

## Assessment on Environmental Impacts of Gold Mining in Wethe-Phatshe Area of Thabeikkyin Township

**Khin Thein Oo\* and Hla Kyi\*\***

### Abstract

The industry of gold mining plays an important role in economy of Myanmar. Gold mining activities are mostly found in Mandalay Region, Sagaing Region, and Kachin State. The study area, Wethe-Phatshe is belonging to Ohzon Village Tract in Thabeikkyin Township. The main aim of this research paper is to analyze the environmental impacts of gold mining in study area. In this research paper, the necessary data and material are collected by the field survey. To explore the strengths and weaknesses for the sustainable development in the mining area, SWOT analysis was used in this research. It can be found that activities of gold mining can provide the socio-economics opportunities for local people and others. Systematic operation of gold mining tends to reduce the risk of environmental impacts.

**Key words: environmental impacts, gold mining, strengths, weaknesses, opportunities**

### Introduction

Gold is a chemical element which occurs in native form as nuggets or grains in rock, in veins and in alluvial deposits. A relatively rare element, gold is a precious metal that has been used for coinage, jewelry and other arts throughout recorded history.

Gold's high malleability, eluclility, resistance to corrosion and most other chemical reactions, and conductivity of electricity have led to its continued use in corrosion resistant electrical connectors in all types of computerized devices. Gold is also used in infrared shielding, coloured glass production, gold leading, and tooth restoration. Certain gold salts are still used as anti-inflammatories in medicines. As of 2016, the world's largest gold producer by far was China with 450 tons per year. It is estimated that world gold reserves to be 186,700 tons above the ground.

The earliest gold artifacts dated back to 4<sup>th</sup> millennium B.C in Natal Qana cave cemetery and in the Balkans. However, the oldest known map of a gold mine was drawn in Ancient Egypt (1320-1200 BC) while the first written reference to gold was recorded around 1400 B.C. In Egyptian hieroglyphs from as early as 2600 B.C. gold was described.

Bronze Age gold objects are plentiful and there are several well-known possible sources. Romans used hydraulic mining methods such as hushing and ground sluicing on a large scale to extract gold from extensive alluvial deposits.

Gold can be mined from two sources as placer mining and hard rock mining. These methods are applied throughout the world including in Myanmar as well as the study area. The most widely used gold mining methods include placer mining; panning, sluicing, dredging, rocker box and hard rock mining.

Hard rock mining extracts gold encased in rocks rather than fragments in loose sediment for which other gold mining methods are used.

Cyanide extraction of gold may be used in area where fine gold bearing rocks are found. Sodium cyanide solution is mixed with finely ground gold-rock and it is then separated from the ground rock as gold cyanide solution. Zinc is added to precipitateout residual zinc as well as the gold methods. The zinc is removed with sulfuric acid leaving a gold sludge that is generally smelted and then finally it is refined to 99.99 t pure metals.

Activated carbon is used in extracting gold from the leach solution. The gold can be removed from the carbon by using a strong solution of caustic soda and cyanide.

---

\* Professor (Head), Dr, Department of Geography, Yadanabon University

\*\* Associate professor, Dr , Department of Geography, Yadanabon University

The technique using dissolution which alkaline cyanide has been highly developed over recent years and this method is applied in gold mining by companies in the study area.

Panning (*inwaing*) is mostly a manual technique of separating gold from other materials. Wide shallow pans are filled with by one or gold-alluvial and submerged into the water and shaken, sorting the gold from other alluvial. As gold is much denser than rock, it quickly settles to the bottom of the pan. Gold panning is the easiest and quickest method for searching for gold but is not commercially viable for extracting gold from large deposits.

Using a sluice box (*myaw*) to extract gold from placer deposit has long been a common practice in small scale mining. A sluice box is essentially a man-made channel with riffles in the bottom. The box is placed in the stream to water flow. Gold bearing materials is placed at the top of the box. The material is carried by the current through the riffles where gold and other dense materials settle out behind the riffles less dense materials flow out of the box as tailing.

Rocker box was riffles located in a high walled box to trap gold in a similar manner to the sluice-box. A rocks box uses less water than a sluice box and is well suited for area where water is limited.

Gold mining is an important sector in the country's economy. In general gold mining is that type of economic activity which needs large capital investment, requiring long time management in advance as well as an adventure work with risks. In Myanmar, gold placers are found mainly in Bantbwegone area in Kawlin Township of Sagaing Region, Kyaukpahto Taung, Kyauk-Pazat area, Phayaung Taung area in Patheingyi Township of Mandalay Region, Kantaung, Wabochoke, Doenwe areas in Singu Township, 5 Mile, Zayakgwin, Kwin 30, Chaunggyi areas in Thabeikkyin Township, Mohtitaung area in Yamethin Township, Mawtingone area in Shwekyin Township Bago Region and so on.

The study area lies on Ohzon Village Tract in Thabeikkyin Township. Gold mining in Wetthe-Phatshe area is being carried out by four companies and small plot of local people. Gold mining is carried out by underground mining and open-pit mining, so there is such environmental degradation as soil erosion, deforestation, ecosystem degradation, water and air pollutions, etc. Likewise, cyanide and mercury compounds which are used to separate gold from other mineral elements are toxic chemical to organisms and men.

It is necessary to examine the good and bad consequences on local population and environment which arises from gold mining. Therefore, the possible conditions being encountered by local people and environment and curative measure are suggested in an analytical mean.

### **Aim and Objectives**

The main aim of this research is to analyze the environmental impacts of gold mining in study area.

The objectives are

- to study the nature of gold mining processing
- to examine the methods of mining operation and their effects on the environment and
- to elaborate the ways of treatment on potential environmental degradation

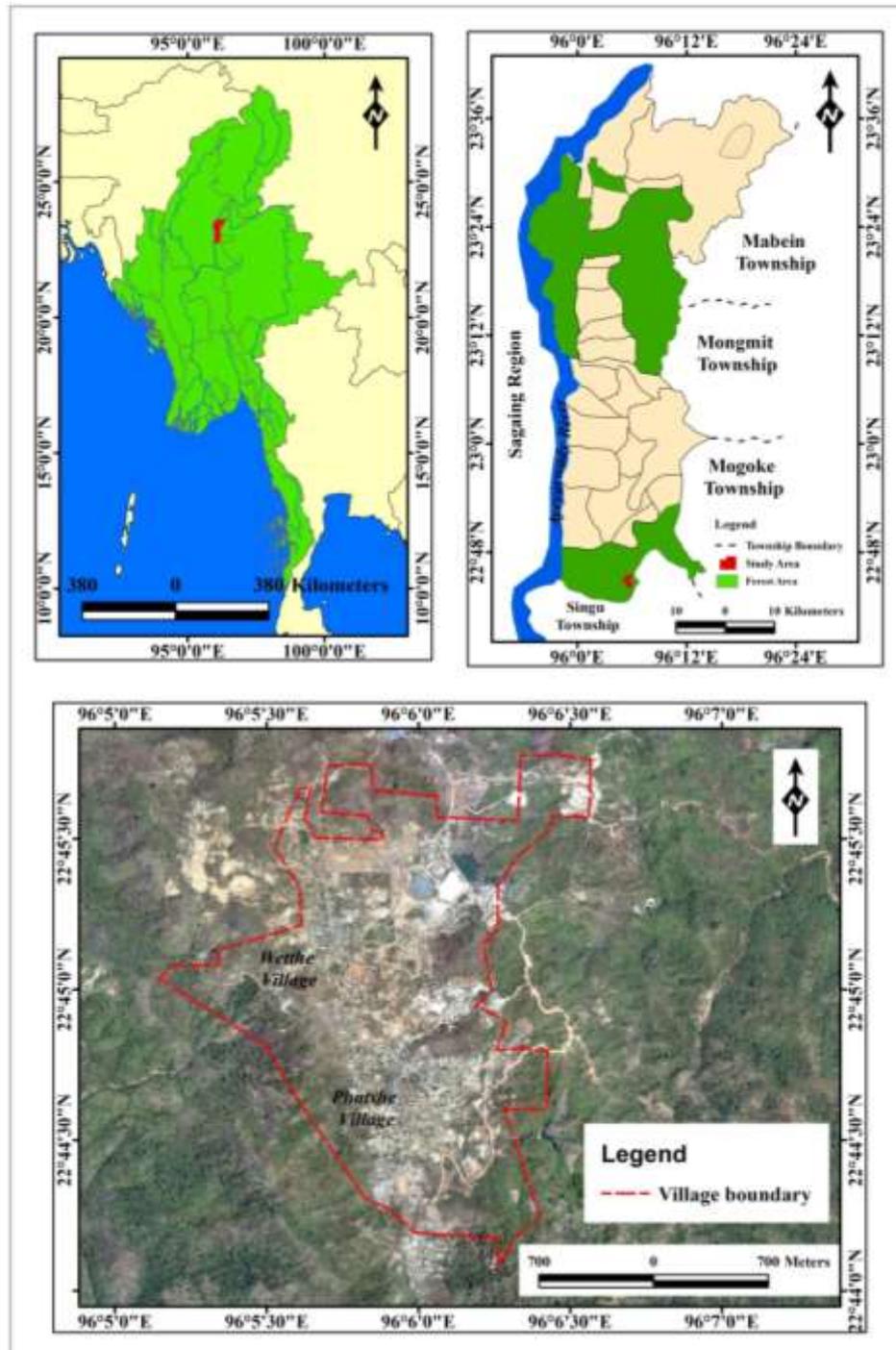


Figure (1) Location of Wetthe-Phatshe Area

**Study Area**

The study area includes 16 villages of Ohzon Village Tract in Thabeikkyin Township, namely-Ohzon, Zayatgwin, Kyaukphya, Leikkyia, Kwin 29, Kwin 30, Kwin 31, Yinkhatpin, Thatkeypyant, Wetthe, Phatshe, Yazeleti, Dakike, Hsinhmwe, Kabarni and Yaynitaung villages. Ohzon Village Track has a total area of 62,443 acres (97.6 sqmille) and is settled by 35,852 persons.

The study area lies approximately at 22° 44' 5.85"and 22° 45'47.03"N latitude and 96° 05' 6.08"and 96 ° 06 '36.02" Elongitude Wetthe and Phetshe villages are located continuously with the area of 175.8 acres and 186.2 acres respectively. The study area is underlain by

metamorphic and igneous rocks including Marble, Calc- silicate, gneisses, etc. Gold bearing sulphates are found due to these rock units.

The study area receives Tropical Savanna Climate (Aw) with about 79.6°F of mean annual temperature and about 45.74" of annual rainfall. The soils of the study area are red earths and red brown forest soils. Wetthe Village is settled by 3,853 persons with 814 houses and 819 households, whereas Phatshe Village is settled 8,559 persons with 801 houses and 812 household. Majority of the working people engage in gold mining.

### Material and Methods

In this research, the secondary data and the necessary map are collected from the concerning offices while primary data were obtained by doing field observation including questionnaires, interviews and open talks with local people and mine workers of "Htarwaya and Myanmar Golding Point Companies". The environmental impact and socio-economic condition of study area are presented by mean of SWOT analysis.

### Findings and Result

The environmental impacts of gold mining in Wetthe-Phatshe area can be divided into two steps, the first is the nature of the gold mining and the second is the processes of gold mining.

**Nature of the gold mining** -In Myanmar, gold extraction is performed by means of *hand-myaw*, *inwaing* circling, *inlone* or underground mining, open pit mining by pumps, natural and mechanized drifting, extraction by sand dredger, by using cyanide, and so on.

In the study area open pit mining by pumping and underground mining by *inlone* are the chief extraction methods. *Inbye* or open pit mining is the mining by a large hole at the respective level starting from the ground surface. As the mining area has to be cleared off the vegetation, this method causes deforestation, soil erosion and sedimentation in the water. It is a method which can be used at low capital investment, little man power requirement and short time.



Photo (1) Open Pit Mining

*Inlone* (earthen pit and rock pit) method is the extraction of gold mixed in the earth and rocks. It also needs short time with low capital and low labour to extract gold in earthen pit method while rock pit method require much labour and capital while it is a dangerous mining method, requiring long time. It is an underground mining method of digging 4'×4', 6'×6' or 9'×9' shafts and adit to extract gold seams. Therefore, *inlone* (rock pit) gold mining method includes digging shaft, extraction of gold alluvial and grind of placer alluvial.



Photo (2) Under Ground Mining

**The processes of gold mining-** Gold mining process can be divided into small scale production and large scale production. Rock-in gold mining which is difficult to extract gold from the rock can be easily separated by using cyanides. Gold mining by using cyanide is permitted by the state authorities only under license.

Gold-bearing rocks from rock-in mining have to be grinded to powder. This gold powder is mixed with lime and sand proportionately and the mixture was boiled until pH 10 is obtained. The cyanide is added to the mixture and placed about 12 hours under water circulating system. Then charcoal is added to the gold solution to catch gold rush for 48 hours. Charcoal was taken and burnt to obtain ash. When this gold-ash is boiled with graphite crucible in the gold smith, gold can be obtained. The obtained raw-gold is refined with nitric acid to obtain pure gold. This method is applied mostly by small scale gold production. The use of cyanide and dust from gold rock grinding can cause chronic and acute respiratory diseases. The noise from rock grindings also causes noise pollution. Moreover, washer water from the gold extraction cannot be disposed systematically as it can effect on soil and water qualities.

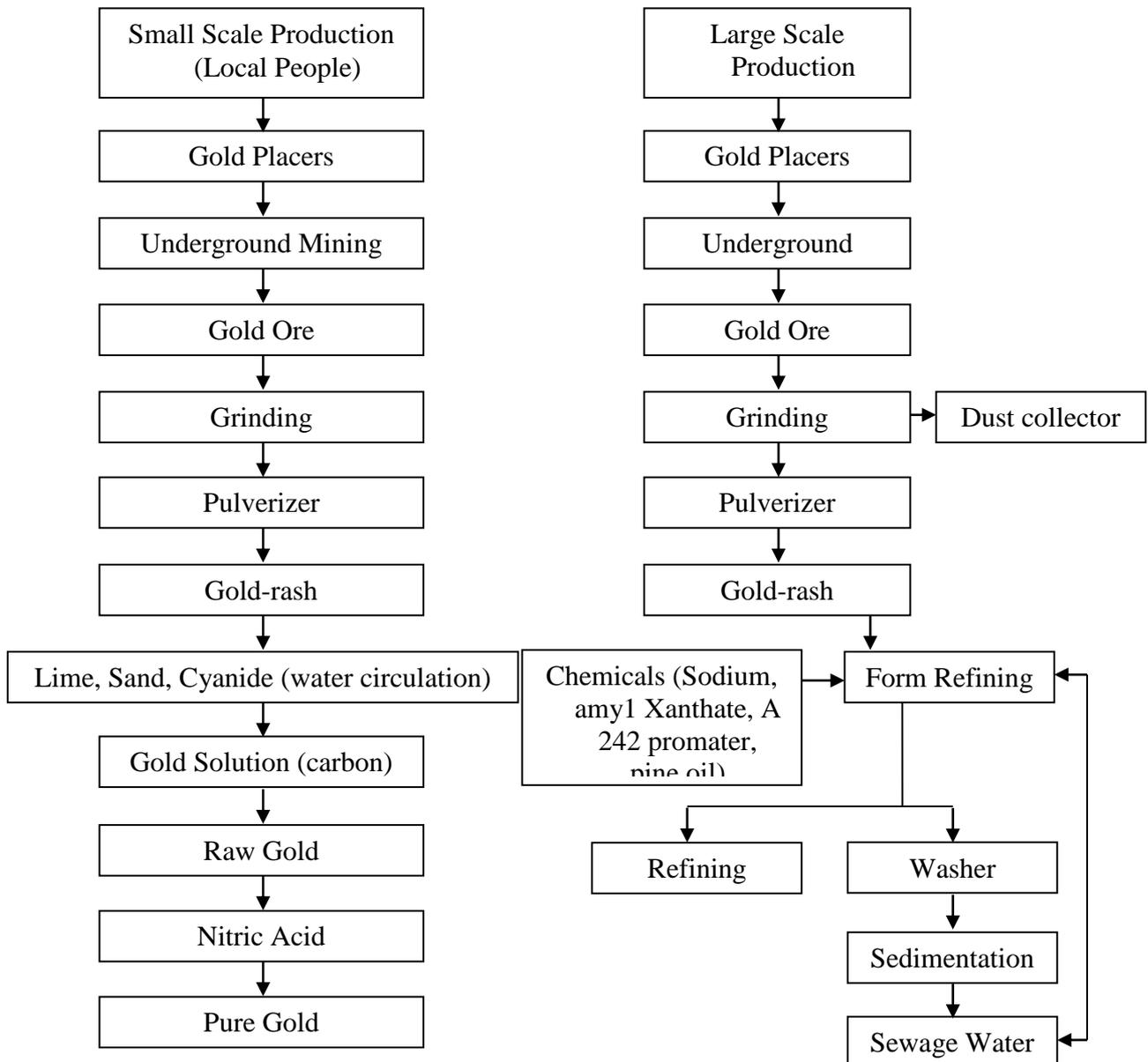


Photo (3) Gold Extraction with Cyanide



Photo (4) Gold Extraction with Mercury

### Stages in Gold Mining Process



*Inlone* (rock pit) mining is done in large scale by the companies. In the study area, gold mining is done by Htarwaya and Myanmar Golding Point Companies. In *inlone* mining, underground mining is carried out in various stages as extraction of gold placer-alluvial and grinding of gold-laden rocks. Rock-powder obtained from grinding of rocks was mixed with chemical compounds of sodium Amyl Xanthate, A 242 promoter, pine oil and processed under foam-refining process. Then, gold refining is done by using cyanide at Kyaukpatto gold refining factory in Kawlin Township or by own works at the site of some companies. Most of the companies get used to dumping the waste-earths systematically and recycling of waste water.



Photo (5) Extraction of Gold

### **Environmental Impacts**

In the study areas, gold mining is performed by means of open-pit mining underground mining by *inlones*. Due to these methods, the depletion of forest occurs by clear cutting surface soil are eroded, water channels face sedimentation problems and pollution of water, air and soils as well as noise from rock grinders leading to environmental impacts. (Asante, Ranseyer (2017))

**Deforestation;** when gold mining is done, the trees in the restricted mining areas had to be cut-off clearly. It causes deforestation.

**Land degradation;** open-pit mining or *inbye* (large in) method is used by local people removed the surface soils and it causes soil loss and soil degradation to a large extent. In *lone* (rock-in) mining method is used mostly by companies and some local people. Being underground mining, it does not have impact, upon surface soils. However, the method needs to store waste water from the factory by digging tank, to construct roads and to build buildings that is more or less causes damages of surface soils and forests.



Photo (6) Land Degradation

**Water Pollution;** *Inbye* (large in) mining method had to rely upon the use of large amount of water. This method after disposing waste water caused sedimentation black-age of waterways and changes of channels. Moreover, it causes landslides. As surface and ground water is used and waste water is released in the mining process, it also causes water pollution problems. Due to these problems, the gold mining by *inbye* method must be prohibited by the state government.



Photo (7) Water Pollution

**Air Pollution and Noise Pollution;** the use of vehicles and machines in gold mining, grinding of gold ores and chemical refineries released gases, dust and noises leading to air pollution and noise pollution. Besides, underground mining method, which use machines and explosive materials, moved up and down in the mines can cause injureable working conditions. Moreover, working in touch with chemicals for gold refining is also dangerous to the workers.(J.Y.Yeboah (2018))

For these reasons, gold mining causes not only environmental impacts but it also causes impacts on human health conditions. To prevent these dangers, both local people and the companies need to perform gold mining systematically.(Ogola J.S,W.Mtullah & Omulo M.A (2002))

### Environmental Treatment

It is found that there are arrangements for environmental treatment to resolve and conserve the environmental impacts caused by gold mining. These methods include the dumping of surface soil systematically to refill the digging sites, reforestation of teak and other hard wood trees for forest conservation, establishment of nurseries and protected forests, etc. Moreover, the water pollution problems are resolved by storing water in the tank and purified by the purifiers to supply the use for the work, employees and surrounding villages. According to the laboratory tests, the water samples are within the limitations of effluent levels and national environmental quality (waste- disposal).

Air pollution is prevented by pouring water into the ground by water boxer vehicles, growing wind breaks, installation of dust soakers, analysis of water quality, and management to wear face masks by workers for their safety, etc. Noise pollution is controlled by the control of magnitude of explosives, construction of silent rooms and distribution of ear phones to the workers.

### The Laboratory Tests for Underground Water

Parameter	Unit	Guideline Value	GW	SW-2
PH		6-9	7.1	7.4
Iron(Fe)	Mg/1	2	0.38	0.29
Suspended Solid	Mg/1	50	34	27
Lead	Mg/1	0.2	N.D	N.D
Arsenic	Mg/1	0.1	N.D	0.005
COD	Mg/1	150	32	32
BOD	Mg/1	50	12	8
Zinc	Mg/1	0.5	N.D	N.D
Copper	Mg/1	0.3	N.D	N.D



Photo (8) Water Disposal Tank

Photo (9) Underground Water Tank

Photo (10) Establishment of Nurseries

### Supporting For Local People

As gold mining has to be related with local people, discussions with local people to resolve the local needs and supplies for them were carried out. The companies assisted the education and health for the local people as well as their economies. The donation of state primary school, construction of dispensary, employment and sharing company shares to the local people as the company partners are found. Moreover, people from other regions also have job opportunities. Supply of domestic water by pipe lines, digging of tube-wells, donation of fire brigade vehicles, supply of electricity power, donation of water purifiers and donation religious affairs of the villages are done by the owners of the companies.(Environmental Management Plan Report (2017))

### SWOT Analysis

According to the personal interview results, it is found that local people in the study area wish to perform gold mining independently on the family subsistence basis in particular. Gold mining is performed by 80 % local people while company employees came from other regions. Moreover, local people can perform gold mining in the contract area of companies on the joint the following strengths and weaknesses as well as opportunities and threats from the SWOT analysis point of view. (Emet GUREL & Merba TAT (2017))

### SWOT Analysis

No	Method of Mining	Strengths	Weaknesses	Opportunities	Threats
1	<i>Inbye</i> (open pit)	<ul style="list-style-type: none"> <li>- Low Capital investment</li> <li>- Small Labor</li> <li>- Short term</li> </ul>	<ul style="list-style-type: none"> <li>- Deforestation</li> <li>- Soil degradation</li> <li>- Land slide</li> <li>- Water, air, soil, pollution</li> <li>- Sedimentation</li> <li>- Use of mercury</li> <li>- Workable in rainy season only</li> </ul>	<ul style="list-style-type: none"> <li>- Participated by all people</li> <li>- Daily income earning</li> </ul>	<ul style="list-style-type: none"> <li>- Environmental degradation</li> <li>- Dangerous working condition</li> <li>- Health problem by mercury use</li> <li>- State policy</li> </ul>
2	<i>Inlone</i> (Underground)	<ul style="list-style-type: none"> <li>- Large capital investment</li> <li>- Lesser environmental damage</li> <li>- Supply of ground water</li> <li>- Permanent workable condition</li> </ul>	<ul style="list-style-type: none"> <li>- The use of chemical</li> <li>- Land slide</li> <li>- Pollution of water, air and soils</li> <li>- Noise pollution</li> </ul>	<ul style="list-style-type: none"> <li>- Creation of job opportunities</li> <li>- Better transport</li> <li>- Performances for regional development works</li> </ul>	<ul style="list-style-type: none"> <li>- Depletion of natural resources</li> <li>- Loss of ground water</li> <li>- Health problem</li> </ul>

### Suggestions

Local people and companies who performed gold mining should take responsibilities for their working sites at the end of their works. They should perform the management for soil conservation and construct control walls to prevent landslides, land filling on to the holes and depressions, perform the soil laboratory test from their work places, examination of soil pollution, removal of buildings and machines from their sites and maintenance and growing suitable plants and perennial trees at their sites.

The local people are still using cyanides and mercury, illegally in their gold mining. Due to their actions, natural environment and ecosystems suffer great losses as well as human health problems. Therefore, it is necessary to educate local people about health knowledge and to apply modern mining method. As Htarwaya Company and Myanmar Golding Point Company, applied environmental conservation method in their gold mining, other participants in gold mining of the area should also use their methods.

By means of these conservation measures green natural environment can be created and the local people will be progressed in their socio-economic activities. Due to the governmental policies, not only the local people but the companies can also be able to gain legal permission for their works and valuable mineral resources can be produced and can be assisted in the regions and nation progress for the socio-economic reforms.

### References

1. Asante, Ranseyer : (2017) “ Environmental Impact of Gold Mining”, *Global Congress on Process Safety*.
2. Emet GUREL & Merba TAT :(2017) “Swot analysis: A Theoretical Review”, *The Journal of International Research*, Volume 10.
3. “Environmental Management Plan Report”,(2017) Myanmar Golden Point Family Co.ltd.
4. **Jason S. Ogola, Winne Mtullah & Monica A. Omulo:(2007)** *Impact of gold mining on the environmental and human health: A case study in the Mogori Gold Belt, Kenya.*
5. **Joseph Yaw Yeboah :(2008)** *Environmental and health impact of mining on study of Anglogold Ashanti in Obuasi.*