local people

First immediate impact of stone quarrying is land degradation. It causes landscape alternation due to excavation, water induced soil erosion due to surface run off water in quarrying site, dumping of waste rock causes loss of land or generation of waste land, over burned soil etc. Soil erosion and soil contamination are common in quarrying sites. In current study area, in many places waste land were generated due to stone quarrying activities. Waste stones are dumped in many places causes blockage of drainage channels. Approximately 10% of land of Kathagochhi area already wasted. In many sites of the quarry area waste water were stored. This decrease aesthetic value of the site. In many areas, plants are unable to grow and some land completely lost their ability for cultivation because of soil contamination by stone quarrying activities.

Both ground and surface water availability varies from one site to other. Many tribal people of the study area experienced scarcity of water in Kathagochhi (23%). 47% respondent are very sensitive about these issues and they said it disturbed forest ecosystem and reduction of ground water level.

Vast majority (83%) of respondent complained about severity of noise pollution caused due to various quarrying activities. Noise pollution occur due to dynamite in blasting operation in quarry (22%), noise emitted by stone crusher (54%) and transport of stone material by truck, dumper, tractor etc.(24%) (Table 02 and Figure 13). Loss of peace (76%), fear due to loud noise and vibration (33%), increased heart beat (55%), headache (47%), development of cracks on houses (23%) etc. are various effects of quarrying related noise pollution (Table 03, Figure 14). The respondent from Kathagochhi and Chandipur are more sensitive about stone quarrying activities because many of them suffered from damaged to their property. 35% respondent revealed that stone quarrying activities also goes during night. Many respondent revealed that before stone quarrying activities initiated, these lands were occupied by forest. Many respondent (80%) think that stone quarrying occupation is not a suitable alternative livelihood like agriculture, service, business etc. because of its uncertainty nature. 70% respondent believe that massive transport of truck and dumper are not safe and there is always chances of accident. Due to short time, seasonal and uncertainty nature, it is not possible to formulate any future planning for employment generation in this field.

Table 2 Various sources of noise pollution in quarrying area

Sources of noise pollution	%
Blasting of hill	22%
Stone crusher	54%
Transport of stone by truck or dumper	24%

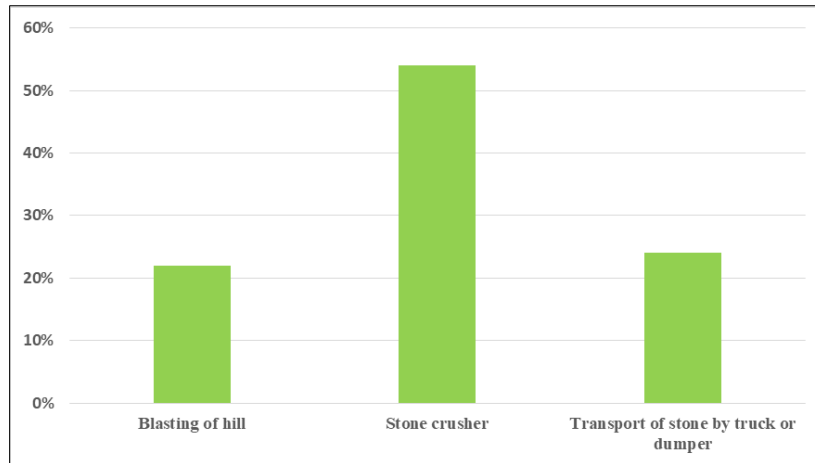


Figure 13 Sources of stone quarrying related noise pollution

Table 3 % of local people experienced various effects of noise pollution

Effect of noise pollution on local people	% of people experienced
Loss of peace	76%
Development of crakes on house	23%
Fear	33%
Increase heart beat	55%
Headache	47%

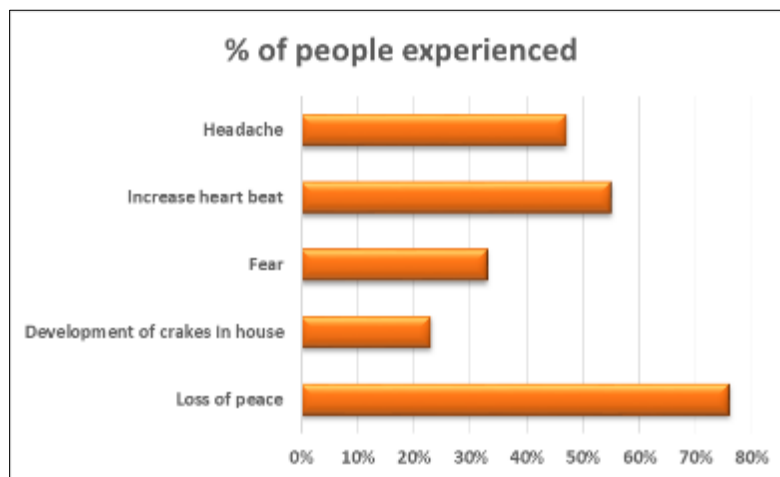


Figure 14 Impacts of quarrying related noise pollution on local people

4. Discussion

The current study showed that stone quarrying activities has environmental and health impacts similar to the study conducted by Kitula in 2004 [10]. Sati, V. P. also gave similar report of stone quarrying that it causes environmental degradation [11]. Similarly, Nartey et al. reported that stone quarrying causes land degradation similar to our observation [12]. Bewiadzi et al. reported that stone quarrying is responsible for land degradation, erosion, destruction

of arable land, destruction of ecosystem etc. also similar to our observation in this current study [4]. Abate Z. reported various health issues like physical injuries, respiratory problems and fatal accidents of workers engaged in stone quarrying activities [13]. Similar observation also reported by Langer (2001) showed that 4 Million people die yearly from acute respiratory problems in developing countries because of environmental pollution, sandblasting and emission of dangerous chemicals. Our current studies showed that various health issues caused by stone quarrying like chest pain, inhaling of polluted air, respiratory problem etc. similar to Langer W. H. observation [14].

Our current study showed that stone quarrying activities causes noise pollution, vibration, erosion and sedimentation. Similar observation also reported by Gale and Groat [15]. Similar to Langer (2001) report, stone quarrying leads to sandblasting and emission of dangerous chemicals into the environment, our current study also reported such kind of problems.

Our present study showed that, in the study area workers used heavy equipment and machinery in their operation in contrast to the study conducted by Bewiadzi et al. [4]. This difference is due to cultural and environmental specific nature of stone quarrying. Stone quarrying strategy also determine by nature of ecosystem and availability of assents. Stone quarrying activities in Krobo and Kumasi area used heavy machines and chemicals reported by Nartey et al. (2012) and Asante et al (2014) respectively, similar to our observation in this current study [12, 16]. Workers in Daglama use simple tools and other traditional methods in search for stones and rocks for their business in contrast to our study. They use simple tools such hoes, cutlasses, pick axe, shovels, spade and pans for their operations. Many workers use flame burning method to soften the rocks before breaking them into smaller fragments [4].

5. Conclusion

Stone quarrying is regard as a crucial economic activity for the poor tribal people of Mitrapur Panchayat of Balasore district. Though it plays a significant role in the sustenance of livelihoods, it also has a significant negative impacts on the environment and health. Current study revealed that financial hardship, unemployment, lack of skill, illiteracy, rural-urban migration, lack of compensation etc. are factors leads to people 's engagement in stone quarrying in Mitrapur panchayat. In spite the hazardous nature of the work, it increases employment and family income contributes to the wellbeing of workers and family of the local people. Excessive demand for stones due to rapid infrastructure development led to uncontrolled stone quarrying of Mitrapur panchayat of Balasore district causing environmental degradation and socio-economic conflict. In spite its huge benefits in term of employment generation, infrastructure development, revenue generation etc. it causes serious environmental damage in the local area particularly when it not follow prescribed rules and regulations and carried out haphazardly.

Compliance with ethical standards

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Statement of ethical approval

Statement of ethical approval: The present research work does not contain any studies performed on animals/ humans subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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