

## Socio-economic and Environmental Impact Analysis of Khothagpa Gypsum Mine

*Karma Galay\**

### Part 1. Overview of mining sector in Bhutan

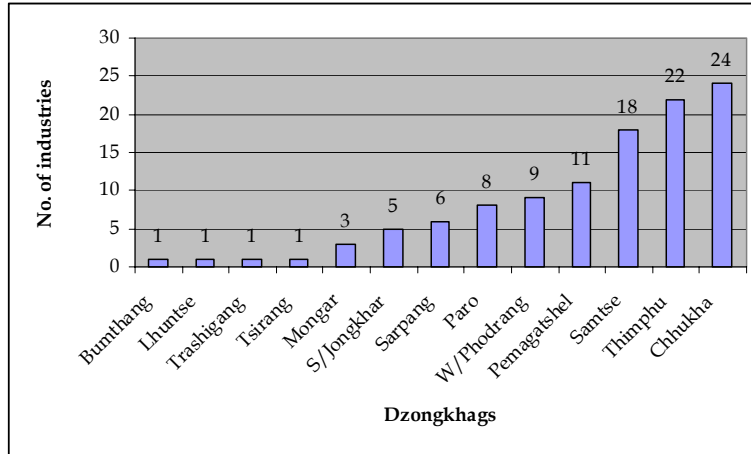
Bhutan is rich in mineral resources such as dolomite, limestone, slate, and coal. It also has small deposits of marble, quartzite, granite, talc, iron ore, and pink shale. Mining in Bhutan started in the early 1970s and it was mostly carried out by the government enterprises. Gradually under the auspices of policy of privatization, mining sector operations were privatized. Mining activities are now solely carried out by private agencies. Currently, there are 27 private mining companies. In addition to the mining companies, there are 83 mineral based industries. In terms of geographical spread, most of the mineral based industries are located in the west, south and south eastern parts of the country. See chart 1.

*Chart 1: Geographical spread of mineral based industries*

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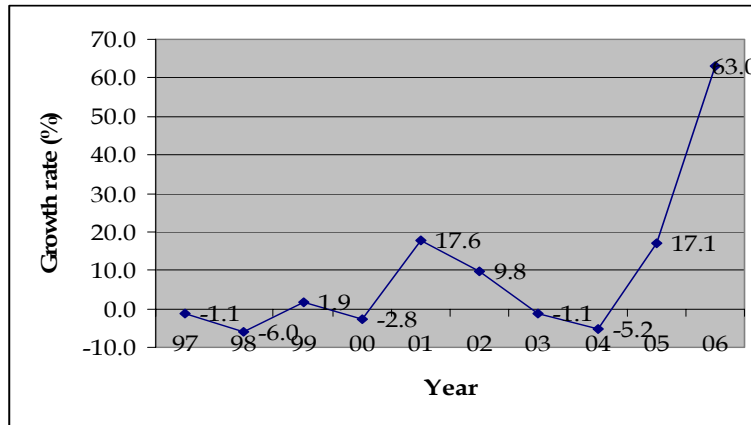
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*Impact Analysis of Khothagpa Gypsum Mine*



Although mining is one of the modern economic activities pursued by Bhutan since the start of planned development, mining sector has not expanded much. The performance of mining sector has been very erratic with some years experiencing negative growth rates. See chart 2.

*Chart 2: Growth rate of mining sector*



The contribution of mining sector to GDP has been very low; it constituted less than 2% of GDP for most of the years. See table 1.

*Table 1: Share of mining sector in GDP*

<b>Year</b>	<b>% share</b>
1997	2.1
1998	1.8
1999	1.7
2000	1.6
2001	1.7
2002	1.7
2003	1.6
2004	1.4
2005	1.5
2006	2.3

However, as we see in Chart 2, mining sector is experiencing some upsurge in the recent years. In 2006, mining sector experienced a growth rate of 63%. More business agencies see engagement in mining activities as a lucrative business and have taken up mining business in the recent years.

While mining sector certainly could play an important role in the industrial development and benefit the country in terms of generation of employment and revenue, it is also a sector that could bring about a wide range of costs to the society. Some of these costs could be felt in short-term and while many others could be felt over and after much longer period of time.

It is in this context that the current study has been initiated. As a baby step towards studying overall impacts of mining sector on Bhutan's economy and society, a case study of mining of

gypsum in Khothagpa under Pemagatshel dzongkhag was carried out. The study looks at the economic, social and environmental impacts of the gypsum mining on people living nearby as well as at the national level. However, given the non-existence of economic and social data on the communities, the impacts outlined in the study are mostly perceived ones.

**Part 2: A brief background of Khothagpa gypsum mine**

The gypsum mine is located at Khothagpa village, some 13 kilometers below Pemagatshel town. It has a total mine area of 26.67 hectares. Mining first began in the early 1980s and was managed by the department of Geology and Mines. Subsequently for a brief period of time, it was managed by the Penden Cement Authority. In 1993, government leased out the mine to Druk Satair Corporation for a period of 10 years. The corporation won the bid to operate the mine for another 10 years in 2004.

Using semi-mechanized open cast method, the corporation mines gypsum which is mostly exported to India. A small proportion is exported to Bangladesh and Nepal, and a small amount sold to Bhutanese buyers. In 2002, the corporation, along with some other promoters set up Druk Plaster and Chemicals Limited. As it is a spin-off company, it is managed by the same team of managers. The two companies, however, have separate staff at the field offices. Remaining part of paper is organised as follows: part three highlights economic impacts; part four social impacts; part five health and environmental impacts; and part six some

concluding remarks. The impacts outlined below are based on random interviews of some farmers of Khothagpa, Nangkor, Yalang, Shali, Gamung, and Jaipobrangsa villages; businessmen of Khothagpa and Pemagatshel; *gup* of Shumar gewog; truckers; Chief Executive Officer and some employees (both permanent and temporary) of the corporation as well as the on-site observations of the author of this paper.

### **Part 3: Economic impacts**

#### **A. Positive impacts**

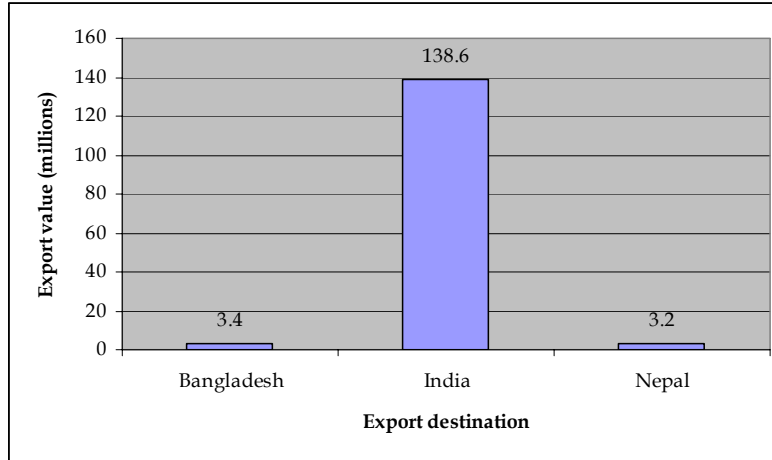
Most publicized economic benefits of gypsum mining are the following:

##### *i) Generation of foreign exchange*

Over 90% of gypsum that the corporation mines is exported to India, Bangladesh and Nepal. Since India is the main buyer, it earns a significant amount of rupees. It contributes towards building up of rupee reserves. In the recent years, rupee shortage has inconvenienced Bhutanese businessmen. Through its rupee earning, it can be said that the corporation contributes towards easing the problem. Furthermore, it contributes towards overall hard currency earnings of the country. Bangladeshi and Nepalese buyers pay in US dollars. Following chart shows the export earnings for the first six months of 2008.

*Chart3: Rupee value of gypsum exports (January 08-June 08)*

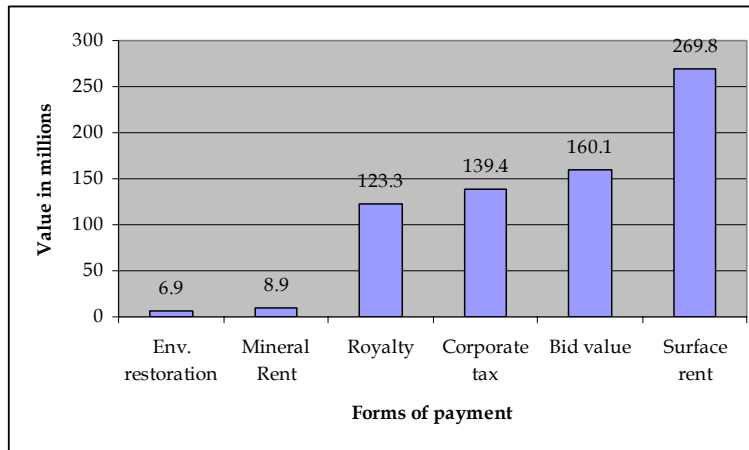
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### ii) Generation of government revenue

The corporation generates revenue for the government payment of bid value, corporate income tax, royalties, mineral rent, surface rent and environment restoration fund. Between January 1994 and December 2007, the corporation has so far paid Nu. 438.95 million as tax and rents. See chart 2.

Chart 4: Various forms of payments made to the



*government*

As a percentage of national revenue, the contribution of the corporation is less than 1% for most years. See table 2.

*Table 2: Share of DSCL's contribution in the national revenue*

<b>Year</b>	<b>DSCL's contribution (in millions)</b>	<b>National revenue (in millions)</b>	<b>% contribution of DSCL</b>
1999	17.1	4381.1	0.4
2000	21.6	4671.5	0.5
2001	20.4	5100	0.4
2002	20.9	4785.3	0.4
2003	24.7	5055.2	0.5
2004	84.9	6066.1	1.4
2005	46.3	6902.9	0.7

*Source: Statistical Yearbook of Bhutan, 2003 & 2007 and information from DSCL.*

However, when DSCL's contribution to the government revenue is juxtaposed with its overall turnover or gross income, it amounts to a high percentage of its turnover. From the point of view of a single corporate entity, the amount it pays to the government is very high; for no year since its operation has its contribution been lower than 19% of its turnover. See table 3.

*Table 3: DSCL's contribution to the national revenue as percentage of its turnover*

<b>Year</b>	<b>Turnover</b>	<b>Contribution</b>	<b>% of turn over</b>
1994	31,748,126.00	9,785,557.00	30.8

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1995	34,883,821.00	6,759,223.00	19.4
1996	46,439,104.00	12,267,424.00	26.4
1997	54,386,017.10	13,458,329.00	24.7
1998	59,908,815.20	14,541,117.00	24.3
1999	84,960,303.40	17,132,168.00	20.2
2000	96,227,307.00	21,622,053.00	22.5
2001	106,919,159.00	20,373,601.00	19.1
2002	108,654,288.00	20,948,637.00	19.3
2003	129,590,773.00	24,749,117.00	19.1
2004	143,659,434.00	84,928,763.00	59.1
2005	181,626,300.00	46,344,022.00	25.5
2006	261,333,265.00	74,188,966.00	28.4
2007	237,572,321.00	71,852,267.00	30.2

*iii) Broad based ownership of the corporation*

The structure of ownership of the corporation is broad and diversified. When the corporation came into being in 1993, His Majesty the Fourth King commanded it to sell its shares to the people of six eastern dzongkhags. Following this command, 30% of the company's shares were sold to people of six eastern dzongkhags. Thanks to the farsighted vision of His Majesty, many farmers from six eastern dzongkhags own shares and receive dividends every year from the company. However, number of shares owned by farmers is small and the number of shareholders varies widely between dzongkhags with Pemagatshel accounting for the highest.

*Table 4: Distribution of DSCL shares*



<b>Name</b>	<b>No. of shareholders</b>	<b>No. of shares</b>	<b>% share</b>
Promoters	8	182,272	40
Central monastic body	1	155,112	34
Public of Pemagatshel	431	43,593	10
Public of Trashiyangtse	324	29,678	7
Public of Trashigang	179	24,314	5
Other buyers	37	8,071	2
Public of S/jongkhar	288	5,784	1
Public of Mongar	19	4,552	1
Public of Lhuntshe	5	3,167	1
Total	1,292	456,543	100

*Note: Institutional shareholder and individual shareholder are taken as same*

Except for 2001 and 2002, the shareholders have been paid dividend every year. By 2007, the company disbursed over Nu. 86 millions as dividends to various shareholders. (See table 5 for details). The company also issued some bonus shares and those shareholders who had only one share initially now own a minimum of 14 shares. It can be said that through the disbursement of dividends, the mining operation not only benefits the promoters and people of Pemagatshel but some people from rest of the eastern dzongkhags as well.

*Table 5: Year-wise disbursement of dividends*

<b>Year</b>	<b>Dividend disbursed</b>
1994	831,167
1995	1,853,500
1996	1,647,125
1997	2,362,500
1998	7,762,500
1999	5,067,200

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2000	5,067,200
2001	12,161,280
2004	4,560,480
2005	15,201,600
2006	15,979,005
2007	13,696,290
Total	86,189,847

### *iv) Generation of employment*

Mining activities usually generates formal as well as informal employment opportunities. All the workers (both regular and wage workers) employed at the company are Bhutanese. It employs 20 staff at its head office in Samdrupjongkhar, 52 at its field office in Khothagpa, and 13 at the field office of its sister-concern Druk Plaster and Chemicals Limited in Khothagpa. Thus, the company provides formal employment to 85 individuals. Most of these employees, particularly those at the field offices are from Pemagatshel; over 46% of employees at the field office of Druk Satair Corporation Limited and 33% of employees at the field office of Druk Plaster and Chemicals Limited are from Pemagatshel.

In addition to the formal workers, the companies employ wage or informal workers. During the time of this research, there were 27 wage workers at Druk Plaster and Chemicals Limited and 37 at Druk Satair Corporation Limited. These workers are paid Nu. 100 per day. Over 66% of them are from Khothagpa and a few other villages under Shumar gewog and 48% of the employees are women.

Number of informal employees could be much higher if we include truckers engaged in transporting gypsum from the mine. During the time of this research, there were 91 trucks that were engaged in transporting gypsum on regular basis. Except for 12 trucks, rest of them had handy boys. This means that about 170 people (91 + 79) were engaged in trucking. Besides, those truckers that carry gypsum on regular basis, several other trucks show up daily to carry gypsum. Most of these drivers are in their early twenties (mean age was 24) and had attended school. It could be argued that if it had not been for the corporation which provides them with job opportunities, these young people would have been elsewhere in the country looking for job, which is increasingly difficult to find.

Interviewees said that the opportunities to find employment, particularly part time work as a waged worker, have dwindled over the years. The management has mechanized some aspects of mining operations and the need for wage workers declined significantly. Management said that the deployment of wage workers could decline further in future as it mechanizes further.

*v) Business opportunities*

During the time of this study, there were eight shops in Khothagpa. Most of the shopkeepers said that people working at the mines were their main customers. Besides shopkeepers, people also benefit through rental income that they earn. More than 10 farmers living nearby the mine have rented out their houses to truckers

and employees of the mine. A few farmers interviewed said that their living standard has improved due to supplementary income they were able to earn through renting and off-season work at the mine.

The corporation assures constant business to the truckers. Most of the trucks belong to the people of Pemagatshel. See table 6 for district origin of trucks currently employed at the mine.

*Table 6: No. of trucks employed by DSCL by districts.*

	<b>Districts</b>	<b>No. of truck</b>
1	Pemagatshel	46
2	Trashigang	13
3	S/jongkhar	14
4	Thimphu	5
5	Mongar	5
6	Paro	2
7	Haa	1
8	Bumthang	1
9	T/yangtse	1
10	Trongsa	1
11	Wangduephodrang	1
12	Others	1
13	Total	91

A few truck owners that were interviewed for this study said that the constant engagement at the mine to transport gypsum provided them with an assured and convenient business opportunity. The monthly income that they get from hiring of their trucks enables many of them to pay back their loans on time. It must also be noted that many of the truck owners,

particularly those from Pemagatshel, were able to own one because of constant business they got from the mine. So far the corporation has paid Nu. 483.07 millions as transport charges to various truckers employed at the mine. See table 7.

*Table 7: Charges paid to truckers for transporting gypsum*

<b>Year</b>	<b>Amount</b>
1994	1,491,379.0
1995	7,915,309.0
1996	9,849,145.0
1997	19,037,759.4
1998	19,724,084.4
1999	28,981,762.5
2000	25,588,849.0
2001	36,841,213.0
2002	37,152,416.0
2003	40,106,849.0
2004	46,769,979.0
2005	59,580,583.0
2006	82,544,245.0
2007	67,487,589.0
Total	483,071,162.35

*vi) Convenient means of transport*

There is no public transport between Pemagatshel and Samdrupjongkhar or Trashigang. In addition to carrying gypsum, trucks ferry people and goods between Pemagatshel and Samdrupjongkhar. People say that since there are trucks plying throughout the day, they are able to find transport to go to Samdrupjongkhar or nearby places at any time

of the day. They also say that if they go in a truck that leaves early to Samdrupjongkhar, they can return to Pemagatshel the same day, enabling them to save time.

#### **B. Negative impacts**

As much as there have been positive impacts, there have also been negative economic impacts. A few of them are discussed below:

##### *i) Siphoning off of labour from other economic activities*

Because of the readily available job opportunities that do not employ them but warrant assured flow of income, people have been discouraged from taking up other economic activities. One such opportunity for people in Pemagatshel, particularly for those in Shumar gewog, is to work as wage workers at the mine. An orange pulp processing unit was set up a few years ago with some 28 farmers as members; now the unit has only 15 members. Likewise, a silo that was set up recently has not attracted many members; initially it had 50 members but now it has only 18. The Dzongkhag Agriculture Officer and the Agriculture Extension Agent of Shumar gewog said that the problems of wildlife depredation on the one hand and the availability of economic opportunities outside agriculture on the other were collectively making many farmers to quit farming. Such developments could have significant repercussions on the policy of ensuring food security in the country.

##### *ii) Decreased horticultural productivity*

Farmers living nearby the mining site, particularly those households nearby the Druk

Plaster and Chemicals Limited, said that yield of their oranges have gone down significantly over the last few years. Farmers alleged this decline to effects of dusting from blasting, factory where gypsum powders are produced, and trucks that transport gypsum. Farmers said that dusting during flowering hampers pollination and ultimately the fruiting. Dusting after fruiting affects colour of oranges; oranges turn dark greenish from continuous dusting. People also alleged that dusts stunt the size of oranges and when they market them, they do not get good prices. Mr. Tshechula said that until few years ago, he used to earn around Nu. 17,000-18,000 on average every year but for the past two years, he earned only about Nu. 7,000 from sale of his oranges. Decline in orange production is also caused by death of trees. Ms. Tera Wangzom said that about four orange trees have died in her orchard from extensive dusting decreasing her earnings from sale of oranges significantly. She said that earnings from the sale of oranges used to be around Nu. 20,000 during the previous years but last year she earned only Nu. 10,000.

*iii) Absence of public transport*

Because most people travel to and from Pemagatshel by trucks, it has not attracted any individual to operate a public transport there. Absence of public transport is seen as a problem by civil servants and police personnel working there. They say that when they go on transfers, they are not able to find transport that can accommodate all of their belongings and family members. Some civil servants also say that the absence of a public transport is not good for

Pemagatshel in the long-run; should ever the mining close down or the route of transport of gypsum changes in future, many people in the district will have no means of transport until a public transport is instituted.

*iv) Loss of customers*

Druk Satair Corporation has set up a grocery shop that supplies ration and other essentials to their employees. It's a legal establishment with formal license and sells stuffs at much cheaper rates than other shops in Khothagpa. While the employees of the corporation buy from these shops, they do buy as much as they used to do before the setting up of canteen. Shopkeepers complain that the canteen was cutting on the viability of their business.

*v) Increase in local wages*

Some farmers complained that as most of the able bodied were working at the mine, it was difficult to find workers during agricultural season. They said that even if they found some, they refused to work for wages less than what they got at the mine, thereby pushing up the local wage rates and making it expensive for many farmers to hire workers.

**Part 4: Social impacts**

Social impacts are not as distinctly defined as economic and environmental ones. It would require one to spend much longer time and immerse with community to find or understand the social impacts of the mine. The issues discussed here are, therefore, at best perceived ones and some of them are just a means



towards ultimate social impacts and are not themselves the impacts.

**A. Positive impacts**

*i) Contribution to purchase of land for construction of school*

The corporation contributed Nu. 250,000, close to 50% of the total cost when the community of Khothagpa bought land for construction of a primary school. A primary school was built in 2004. Without the contribution from the corporation, it would have been difficult for the people of Khothagpa to buy the land. The presence of school has enabled many young children of both people of Kohthagpa as well as the employees of the mine to attend school. The company also contributed 60 bags of cement when the new building was built in 2005.

*ii) Contribution to Health Trust Fund*

The corporation contributed Nu. 1.5 million to the Health Trust Fund. The corporation's management claims that they were one of the first Bhutanese organisations to make such a contribution and it sparked off similar donations by other corporate bodies, enabling a good flow of donations from within the country.

*iii) Contributions for organisation of annual religious ceremonies*

The corporation contributes Nu. 1.5 million every year to Yongla Dratshang to conduct drubchen. It has been making this contribution since 1998. Besides, the corporation has also contributed Nu. 150,000 to making of a

*thongdrel* at Pemagathsel Dratshang. The corporation also helps the dzongkhag administration organise annual Moenlam Chenmo by His Holiness the Je Khenpo. In 2007, the corporation contributed Nu. 20,000 to the community of Khothagpa during its annual *tshechu*. It also allows the people of Khothagpa to use its trucks for free to fetch firewood for annual *tshechu* at the community temple. While the annual *tshechu* of Khothagpa is attended by members of its community and a few others from nearby villages of Bartseri and Denchi, Yongla Drucbchen is attended by people from several other villages. Since *tshechus* and other annual religious ceremonies act as a forum for people to come together, it can be said that the corporation, through its financial contributions, is helping maintenance of community vitality in these villages.

*iv) Employment of students*

During winters when the students are on vacation, the company employs between 80-90 students. Management says that students are employed even when there is no labour shortage at the mine site; they are recruited largely to enable them to make some income.

*v) Other social contributions*

Whenever someone in the villages nearby the mine site falls sick, the corporation provides its vehicle to transport the sick to the hospital. It has donated two television sets with DVD players and two room heaters to the general hospital. The corporation allows the children of Khothagpa and Denchi studying at Nangkor High and Pemagatshel Middle Secondary schools

to use their school bus both to and from their schools. It has donated a refrigerator to Nangkor Higher School which has enabled the school proper storage of vegetables and other perishable items required for the students' mess.

## **B. Negative impacts**

### *i) Family disorganisation*

The mine operates for sixteen hours: from 7 a.m. till 11 p.m. This requires the workers to work in shifts. This long hours of the mine's operation causes inconveniences to the workers and their families. When they are required to work in the first shift, i.e. from 7 a.m. through 3 p.m. they have to wake up early and leave for work. This doesn't allow them to have breakfast with their family. For the workers who work the second shift, they are late for dinner and by the time they are home, their children and spouses are already asleep. This doesn't allow families to spend much time together.

### *ii) Inconvenience in participating in community events*

The need for consistent and reliable workforce that does not take time off on a seasonal basis creates a situation in which the benefits of employment in the mines are often offset by the social and family disruptions and loss of opportunities to participate in community life. Like in family affairs workers, particularly the wage workers working at various shifts of the mine's daily operation are only partially able to participate in community events such as annual *tshechus*. The corporation operates seven days a week and sixteen hours a day; this inconveniences many workers from participating

in community events. For instance, a wage worker sought a replacement for him when he was attending mask dance practice sessions for the annual community *tshechu*.

*iii) Migrant workers*

Many local people complain that the presence of migrant workers, mostly from Bhangtar, has deprived them of opportunities to work at the mine. These migrant workers stay and work at the mine site regularly. The need for consistent and reliable workforce that does not take time off on a seasonal basis forces the management of the mine to prefer migrant workers, disallowing people of the local areas from taking advantages of opportunities to work part time at the mine.

*iv) Inadequate housing*

Most of the migrant workers that have come to work at the mine are living in make-shift structures while a few of them live in hired rooms in the houses of the nearby people. The permanent employees of the corporation live in semi-permanent houses. All these structures are unfit for decent living. This poor quality of housing has potentials to cause diseases to employees and their children, if none of them are suffering from one already.

*v) Safety problems*

People complained of threats to safety of their animals and children from speeding and overloaded trucks. Empty trucks returning from Samdrup Jongkhar speed up to arrive on stipulated time for loading at the mining site. So

far, there had been no accidents but people are worried of some mishaps in the future. People also complain that the trucks overload themselves; sometimes almost twice their legal capacity. This not only poses the risks of accidents but because the road from mining area to the Trashigang-Samdrupjongkhar highway is all uphill, the overloaded trucks produce more noise and vibration to people living by roadsides.

*vi) Other social problems*

There is no prostitution in the legalistic sense but people do mention of prevalence of overt promiscuity among or between workers of mine and sister agency- Druk Plaster and Chemicals Limited. This has a high chance of spreading sexually transmitted diseases. There have also been some five or six cases of local women having children from illegitimate relationship with drivers. Gup of Nangkor said that it was difficult to track down the fathers of these children.

**Part 5: Environmental and health impacts**

**A. Environmental impacts**

All the mining operations are inspected regularly by the National Environment Commission to check that their operation does not cause no or little footprints to the nature. Despite these regular visits by the staff of the National Environment Commission, mining operations are causing significant damages to environment. Given the technicalities of environmental impacts which the author of the study is not

familiar with, only obvious ones are reported below.

*i) Air pollution*

Dusts generated by various mining activities are of major concern to the people living in the nearby areas. Dust is generated by blasting, loading and haulage, vehicular movements, open air disposal of waste rocks, drilling, and crushing. These fugitive dusts from mine site as well as from the factory of Druk Plaster and Chemicals Limited are added to the air and eventually settle down as fine dusts on nearby trees and houses. People said that dusts were dirtying their houses as well as making their fodder plants unpalatable for animals to consume. People say that the level of hygiene in their community has deteriorated due to presence of so much of dusts in the air; a few of them said that the problem was particularly worse during winters. Company claims that it sprays water along the road to reduce dusts emission due to vehicular movements but people complain that the company does not carry out this function faithfully. As discussed under economic impacts, dusting has hampered horticultural productivity in the nearby areas. People also complain of unpleasant odour that they smell after blasts at the mine site.

*ii) Noise and vibration*

Main sources of noise and vibration are blasting, operation of heavy machineries, and movement of trucks. People allege that vibration from blasts, operation of large machineries at the mine, and movement of trucks vibrates their houses, causing their roof materials to slide. Mr.

Karma Gyeltshen of Borangchilo complained that every year he spends two or three days fixing the roof materials that slide down due to vibration caused by blasts. He said that since he uses slates, some of them get damaged during the repairs, forcing him to find new ones.

People also allege that the cracks in some government buildings nearby the dzong located about two kilometers from the mining site are caused by vibration from the blasts. The management of the mine however argues that these allegations are baseless as not a single house in the immediate neighbourhood where the vibration is supposedly stronger has suffered any cracks.

The mine starts its operation at 7 a.m. and goes on till 11 p.m. People of Borangchilo village, which is located across the mining site, complained that the noise of vehicles and machineries affects their sleep and quiet moments. They said that due to deafening noise from the mine site, they were not able to hear the sounds of wild animals when they entered their fields, losing substantial amount of their crops to wild animals every year.

*iii) Water pollution*

There are no complaints of pollution of drinking water as all the water sources are from places above mine site. However, rock and mud wastes that are unmindfully disposed off down the slopes get deposited into the stream below. This has caused siltation of its banks. Disposal of a large amount of wastes into the stream increases its sediment load. People said that

during monsoons, when the volume of water increases in the stream, it floods causing damages to plants and aquatic lives as well as causing great risks to people living downstream.



*Picture a: Wastes sliding down to the stream*

*iv) Soil erosion*

The mine site does not have a proper place to dispose off the wastes and debris generated by blasts. Rock and mud wastes are disposed off unmindfully down the steep slopes below the mine site. Bigger rocks and other debris slide down to the stream below while smaller ones are left hanging loosely onto the slopes. The run-off water after heavy rainfalls washes down these materials. During such process, not only are the loose materials carried away but also the intact materials on to which the loose materials hang



also gets washed away, causing blanketing of the bottom of the gorge and the banks of the stream.



*Picture b: Truck unloading debris on to the slope*



*Picture c: Unloaded debris sliding down the slope*

*v) Physical damages*

What has been a group of some nine households and their farmlands along with pristine forests around some 26 years ago has now been converted into a brown opencast mine site. Trees and plants have all disappeared and the topography has been altered significantly. What has been a gentle slope is now converted into steep slopes. People of Borangchilo, a village on the opposite side of the mine, say that the site has certainly degraded in its aesthetic beauty. Another physical damage associated with the mine is degradation of roads between Tsheringkhor and Pemagatshel. They said that a large number of heavily loaded trucks plying the road has damaged roads in many places.



*Picture d: Scar caused to the landscape by mining*



*Picture e: Close-up view of the scar*

### **B. Health impacts**

A few interviewees of this study reported that the frequency of occurrence of diseases such as cold and cough which people believe are commonly caused by presence of more dusts, is more now as compared to previous years. There was no data to substantiate such a claim. The district medical officer said the hospital received two or three accident cases from the mine site every week.

### **Part 6: Summary and conclusions**

This study points out to a number of conclusions. The mining of gypsum at Khothagpa does have some economic benefits. At a national level, it contributes to the exchequer and helps our country to earn rupees and hard currency. Locally, people benefit from part-time jobs and renting of their extra space in their house to migrant workers. Local business community benefits from the extra customers generated by the mine. Truckers are able to deploy their trucks in transporting gypsum on regular basis. In the social sector, the corporation provides financial support to organise some important community religious ceremonies and has made donation of goods for social causes. These tidbits of contributions that the corporation makes, however, are very sporadic.

People are of opinion that benefits, especially the economic ones, are shrinking every year. They say that during the first lease period (1993-

2003), more local people were able to work at the mine and earn some extra cash. During the second lease, migrant workers have arrived from other parts of the country, competing with the local people for jobs at the mine. Besides, due to deployment of more dozers and rock breakers, the need for manual workers has been reduced significantly; the need for manual workers will be even lower when more dozers are deployed, which the management intends to do in future.

While benefits or positive impacts are small and shrinking, mining operation has caused several negative socio-economic and environmental impacts, most of which cannot be quantified. Interviewees said that many people were discarding their farming practices to embrace non-farm work such as working at the mine, which warrants them some assured monthly income. This has not only led to fallowing of land but also to labour shortages and increased wages in the local areas. Horticultural productivity in the areas nearby the mine has decreased. The management compensates three households annually but there are still both moral and economic issues involved in such compensation packages. The management of the company has agreed to compensate two households Nu. 7,500 each every year until the manufacturing of plaster of paris is discontinued. Manufacturing of plaster of paris may conveniently stop when it is no longer profitable and farmers will not get compensation. But many orange trees would have died by then and the health of surviving ones hampered seriously. For several years down the road, these households would neither

get compensation nor would earn anything from their horticulture.

Cohesive family life and participation in community events are important aspects of Gross National Happiness. The shift system induced by 16 hour daily work period for the mine is causing inconvenience to social life of the community. People are not able to spend time with their family and partake in community events. Some workers are of opinion that despite handsome profits that company makes, they are paid very low. Some workers wondered if it was worth inhaling so much of dusts for just Nu. 100 a day.

The mining operation has caused some serious ecological footprints. Given the technicalities of the environment impacts, this study has outlined only those that are obvious to a lay person's eyes. A huge scar has been inflicted to the landscape and it will only worsen as more trees are cut and more rock faces are blasted. Ensuing soil has resulted in siltation of a stream below. If researches elsewhere have found that siltation and flooding kills aquatic lives, it must also be so those aquatic organisms of the stream below the mine and others that it joins downstream. Continued mining could pose a serious challenge to the communities nearby. Not only there be more vibration, noise and dusts but the stability of the whole slope could be threatened as the company digs in deeper every year. There are villages adjacent to the mine; some day, if not any time soon, these villages would face serious problems of environmental instability.

*Impact Analysis of Khothagpa Gypsum Mine*

In the final analysis, it can be said that the mining operation does have benefits as well as costs. Although this study has attempted to pass some judgments in that it is of the opinion that there are more costs than the benefits, more detailed study involving multi-disciplinary team would be required to see whether the benefits outweigh costs or the other way round. Also, given the ownership pattern of the mine, which is very broad and diverse, the findings of this study may not be applicable to other mines with different patterns of ownership.