REPORT

ON

MINING SECTOR STUDY

FOR

THE SHINYANGA REGION HUMAN DEVELOPMENT REPORT

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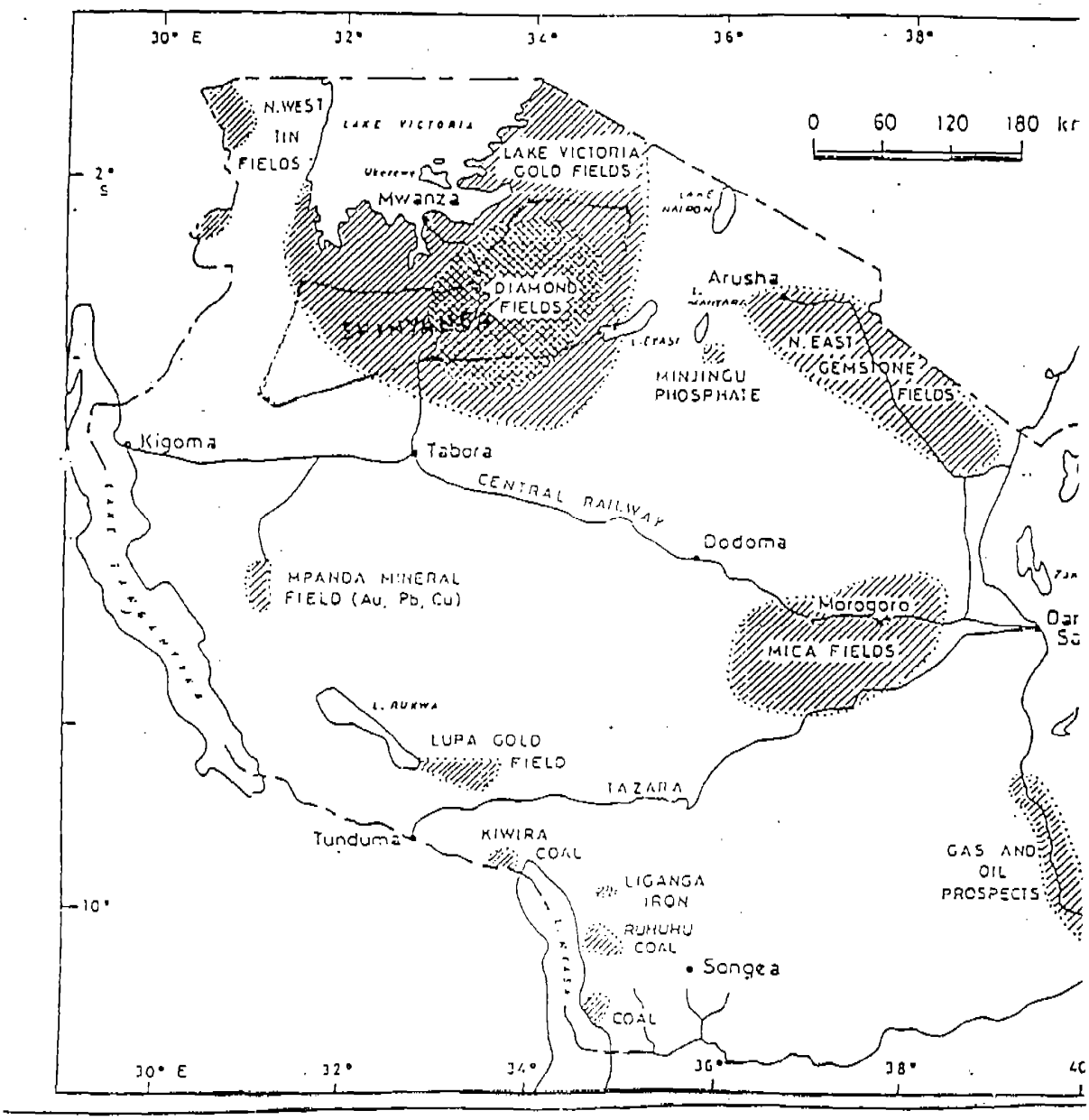
MAP. I

MAJOR MINERAL FIELDS



1.0 INTRODUCTION

Shinyanga Region is endowed with a variety of minerals including gold and diamonds. It has been a mineral producer (Map1) Since the 1940s when diamonds were discovered at Mwadui by Dr. Williamson who founded the Williamson Diamonds Mining Company. Among the minerals mined for export and local uses are: gold, diamonds, gemstones, limestone and aggregate.

Apart from Williamson Diamonds Mines who are mining diamonds at Mwadui and operated a small diamond mine at Nyanghwale in Kahama District from 1967 to 1971, all other minerals are mined by small scale and artisanal miners since the 1980s.

Artisanal mining is a type of manual, low technology mining method conducted on a small scale, predominantly in rural areas of Tanzania. In its traditional form, artisanal mining is essentially a subsistence activity which requires neither large capital investment nor sophisticated equipment, and is integrated into the rural economy. Artisanal mining is a source of livelihood for thousands of unskilled workers, including a large number of women in rural areas. Hence the orderly conduct of this activity can contribute to poverty reduction. However, uncontrolled artisanal mining has several negative side effects such as; unacceptable environmental practices; poor social, health and safety conditions; illegal mining and marketing and waste of resources.

This sector study, which forms part of the Human Development Report (HDR) for Shinyanga Region is aimed at finding out the facts on the above statement on small scale and artisanal mining. It gives proposals that aim to minimize these side effects and to maximize the socio-economic benefits of artisanal mining. The study also aims at finding out what the multinational companies which have Prospecting and Mining Licences in the Region have in the pipeline to improve the Regional economy and what opportunities exist to strengthen the impact of the sector on the income and wellbeing of poor rural households.

2.0 METHODOLOGY

Prior to start of the study, the Consultant visited the Zonal Mines Offices in Shinyanga to get a list of the areas being mined in the Region, claim owners, licence holders and other informal mining activities. The locations visited were selected from the list by using the following criteria:-

(a) Areas with many claims, areas without claims but being mined by illegal miners. Kahama District has the highest number of claims, followed by Shinyanga Rural and then Bukombe District.

(b) Minerals of high value such as diamonds and gold which bring quick revenue returns.

Then followed programme preparation which included period to be spent at each location and the type of information and data required and how they will be obtained and who will provide this information and data.

Tables 1 - 3 below show the type of minerals being mined, the number of licences and claims.

Table 1:

NUMBER OF CLAIMS IN SHINYANGA REGION

District	Mineral	Number of Claims
Shinyanga	Gold, Amethyst, Zircon, limestone, Aggregate	86
Kahama	Gold, diamonds	107
Bukombe	Gold	17
Maswa	Amethyst	1
	Total	**211**

Table 2:

LICENCED COMPANIES IN SHINYANGA REGION

District	Number of Licences
Kahama	25
Bukombe	21
Shinyanga	2
Total	**48**

Table 3:

MINERAL DEALERS LICENCE HOLDERS IN SHINYANGA REGION

Name of Dealer	Minerals
1. Soza Plast	Diamond
2. Hasu Purshotam	Diamonds
3. Mrs. Helena Nyingi	Diamonds and Gold
4. M/S Real Ltd	Diamonds

Source: Tables 1, 2, 3. Shinyanga Zonal Mines Office.

A total of 15 locations in three Districts were visited in the course of the study (See Appendix 13). Among the locations were 3 gold rush areas at Busulwangili and Kalole in Kahama District, and Matabe in Bukombe District. one diamond rush area at Maganzo (near Mwadui). A visit was made at Bulyanhulu in Kahama District where a big gold mine is being developed by Sutton Resources Company of Canada; at Mwime where Buzwagi Exploration Project is being carried out by a Joint-Venture company under the Madaba/Pangea/Anmercosa Exploration (T) Ltd of South Africa. The Consultant also made a visit to Williamson Diamonds Mines Co. at Mwadui which has been mining diamonds since 1940.

The study was carried out by interviewing various people using the Participatory Rural Assessment (PRA) method and questionnaires where it became necessary. People interviewed included claim holders, pit financiers, miners, mineral dealers and officials of multinational companies. Other people interviewed were those indirectly involved in mining but were giving services to the mining community. These included food vendors, petty traders at the mine camps and leaders of villages near mining areas, housewives of miners, women and men at nearby villages, village government officials at nearby villages, Mines and Forest Officials in the Zones and Districts.

The research methods used included focus group discussions, semi-structured interviews, direct observations plus secondary data collection.

A summary of specific issues covered in this study is as follows:-

(i) Census. This involves estimation of the number of people involved in the informal, formal artisanal and small scale mining by location/district and mineral commodity groups. The separate census also shows the number of women directly involved in mining by location/district and mineral commodity groups. Most of the women are involved in mining alluvials, reworking waste dumps and some are pit owners and financiers.

(ii) Work Preparation and Organization: This shows how miners and claim holders organize themselves into working groups, the income distribution, mine rush gangs and specialized service gangs/operators and how they operate.

(iii) Mining and Processing. This involves work preparation and organisation, mining operations, determination of labour productivity, technology used in mining and processing, and tools and equipment used.

(iv) Product Marketing. Mineral production and selling prices, diamonds exports, marketing problems and income distribution.

(v) Environmental Impact. Environmental impact caused by mining activities including affected areas and water pollution.

(vi) Health and Safety. Time series of accidents including reported and unreported cases, AIDS cases and other diseases.

(vii) Socio - Economic aspects. This includes the social and economic significance of artisanal mining, economic aspects of multinational companies, and women and childrens participation in mining.

CENSUS

"The present study shows that there are more than 215,000 people (Appendix 1) who are involved in mining and mining related activities such as offering services etc. in Shinyanga Region, out which about 29% are women. The actual number of women directly involved in mining activities is 5,401 people (equivalent to 2.5% of the mining and mining related community). This is equivalent to 12% of the total population of Shinyanga Region of 1,764,000 according to 1988 Census. Some of them are full time miners and others alternate mining with other economic activities, especially farming. Others offer services to the mining community; such as operating transport to enable miners to travel to various destinations of their own choice; kiosk owners, food and water vendors, and those offering social services such as dispensaries and recreational facilities.

The next highest number of the mining population of about ~~150,000~~ 57,198 is in Kahama District where there are a lot of mining activities including two mine rush areas at Busulwangili and Kalole, including the famous mining village of Kakola which grew as a result of a mine rush at the nearby Bulyanhulu mines. In Bukombe District, there is a mine rush at Matabe, with a population of 150,000 people.

3.0 WORK PREPARATION AND ORGANISATION

Formal mining activities are carried out after Prospecting Rights (PR) are issued under the following categories: individual, partnership; cooperative or company. Claim titles are also registered on the basis of the same category, but the monthly mining return forms are designed with the assumption that artisanal mining operation are conducted under a formal enterprise system. The present study shows that very few mining groups visited operate under a formal enterprise system. Co-operative activities in loose form were observed at Katente where there are 240 miners society members. Katente mining village resulted from small scale miners who, on voluntary basis, decided to form a Co-operative Society during late 1980s for the purpose of mining gold. The society members elected their first Chairman, Mr. Simon Mwakisasa and Committee members. They agreed that Mr. Mwakisasa should go to the Mines Office (Madini) to get a Prospecting Right (PR) after which 5 claims were granted.

Since then this Co-operative Society is still in operation todate, and members are Tanzanians only. Founder members were few, but now there are 240 society members. Women who cook for the miners are also members of the society by being part of pit owners.

Each society member operates his/her own pit as an individual.

Income distribution is in the following ratios:-

- Claim holder (i.e the Society) gets 30%
- Miners get 70%

Out of the 70% for miners; those miners who sunk (dug) the pit to the level where a reef was intersected get 40% and miners who help the pit sinkers get the remaining 30%.

However the society is faced with the problem of theft due to too many members; but many members believe that a big co-operative society can perform better provided the issue of theft is eliminated by good administration.

The informal tributing system or production sharing system is the widely used system both in mine rush areas and in most registered claims in Shinyanga Region.

The study shows that the present mining groups can also be classified on the basis of skills and legality of mine operation as: mine rush gangs; special service gangs/ operators: formal/informal mine claim organization; and village organization structures. It was noted that the types of operational organization in most cases depend on each other; that it is common to see specialized gangs and mine gangs operate in informal mine claim organization.

3.1 Mining Claim Organization Structure

Production organization structures in areas with registered claims can be formal or informal.

A formal claim operator has the responsibility to make sure that all mining and processing activities are conducted in accordance with proper practices which take into account care of the environment, safety and health issues. He is also supposed to build a camp, and provide other social amenities to his workers. It is his responsibility to supply all mining camp requirements. He keeps custody the recovered minerals, markets on his own and pays salary to his workers. The successes and risks of mining operations belong tho him. However, adaption of this structure is limited by the presence of informal ones (e.g. the presence of mine rush areas).

The informal organization structure is adapted when the claim holder can no longer supervise or finance, lacks funds for mining operations and instead, he informally commissions the running and supervision of the mining activities to the pit financiers, also known as pit owners, for a fixed duration of time. The claim holder therefore becomes a landlord and the pit owner finances and supervises the mine operation, and they share the products with the claim holder on agreeable terms. The pit owner and his mine workers, usually a group of 3 to 10 people, normally operate on short (single cycle operation) contracts, and split their products using agreeable ratios. Income distribution ratios range from 20% retained by pit/claim owner and 80% remain with miners to 30% retained by pit/claim owner and 70% remain with miners if miners provide their own mining tools.

This may change to 40% for claim holder and 60% for miners if claim owner provides mining tools. In most cases the claim owners provide miners free food, medicines and meet other mining expenses. The claim holder can adopt an informal production organization by making a production sharing agreement with the mine workers without involving the pit owner/financier. In some cases, such as at Nyangh'wale diamond mines, the diamond gravels are shared equally among the miners and the claim holders, and when any diamonds are recovered, the claim holders buy them. Few claim holders pay salaries to miners.

Mining activities under village/association areas, such as at Mwime, fall on registered claim areas but the production organization structure involves the village authority. Normally, the registered areas are dividend into small plots and given to individual operators.

3.2 Mine Rush Gangs

These types of groups were found at Busulwangili, Kalole and Matabe. A mine group is usually formed by members who simply recognize the need to team up together in order to perform better the different basic mining operations such as digging, hoisting and ore processing.

The mine rush gang operates independently under a group leader, chosen out of his mining skills and wisdom to settle regularly disputes of gang members or amongst nearby gangs. The working capital of the group comes from individual members' contributions of basic working tools like picks, shovels, moil points and seives. Mineral buyers do offer financial support to mine rush gang working on known mineral potential grounds.

Small scale and artisanal miners concentrate on alluvial and near surface deposits, and mainly operate in high unit value, low volume products such as gold and diamonds. They exploit high grade pockets of ore with simple mining techniques. Their actions can consequently cream off the more valuable positions of an ore deposit, such as when was observed at the three gold such areas mentioned above, making it difficult and often barely economic to bring in capital and modern technology at a later stage. This means that small scale and artisanal mining, in particular, can be extremely wasteful, as it can effectively sterilise partially developed ore deposits.

Where artisanal mining is common, such as at Bulyanhulu, it was difficult and impossible for larger companies to obtain secure mineral rights and land tenure. A company which has legal rights at Bulyanhulu faced encroachment by illegal miners. This delayed the most timely fullest possible exploitation of the ore deposits.

Lacking capital, and often using rudimentary equipment, artisanal miners can be wasteful and, above all, environmentally damaging, They have very short time perspectives, and are influenced neither by public opinion, nor by providers of finance. For example, when miners were asked at Kalole why they are doing haphazard mining, they replied that they are doing so because they are not sure when they will be evacuated from the area because it belongs to Pangea and Ashanti Companies, who obtained a Prospecting Licence in 1992. Therefore, their atitude is "mine as quickly as possible before the owners come".

3.3 Specialized Service Gang/Operators

These types of work organization exist in all types of artisanal and small scale mining activities. They operate on informal tributing system for non-mechanized operations such as manual ore crushing, grinding, panning, and amalgamation; and mostly on formal enterprise systems to mechanized activities e.g. custom mills, where they are paid cash for every ore ground.

It was observed that the efficiency of these services vary from one group/area to another depending on skills, experiences and type of technology employed.

The self supporting service gangs can be seen in non - mechanized skill requiring works e.g. shaft sinking, timbering, grinding etc. The group can be of 2 to 10 members and share income and work strictly on contract basis.

Charges by hand (manual) grinding operators are normally in the region of Shs. 1,000/= per pan of 20kg (karai) per person but their production per day is very low which is normally in the range of 1 to 2 pans compared to a ball (batch) mill operator who charges Shs. 1,000/= per pan (tin) and can grind 5 pans (tins) (120kgs) for one hour. The batch mill operator therefore earns between shst. 40,000/= and Shs. 100,000/= per day depending on volume of work. All batch mills seen in areas visited are run by diesel engines using drive shafts, pulleys and vee-belts. This is an improved technology when compared with batch mills which were being driven by tractor engines through a differential axle shafts, about two years ago.

As stated above most mechanized and specialized services are operated under formal enterprise organization system. The machine owners hire skilled workers to run and maintain the equipment and most of the workers also get performance allowances, free food and medical expenses.

It was noted that service gangs which use poor technology normally work in prolonged exposure to harmful dust and toxic fumes.

Although there are several examples of individual initiative operators to improve the present technologies, the general observation is that technologies are adapted without consideration of machine efficiency and process and hence not economically viable.

OBSERVATIONS AND RECOMMENDATIONS

The tributing system is the most commonly paracticed method of operation in the Region and the country as a whole due to the following reasons:-

(a) Claim holders' lack of working capital to pay salaries to miners.

(b) Most claim holders lack capital to procure working tools such as picks, shovels, moil points etc. Hence miners purchase their own working tools.

(c) Lack of supervisory skills by claim holders to enable miners work efficiently.

This system has the following advantages:-

(a) Miners feel themselves to be part owners of the claim. Hence they work diligently without any supervision.

(b) Eliminates absenteeism of miners

(c) Each partner in the various groups is satisfied with his share of distribution, aspecially if is cash distribution

(d) The claim holders do not suffer any losses.

However, it has the following disadvantages:-

(a) If the ground being mined is poor in minerals the income for each group is low.

(b) It does not take into account the grade of ore being mined. Since these people share production (ore mined), one group may get poor ore and another rich ore. Hence the incomes for each group may differ.

(c) It does not take into account skills of the miners in the groups. A group of say 10 people may have only one skilled miner, but this miner shares production equally with the other unskilled miners. This forces some skilled miners shift to other working areas where they expect to get good income.

(d) In most cases the claim holder gets the "lion's share" because he has many, pits in his claim, leaving very little share to individual miners.

To improve the system, the following are recommended:

(a) The tributing system should be strictly on cash basis, and not sharing ore.

(b) The claim holder should give incentives to skilled and experienced miners by increasing their share in the tributing system. This will enable hard workers receive fair shares.

4.0 MINING AND PROCESSING

4.1 Introduction

As stated earlier, Shinyanga region is endowed with a lot of mineral resources which are untapped except diamonds which are being mined at Williamson Diamond Mines since 1940.

Districts where mining concessions are held, with minerals mined in brackets, are Shinyanga (gold, amethyst, zircon, diamonds, limestones and aggregate); Kahama (gold and diamonds); Bukombe (Gold) and Maswa (Amethyst). (See Table 1).

The study was carried out in Shinyanga Rural, Kahama and Bukombe Districts where extensive mining of diamonds and gold by artisanal miners is being carried out. Nine mining sites were visited, out of which two are diamond mining sites. The following report describes how gold and diamonds are being mined and processed.

Most of the so called small scale miners interviewed in the Districts visited are in the technical sense artisanal miners; they are "amateurs" in the mining profession. Due to lack of technology, they do not plan good prospecting methods that will enable them to discover the minerals in the shortest time possible and employing the least costly methods; they do not understand proper mine development methods that will enable them deliniate ore reserves and understand the nature of the mineral deposits they intend to mine, nor do they know any conventional mining methods such as benching in opencast mining or stoping in underground mining. They have no sound knowledge of the location, attitude and composition of the ore zones. To obtain these data, diamond drilling and drives/drifts, Cross-cuts and raises are the standard exploratory media in formal underground mines. These practices are practically unknown to most Tanzanian small scale miners.

Mineral discoveries are struck by "luck" or "accident" after many trial and error prospecting methods, mostly done by pitting and trenching. After discovery, there is only one mining method, and that is pitting and trenching. In practice ore reserves are not proven, for miners exploit the mineral as soon as they discover it. They dig straight down the reefs until the second enrichment is encountered, typically about 10 to 15 metres. At this point they cast about on the reef laterally along drifts or crosscut up to the limits of their section, trying to look for visible minerals in it. There is no strict respect for horizontal plane with development headings such as drifts and cross-cuts with of course allowance for about a degree of inclination in favour of loaded cars or other tramming system in use and water drainage from the drift faces.

4.2 Labour Productivity

The low technology base together with lack of machinery and equipment result into poor mining practices and low productivity. Appendix 7 shows that weight of ore mined and productivity is 2.9 tons per man per day at Mr. Soud's claim at Nyangh'wale because he uses an excavator to mine the ore, while the other claims have productivity ranging from 0.6 Kg/man/day to 35 Kg/man/day; which are very low because they mine using picks and shovels, and hoist the ore using buckets.

4.3 Mineral Production

Due to the same reasons givens above, mineral production and revenue for each District is low. Appendix 4 gives comparative figures of estimated monthly mineral production and value for each District. However, the value of minerals produced per month for Shinyanga District are high due to Williamson Diamonds Mine, which is a highly mechanised modern mine. Although miners in Kahama and Bukombe use the same tools i.e. picks and shovels, yet value of production for Bukombe District is higher than that of Kahama District because there are more miners in the District than in Kahama District.

It should be noted that, with the exception of Williamson Diamonds Mine at Mwadui, all revenue received from mineral sales (Appendix 6) remain in the respective districts.

4.4 Income for Miners and Others

Average monthly income for miners range from TShs. 10,000/= to TShs. 300,000/= depending on amount of production. Appendix 3 shows comparative figures for the Districts. The income depends very much on grade of ore; amount of production and methods of recovery. Income for other people offering services at the mines varies according to the type of services offered.

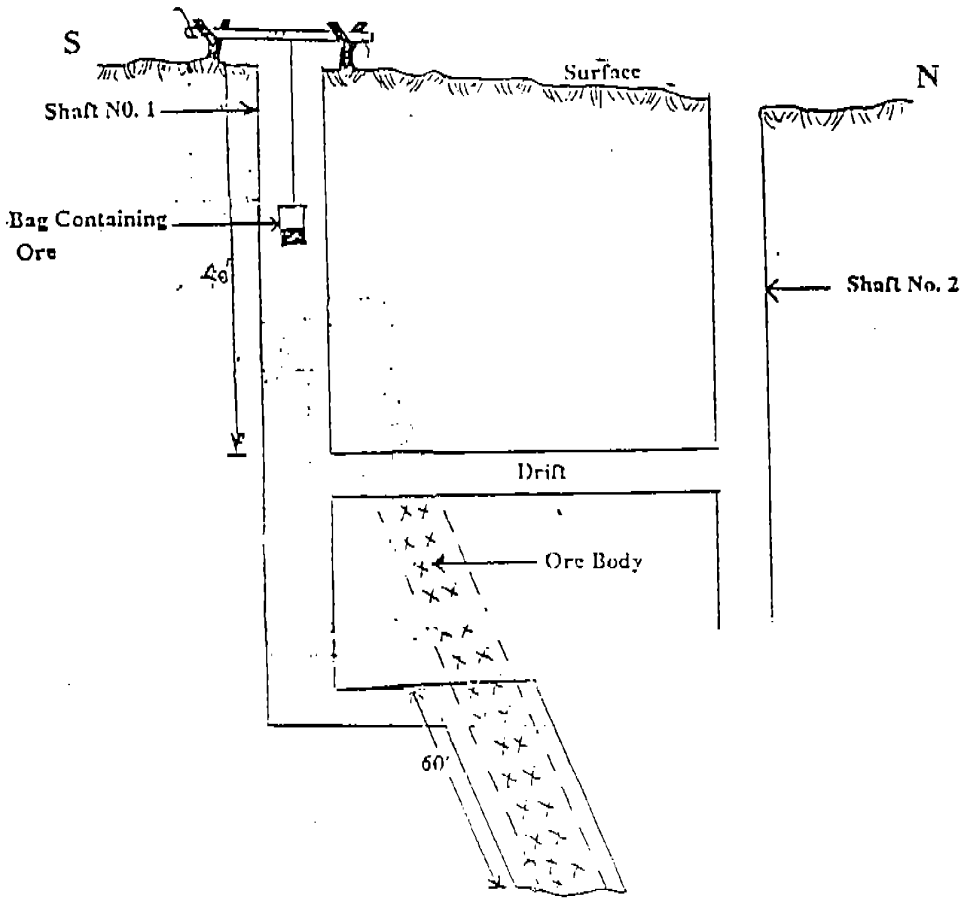
4.5 Gold Mining Methods

The mining method chosen depends on the type of gold mineralization, shape and the location of the orebody. Mining activities can be subdivided into open cast and underground operation methods (Appendix8) Both methods are used in the areas visited. In opencast mining, the operation consists of excavating an opencast or pit.

(a) Opencast Methods

Opencast gold mining methods are carried out at Busulwangili and Kalole in Kahama District and at Bukandwe, Katente and Matabe in Bukombe District where there is a lot of alluvial gold. The most common opencast mining and processing methods used are panning and sluicing.

Figure 1



CROSS SECTION SKETCH OF SHAFTS

NOT TO SCALE

(i) Excavation

Excavation of country rock and ore is done mostly by using moil points, a single-sided pick locally known as "Sokomoko", a double sided pick axe, shovels and other tools that the small scale and artisanal miner finds useful to excavate the rock mass. According to the study carried out 92% of the artisanal miners visited extracted gold ore and waste using the tools mentioned above. There is only one miner at Itilima who is using jackhammers and blasting by using gelignite.

(ii) Tramming and Hoisting Methods

Ore and waste is trammed from the drift or working face to the pit (Shaft) bottom by either of two methods. One method is to put ore or waste into plastic drums or buckets of 15 Kg capacity. These are then carried by miners to the pit (Shaft) bottom and hoisted to the surface manually using a rope and wooden windlass. Another option is to put ore or waste into 25/50Kg canvas bag/sack, tie it with a rope and drag it along the floor to the pit bottom.

Most of the pits are equipped with locally made wooden windlasses for hoisting ore and waste. A windlass is a round timber log of about 6 inches diameter cut into a size slightly more than the width of the shaft, (pit) to which a 3 cm sisal rope is tied and wound round. The timber log is placed on two vertical V-like timber posts of the same size as the log, which are erected across on both sides of the pit. The log is then turned manually to elevate or descend the rope. This hoist arrangement seems to gain popularity amongst miners. At the time of the study it was found that 95% of mines visited installed wooden windlasses.

Some of the pits have ropes only without windlasses; miners enter the mine workings by stepping on notches cut into the sides of the pit (shaft) walls. However. this practice is dangerous to the miners, especially when the pits (shafts) are very deep.

(iii) Underground Support

Timber is widely used for underground support. About 31% of mines visited had timber support. This timber support was found at Itilima, Mwime, Bukandwe, Katente, Nyakafuru, Busulwangili and Kalole. There was no timber support in some soft rocks in mise rush areas of Busulwangili, Kalole and Matabe. This accounted for 44% of the mines visited. As a result there are a lot of roof falls which are not officially reported to the Inspector of Mines because these people are mining illegally.

(iv) Ventilation Methods

It was noticed during the study that ventilation in the pits is very poor, especially in areas where about 29% of the pits (Shafts) are very deep such as at Itilima and Katente, where some of the pits are about 60 metres from the surface. At Bukandwe, PVC pipes have been installed in one pit to improve ventilation. The pipes protrude at the surface, where they are dressed with fan-like canvas cloth. About 38% of mines visited have natural ventilation because they are shallow. The rest use natural ventilation by connecting two adjacent pits (shaft) with drifts.

(v) Lighting

Lighting for underground mines is generally done by using torches powered by dry batteries. Open flame lanterns, locally called "vibatari" are extensively used at Itilima, Nyakafuru, Katente, Busulwangili, Kalole and Matabe. This accounts for about 53% of areas visited.

(vi) Dewatering the Mines

Many underground mines have been abandoned due to excessive water flows. This has been a major production bottleneck which most miners have failed to solve. The majority of miners bail out water from the pits (shafts) using buckets and plastic drums tied to ropes.

Serious mine water problems existed at Bukandwe, Katente and Nyakafuru. However , at Bukandwe there is one pump. A claim owner at Nyakafuru wanted to hire a pump from Mwanza and was given the following conditions: The claim owner to pay a deposit of Shs. 500,000/= before the pump was released; the claim owner to pay for transporting the pump from Mwanza to Nyakafuru, provide food for the pump operators and pay for fuel. When there is gold production, the distribution of value of gold would be 40% to the pump owner and 60% to the claim owner. These conditions were too tough for the claim owner that he abandoned the idea of hiring the pump. Hence, miners opt to use buckets and plastic containers to dewater their mines using hoisting systems available at their mines, an exercise which is impossible to achieve.

4.6 Gold Processing Methods

There are three major stages of gold processing operations commonly in use. These stages are panning, sluicing and amalgamation. However, these methods are not capable to extract gold from low grade ores or refractory gold which is locked up in sulphide because sulphide do not react with mercury.

Gold recovery is still low due to low technology employed, especially the crushing and grinding stages which are the most important. The liberation size of most of gold ores is usually less than 100 mesh (150 microns), while the size range of mined ore ranges to several centimetres. In order to reduce the size, two main stages are involved; the first stage includes size reduction of the particles to about one centimetre conducted on dry solids using a hand hammer and a hard rock/steel surface. The second subsequent size reduction stage of the crushed material is achieved by grinding in batch (ball) mills, wooden mortar and vehicle axle as pestle. In each stage of size reduction, hand sorting or nail perforated sieves are used in order to achieve final required size range. (See Appendix 9).

Gold processing and recovery can be achieved by combination of the three methods as follows:-

(a) Panning

Panning alone is used to recover free and coarse gold from alluvial or eluvial deposits. This was noticed being applied to a lesser extent at Matabe, Busulwangili and Kalole gold rush areas, where there is some alluvial gold. Alluvial gravel is excavated and panned directly to recover gold without passing through other stages.

(b) Panning and Sluicing

A two - way approach which is a combination of panning and sluicing is used to recover coarse and fine gold from alluvial or eluvial deposits. Mined ore is passed through a sluice box whose bottom is lined with sisal mat and fitted with riffles to trap the gold. A sluice box is positioned at a suitable slope, usually at gradient of 1 in 12. At the top of the sluice box is placed a half-drum which is perforated at the bottom to allow fine gravel to pass through. Mined gravel containing gold is fed in the half - drum and water added in the drum to make a pulp. The pulp then gravitates through the holes of the drum and then through the riffles of the sluice box and discharges at the end. Coarse gold is trapped by the riffles and the sisal mat placed in the sluice box.

The discharge from the sluice box can be reprocessed again, until almost all the gold is trapped in the sisal mat. The sluice box is emptied by removing the sisal mat and washed thoroughly by shaking in a bucket of water to remove all the entrapped gold. The pulp obtained is then panned to remove all light materials until the heavy gold fraction is left behind. The size of the sluice box and the angle of the slope depend on the quantity of ore to be treated, the resident time needed from the gravel to elutriate, the flow rate of water available and the grain size of particles.

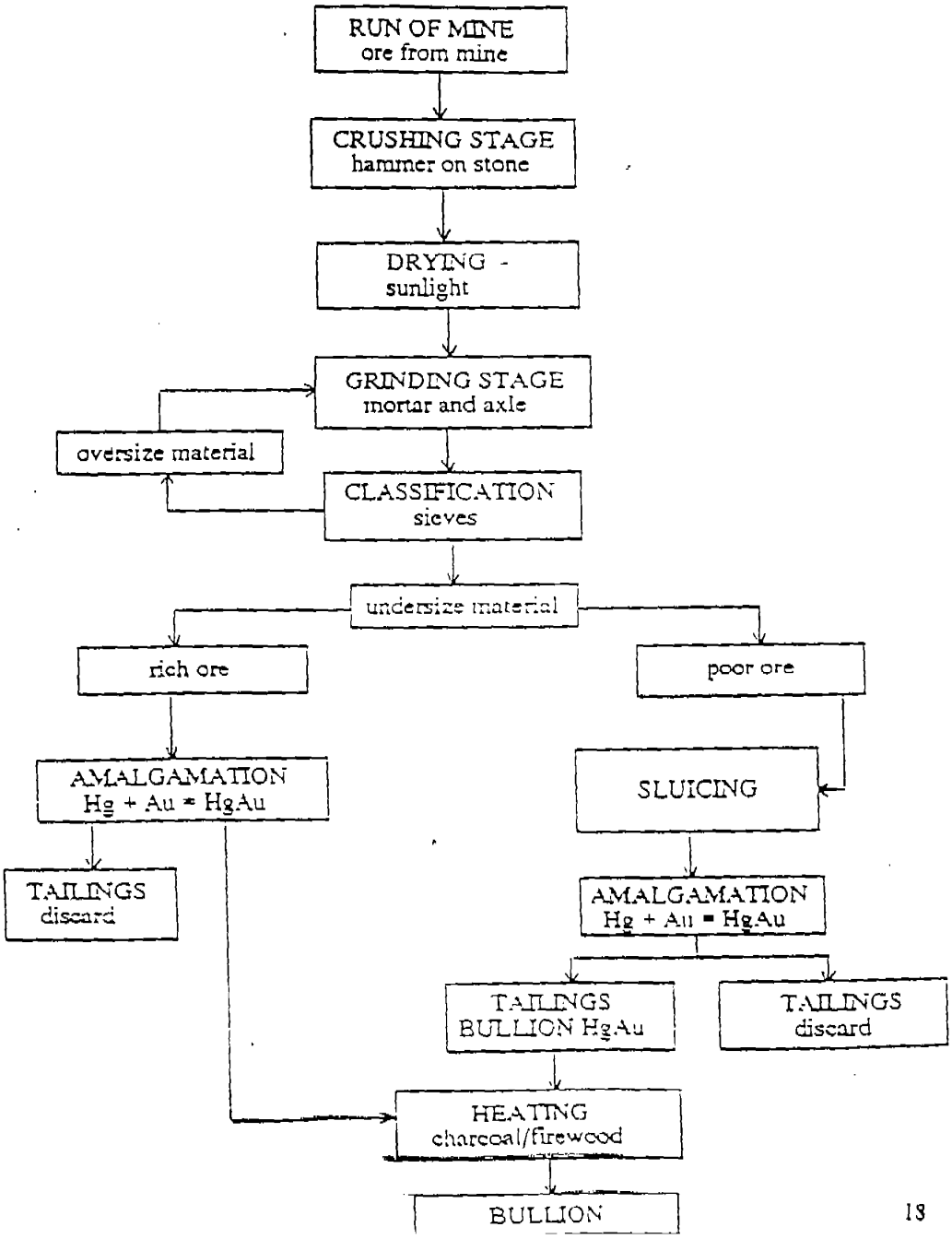
(c) Panning, Sluicing and Amalgamation

The three - way approach is used in the recovery of gold from primary ore where both coarse and fine gold may be present. The process of recovering gold by this method is as follows:-

(i) Primary reef ore mined is broken by hand with a 4 1b hammer to sizes less than 19mm (about 3/4 inch). This is known as primary crushing.

Figure 2

SIMPLIFIED FLOWSHEET OF GOLD RECOVERY



(ii) After primary crushing the ore undergoes a secondary stage of grinding by either one of the two methods:-

In the first method, the ore is crushed manually down to 100 mesh size ore in a hardwood mortar using vehicle half-shaft axel as pestle. The crushed ore is sieved from time to time by using rectangular locally made nail perforated metal sheets as screens. Some miners use mosquito wire gauze as screens. Very few miners use the official 100 mesh (150 microns) and 200 mesh (74 microns) screens.

In the second method, the primary crushed ore is charged into a locally made 120-150Kg capacity unlined batch mill, (or ball Mill as is commonly called). Which is powered by a diesel engine through transmission shafts and vee-belts. The ore is ground for a period of one hour, which is considered enough to achieve the fineness required to liberate most of the gold from the rock matrix. This method accounts for 36% of grinding methods while the first methods accounts for 64% of grinding methods used during the study visit.

(iii) The finely ground ore from either of the two methods is then processed as follows:-

- If the ore is very rich, it is panned directly to recover gold.

- If it is not rich it is run over sluice boxes. The concentrate from the sluice boxes is then amalgamated, and the amalgam bullion is recovered by heating it openly on a soft drink crown cap in silver paper or on a shovel over a charcoal fire. Grinding and amalgamation many be repeated several times, depending on the nature of ore until almost all the gold is recovered.

The gold recovery process by amalgamation is done as follows:- The concentrate from the sluice box is washed in a gold pan to reduce the amount of lighter material leaving the fine black mud concentrate. Amalgamation is applicable where gold occurs as fine particles. The concentrate is then treated with mercury by adding mercury in the form of a small bead, commonly the amount that can be contained in a soft drink crown cap and is allowed to circulate in the pan during the final stages of washing. The excess mercury is removed from the amalgam by squeezing it with fingers through a fine cloth. A typical flow sheet showing this method of gold recovery is shown in Fig 2.

During the study, all the mines visited were crushing ore using hammers and stones, 54% were using amalgamation method of gold concentration and 23% were panning only.

4.7 Diamond Mining Methods

Mining Methods

Diamonds are mined at Maganzo in Shinyanga District and Nyangh'wale in Kahama District. Like gold, there are two methods of mining diamonds i.e. open cast and underground methods (Appendix 10).

Open cast mining is carried out at Maganzo and Nyangh'wale while underground methods are carried out at Nyangh'wale only.

(a) Opencast Mining Methods

Open cast diamonds are mined mechanically and manually.

(i) Mechanical Methods

At M/s Soud Diamonds Ltd concession at Nyangh'wale exploration for diamonds started in 1994/95 where it was discovered that there is kimberlite and alluvial gravels which contain diamonds. It was then decided that the best way of mining these diamonds is by machines using modern methods in small scale. The diamonds are contained in gravel and conglomerate and in Kimberlite under the cover of laterite and calcrete which is like a soft natural limestone.

To obtain these alluvial gravels and conglomerate, the top cover of laterite and calcrete is stripped off to expose them. The gravel and conglomerate is then mined by an excavator and the material loaded on to dump trucks ready for processing. At the time of the visit, this deposit was being mined in two benches, each with a height of between 2 to 3 metres, by using a crawler mounted back-hoe excavator and two 7 tonne capacity trucks. The mined ore was loaded into the trucks and stockpiled near the process plant.

(ii) Manual Methods

Near M/s Soud Diamonds Nyangh'wale Concessions, there are artisanal diamond miners who use the traditional picks and shovels to mine the alluvial gravels. The mined gravels are sieved using screens with small openings of less than 5mm. A similar method of mining the gravels is used at Maganzo where there is a mine rush.

(b) Underground Mining Methods

Underground mining methods are carried out by artisanal miners at Nyangh'wale where the diamondiferous gravels are under think cover of top soil. Mining is done by sinking pits (shafts) similar to those found in the gold mining areas. The depths of the pits differ depending on the level where the gravels and conglomerate are encountered. For example, pits located at the southern end of the deposit are only 2 to 6 metres deep until they intersect gravel and conglomerate; whereas pits located at the northern end of the deposit are between 13 and 17 metres deep.

Miners go down the 3ft x 6ft pits by using ropes and stepping on notches cut into the sides of the pit walls. The same ropes are used for hoisting the gravel from underground. Wooden windlasses similar to those in gold mines are not used, but instead worn out conveyor belt rollers are installed at the top of the pit. The hoisting rope tied to 20-25 kg capacity buckets or gunny bags passes over these rollers while being pulled to the surface by the miners. This is to enable the rope pulled up easily during hoisting.

Gravel and conglomerate is mined using picks, shovels and "Sokomoko"; loaded into buckets or gunny bags and hoisted to the surface. No blasting is done because the rock is soft.

All pits are timbered from the surface through soft ground to levels where the rock is hard, to avoid caving in, especially during the wet season.

Natural ventilation is used because the pits are shallow, Underground lighting is by use of open flame lantern "vibatarai" which is dangerous for human health.

Underground water is a major problem in all the pits, and is normally encountered when the diamondiferous gravels are intersected. Buckets are used for bailing out the water, but where this fails the pits are abandoned.

4.8 Diamond Processing Methods

(a) Mechanical Processing

At M/S Soud Diamond Ltd concession, the diamondiferous gravel is processed mechanically using a 5 - foot diameter pan.

A pan is a round tank fitted with an electricaly driven rotary rake through a worm gear on the central shaft.

Diamondiferous gravel is fed into the pan followed by water. The mixture of water/gravel is stirred in the pan by the rotary rake. Some clay is added in the mixture until the pulp reaches a density which allows separation of heavy minerals from light minerals by specific gravity method. The rotary motion of the rake and triangular shape of the rakes (tines) creates a certifugal force in the gravel/water mixture which forces heavy minerals to the periphery of the pan where they are discharged into a container located on the sides of the pan. The light minerals remain at the centre of the pan and discharged separately.

The heavy minerals (Concentrate) are subjected to another gravity separation by using a jig. Diamonds are then sorted by hand from the jig discharge concentrate.

(b) Manual Processing

Artisanal miners process the diamondiferous gravels by using 60cm diameter round sieves. Which have bottom opening of 5 to 6 mm fine mesh.

The sieve constraining the gravel is held in a tub of water or a pool constructed to hold water, where it is sharply twisted one way then the other repeatedly and then moved more gently up and down in a jigging motion. The actions are repeated until the lighter gravels are graded towards the top of the sieve and the heavier ones are concentrated in the middle to the bottom of the sieve. The sieve is lifted out of water and taken to a flat ground or a picking table where it is deftly turned over and the contents dumped on the flat ground or table like a child making a mud-pie. When the sieve is lifted off, the gravel is left, shining wet, in the shape of a large flat cake. The picker examines the stones on the top in the middle of the pile, and picks out any diamonds crystals. Them, to make sure that no diamonds have remained in the rest of the gravel, he goes through the "cake" gravels slicing it at a time.

Due to nature of occurrence of alluvial diamonds and mining methods applied 90 buckets (of 25 Kg each) of gravel mined in 3 days may give production of 2 stones of 0.5 carat each or none at all. One carat is equivalent to 0.2 gm.

GENERAL OBSERVATIONS AND RECOMMENDATIONS

(a) Observations

Despite the above specific observations, the Consultant has generally observed that:-

- The level of technology used is primitive, labour intensive, not competitive and gives low labour productivity.

- Mining methods applied are not appropriate. Artisanal and small scale miners do not observe the stability of hanging wall and footwall in order to choose the best method of ore extraction.

- Timbering technology is improperly practised; constructed structures are weak and use excessive materials.

- Only ore containing visible gold is mined and the rest discarded despite that it may contain enough gold quantities to be mined economically.

- Gold processing procedures do not take into account presence of other minerals in which gold is locked up. Hence a lot of gold is left in the waste dumps (tailings).

- Miners do not have enough geological information on acquired lands.

- Miners are not getting enough technical support from Mines Division officials.

(b) Recommendations

(i) Prior to mining, artisanal miners should require assistance from the nearest mines office on:

- better use of available geological data for the area
- how to improve prospecting methods
- choice of mining method and how to access professional advice before dealing with complex operations such as timbering, ore extraction and processing.

In general extension services should be introduced.

(ii) Samples of ores should be collected from the mines and sent for laboratory tests and miners advised on complexity of ores.

(iii) Consulting companies should develop their services to small scale miners before and during their operations.

(iv) Improve technical know-how of Technicians stationed at the Mines Offices through seminars and refresher courses. The present Technicians have very little technical know-how.

5.0 MINERAL MARKETS

Mineral markets, especially diamonds are normally conducted in privacy and it is very difficult for outsiders to follow market trends.

Mineral markets influence behaviour and activities of artisanal miners in a number of ways: intensity of artisanal mining activities is directly related to the existence of good markets. If the market disappears, the miners stop working. For example, when the Banks were purchasing gold during the period 1990-1993, a lot of artisanal miners at Itilima were mining gold. During the study a lot of villagers in this area were complaining that they are being discouraged by lack of gold market and most of them are farming to subsidize mining activity which is done from July to December. The few brokers or "Makotas" as they are normally called, who visit the mines do not have enough money to buy all the gold produced. Last year Katente miners failed to sell their gold at the Bank of Tanzania Mwanza Branch.

The prices of gold also differ. For example, at Itilima one gram is Shs. 4,500/=; at Nyakafuru it is Shs. 4,600/= whereas at the gold rush areas of Busulwangili, Kaloleand Matabe the price is Shs. 5,000/= per gram.

The market for diamonds is more uncertain compared with gold because prices always depend on the size and quality of the stone. Business depends on power of negotiations between the seller (miner) and the buyer who is normally the claim owner. The claim owners sell the diamonds to a dealer. Prices of diamonds were stable when Tanzania Diamond Cutting Co. (TANCUT) was buying them during the period 1992-1993. During the study, there was no steady market for diamonds. The price of 2 - 3 carat stone may range between Shs. 30,000/= and Shs. 150, 000/=. For this size of stone TANCUT used to offer U.S. $ 250 (T. Shs. 155,000/-). per carat.

Active local mineral markets do not automatically reflect the contribution of the mineral sector to the local community and the Region as a whole. Some of the miners come from other Regions such as Tabora, Mwanza, Singida and Mara. Hence, the money they obtain from mining activities is not spent in Shinyanga Region, but in the Regions they come from. Likewise many traders in minerals and goods come from Dar es Salaam, Mwanza, Moshi and Arusha. The profits of these traders do not contribute to the development of the local community and Region as a whole.

Absence of statistics from miners and market dealers does not enable local leaders to know what has been produced in the district/Region.

Due to the small number of mineral dealers in the Region, local mineral trading is usually in the hands of small brokers, mineral brokers (traders and miners) and licenced mineral dealers. ***Small brokers*** normally stay with the miners. They live on commissions for linking services. Sometimes they are hired by mineral brokers as informer or body guards. In most cases they subsidize miners during non-productive periods.

Mineral brokers provide a reliable major market for minerals produced by artisanal miners. Brokers can strongly influence export channels of the purchased minerals as they can sell their minerals to official dealers or to smugglers. They operate in mining areas and travel to towns to sell minerals. Mineral brokers can be full time or part time traders, which is the case with most claim holders. Claim holders are actively involved in mineral trading for the following reasons:-

- to minimize operational costs
- buying and selling of minerals is an income generating project. It has a high profit margin.
- offers security and confidence to his/her mine workers.
- is a way of recovery minerals which have been stolen by mine workers.
- a claim holder is the first buyer of production from miners under a production sharing system.

There are licenced and unlicensed mineral dealers in gold and diamonds. At present there are only 4 licenced mineral dealers in Shinyanga Region (See Table 3). These dealers are the only ones with enough operating funds and fulfil the Government's target of exporting minerals valued at U.S. $ 200,000 and above per year.

There are other dealers who come from other Regions, especially Dar es Salaam, Arusha and Mwanza to buy minerals in the Region. Not all the purchased minerals are exported through official channels because there are other dealers who operate without licences. A cartel for diamond business exists.

Most mineral dealers do not visit the mining areas but operate from small towns and Shinyanga Region headquarters.

Mineral dealers have different financial capacities and mineral trading knowledge mainly due to trading preparation and co-operation with foreign partners/buyers.

6.0 SOCIO - ECONOMIC ASPECTS

(a) The Significance of Large Scale Mining For Development of The Region.

Although small scale and artisanal mining has been going on in the Region for the past 15 years its contribution to the Region development and alleviation of poverty in rural mining districts has been minimal. However, a change of the mining policy has enabled companies, (both local and foreign) to acquire concessions to explore for minerals in the region. There are 48 companies with Prospecting and Mining Licences in Shinyanga Region (See Table 2) Among them are:

1. Rand Gold/Pangea Joint - Venture Company which is prospecting for gold at Mwakitolyo, (Shinyanga Rural).

2. Williamson Diamonds Ltd, which is mining diamonds at Mwadui since 1940 at Mwadui in Shinyanga Rural.

3. Kahama Mining Corporation, which is developing a gold Mine at Bulyanhulu, in Kahama District; and

4. Madaba/Pangea/Anmercosa (T) Ltd, Joint - Venture Company, which is prospecting for gold at Mwime in Kahama District.

The system of licencing companies is different from that of small scale miners whereby, prospecting and mining licences are granted by the Minister responsible for minerals after receiving their applications; whereas claim titles for small scale miners are granted by the Commissioner for Mineral Resources after receiving their applications through the Mines office located near their operating areas.

Due to the present system of licencing; land disputes have sometimes arisen between the two groups, especially if the area applied for by the two groups is the same. This has led to serious disputes in some cases which required the Minister's final ruling. In most cases the small scale miners end up the loosers resulting in creation of antagonism between the two groups. During the study, this hostility was observed at Kakola Village; Busulwangili, Kalole, Maganzo and Matabe mine rush areas, where the artisanal miners are accusing the Minister responsible for minerals of allocating all land with minerals in the Region to foreign companies. Fortunately there are no land disputes between farmers and the companies carrying out exploration because the licenced areas are too big. The minimum size of one prospecting licence is 50 Sq. km and maximum size of 150 Sq. km in one area. Many villages and forest reserves are within the licenced areas.

If minerals are found in farms, and Mining Licence granted, the farm owners are always compensated. For example, at Katente, villagers and miners were paid TShs. 18 million by SAMAX Company to be allowed to drill in their claims and farms.

The companies and small scale miners do not contribute directly to the District/Regional economy as they pay their licence fees, annual rent and royalty to the Central Government.

It was noticed at Busulwangili gold rush area ~~where~~ that the artisanal miners are carrying out mining since January, 1997 in an area under Madaba Minerals Prospecting Licence, after they were evacuated from Bulyanhulu. The same was noticed at Kalole gold rush area which was encroached in July, 1997. This area is located in a Prospecting Licence granted to Ashanti/Pangea Joint-Venture Company in 1992 but which has not been developed todate. Similarly this was noticed at Matabe gold rush area which was encroached in June 1997, an area located in Prospecting licence for Eagle Gems/Ashanti Gold Mines joint - venture company; and at Maganzo diamond rush area which is located in licenced area for TANEX, Ltd; a subsidiary company for De Beers of South Africa.

In order to reduce conflicts between large companies and small scale miners:-

(a) it is possible to advise the Large Scale miners to provide technical help to small scale miners to improve their technology know - how and increase production.

(b) reserve areas for Small scale miners in the Prospecting Licences where the big companies feel that the mineral reserves in the licenced areas are too small for them.

Unfortunately, no big company has offered any technical help to Small scale miners.

It is hoped the Mining Code under preparation will rectify these problems.

The Consultant visited areas where some of these companies operate, interviewed officials with the intention to know what past and future programmes they had on the development of the districts where they are operating. Three prominent companies were selected for this exercise. They are Williamson Diamond at Mwadui, (Shinyanga Rural) Anmercosa, which is a joint - venture company between Madaba Minerals, Pangea and Anglo American Corporation. This company is carrying out detailed exploration at Buzwagi near Mwime Village, close to Kahama town and Kahama Mining Corporation, a Subsidiary of Sutton Resources of Canada, which is developing a gold mine at Bulyanhulu, Kahama district.

These companies have done and will do the following for the districts:-

ANMERCOSA EXPLORATION (T) LTD.

At the time of the study, this company was constructing classrooms for Mwime village Primary School. After which it will construct a dispensary and clinic for the village.

Negotiations with the Kahama District Council are underway in order that the company can take part in the development of Kahama township. This will include construction of an all weather road from Kahama town to Mwime, a distance of 9Km, construction of childrens' ward dispensary at Kahama and a Secondary School at Kahama.

During the study tour, the Consultant held discussions with Mwime village government leaders. Apart from the school, and dispensary, the village leaders expressed the need that they want more assistance from the company. This includes construction of a technical secondary school at the village, provisions of recreational facilities, cattle dip, a market and electricity. The villagers were advised by the Consultant to formulate and budget their projects and show signs that they are also ready to contribute funds for some of the projects and not rely solely on the company's contribution.

WILLIAMSON DIAMONDS LTD.

During its existence in the Region for 57 years the company has contributed the following services for the Region:

(a) Constructed a community centre for Shinyanga town.

(b) Partly financed the construction of Shinyanga airstrip in June - August, 1997.

(c) Was supplying electricity and water to Shinyanga township when it was faced with shortage of these services during the 1980s.

(d) Water dams at Songwe and Nhumbu which are for mine use also serve the neighbouring villages.

(e) The Mine hospital used to be consulting hospital for the Region.

(f) Company contributed a plot for construction of Shinyanga Sec. School which is operational. This School was vandalized in 1994/95, the power line wires and poles were stolen. The company has replaced these and the school in operational.

(g) From 1974 - 1975 this Secondary School was, established for children of the mine employees and outsiders.

(h) There was a technical training school for employees' children as well as other dependants. Subjects taught included the following subjects: Electrical, mechanical, masonary, fabrication, fitters, and carpentry.

(i) The Company is one of the founders of Dar es Salaam Technical College.

(j) The Company initiated the establishment of the Geology department at the University of Dar es Salaam.

(k) The Company donated buildings for Nhumbu village dispensary.

(l) The mines' Chief Medical Officer used to visit Shinyanga, Kahama and Maswa hospitals during the time when the mines' operations were at peak levels.

(m) The company constructed an Agricultural School for training company workers' children to be good farmers. Some of the students are now lecturers at Sokoine University of Agriculture at Morogoro.

(n) The company's hospital is offering services to non-company employees.

Regarding cost benefits on Regional levels, the company spends in the region of not less than Shs. 194 million (or U.S. $ 310,000 a month) for salaries and other benefits for company employees. The company offers direct employment opportunities for 872 people. Other people who benefit from the company include the employees' dependants, temporary/casual employees and those employed in related enterprises such as shops, butcheries, recreational services, dairy farming and primary schools for miners' children and others. Therefore, many people benefit from Williamson Diamonds Ltd activities directly or indirectly.

KAHAMA GOLD MINING CORPORATION.

This company is a subsidiary of Sutton Resources Company of Canada which is developing a gold mine at Bulyanhulu near Kakola village in Kahama District. Upon its completion, the mine will offer employment opportunities for 500 people.

The following are what the Company will do as per conditions of the Mining Licence for future development of the nearby Kakola and other villages and the Region as a whole:-

Local Development and Benefits for Bulyanhulu

The mine site will provide the following services, all of which will assist the local villages.

(a) Improved road access to Mwanza and Kahama suitable for all weather traffic. There may be buses which will start to operate regularly for villagers.

(b) Improved local roads for access to nearby sites and at the mine site generally.

(c) Telephone services connection to the Tanzania's grid, local line could be made available to nearby villages.

(d) Improvement of airstrip for all weather conditions and certified under the Tanzanian Aviation Board. It will be maintained by the Company, but could be used to assist the local community.

(e) The assurance that adequate industrial and drinking water supply will be made available. At present, the local river dries up seasonally and good, safe water is not readily available, as the illegal miners are contaminating some sources with poisonous mercury. A reservoir and a number of wells (9 of them) would be sunk.

(f) Electrical power will be installed. The mine generates its own power, then lines would be connected to some local communities. If power from the Tanzanian grid is brought in, then revenues from both the mine and connections to the villages will ensue to the state.

(g) Business opportunities to supply goods and services to the mine will flow to the local communities; those benefitting would include food and hardware suppliers, drivers etc. As well, as many miners have assisted entrepreneurs in setting up business, with small loans, so that business can contract to the mine.

(h) Skills establishment and training to give local employees advancement opportunities for better paying jobs will be continually underway throughout the life of the mine. This training in mining, milling, clerical, electrical, mechanical or support staff would benefit them in any other job situation as well.

Social and Educational Benefits.

(a) The mine site will provide a fully functional medical clinic with trained staff. Employees, their families and arrangement with the local population are envisioned. Vaccination clinics to prevent diseases are likely to be scheduled, paid for by the mining company.

(b) Health programs of an educational nature will be implemented and programs aimed at reducing malaria and other parasitic diseases could be organised. Maternity programs are also common.

(c) An educated population is required, and so assistance to general schooling programs, book purchases and teaching facilities is expected.

(d) The mine may also give schorlarships to advanced educational institutions for bright students who might not otherwise have such an opportunity.

(e) The mine will provide a community facility for social meetings, soccer games and the like for general recreational functions, TV would be brought in.

(f) Many aid agencies like CIDA are actively looking to assist in job training and health services for new active business enterprises and a mine at Bulyanhulu would certainly attract such agencies funding for programs beyond and supplementary to those implemented by Kahama Mining Corporation. The mine would seek such opportunities for the local community.

(g) Water treatment, inspection and testing would be provided

(h) Sewage treatment would be installed

(i) Fire and possibly ambulance services would be available.

(b) Impact of Migration on Social Cohesion.

The political stability, peace and lack of tribal strife has enabled miners to migrate freely from one part of the country to another without any objection or obstruction, and Shinyanga Region in particular has witnessed such migration due to the vast mineral wealth.

There is a rapid increase of miners populations in mine rush areas, and this has created unexpected hygienic and health problems. Rapid population changes drain local available resources such as water, food, medicine etc. In most cases the local authorities cannot cope well with these sudden demands.

Families are separated for long periods. For example, at Nyangh'wale mining location, some of the miners interviewed said they had not visited their dependants for six months. In some cases their families are forced to visit them at the mines in order to get financial help. At Katente mining location one miner said he has not visited his family for the past two years and another miner for the past five years despite the fact that they have 7 and 9 dependants respectively.

Some of the miners decide to have new families, and may change when they migrate to another place. Most of the miners stay in the mines without their families until they are too old to work. Such cases were found at Itilima where there are old miners who are living there. They left their wives and grand children in their home villages. They are now too old to carry out any mining or farming and are refusing to go back to their original villages.

In June 1997, there were between 300,000 and 400,000 people at Matabe gold rush area. At the time of the study in September, 1997, the population had decreased to 150,000, out of which 30% were women involved in mining (panning), food vendering, petty trading, bar services and prostitution. Only few of these women live with their official husbands, as most of them have e temporary husbands. STDS and AIDS are common is such areas.

Migrant miners also cause reduction of production in areas they vacate. This effect was noticed at Itilima, Nyakafuru, Bukandwe and Katente where there is a big shortage of labour. At Nyakafuru, for example, claim owners have resorted to farming after miners' migration to Matabe, Busulwangili and Kakole in order to subsidize mining activities. Hence erratic income patterns have been caused for those who were left behind. For example at Matabe, when the population was high production of gold was 5 Kilograms per day. With the current price this gold was worth Shs. 25 million. At the time of the visit production was one kilogram per day valued at Shs. 5 million. Miners have migrated due to shortage of water for washing gravel.

In terms of economic aspects, migrant miners have boosted trading incomes in areas they are operating and reduced incomes in areas they migrated. For example, at Kakola Village, located at 2 Km from Bulyanhulu mine under development, there were about 12,000 people who were involved in mining and mining related activities before they were evacuated in 1996. During their presence in the area, Kakola village had a large population most of whom were traders. There were several butcheries, many illegal gold dealers, locally known as "Makota". The village is now left with 4 butcheries, out of which only 2 are operating at a time because of lack of business.

The village had a lot of shops, food vendors, bar operators. There is now very little or no business. Deaths have increased because villagers cannot afford to pay for medicines in private dispensaries and have no farms to subsidize their income.

During the good days the village government used to collect local taxes from the miners, bicycle owners and other traders who have now moved to gold rush areas at Busulwangili, Kalole and Matabe. Village development activities have therefore come to a stand still.

At Katente mining village 85% of the 240 miners have migrated to Matabe gold rush area, leaving their wives and children in absolute poverty. Families are short of food, and neighbours are feeding them.

Regarding the three big companies visited; these allow their employees to visit their families at least once a year in order to allow them offer financial help and social security including provision of essential services, like paying school fees, buy food and other family needs. This is normally done after working for 3 to 6 months. The reason is because most of the companies, with the exception of Williamson Diamonds, are carrying out exploration work. They do not have permanent premises. After finishing work in one area, they move their camp to another area. Hence geologists, drillers and labourers do not stay with their families.

The companies have also good medical facilities like a modern hospital at Mwadui, a good dispensary at Bulyanhulu and a clinic is being constructed at Mwime. These medical facilities serve company employees, their families and nearby communities. Campaigns are made to educate the mining communities and neighbours on the dangers of sexually transmitted diseases (STDS), AIDS and carry out vaccinations to prevent the spread of outbreak diseases like meningitis etc which existed at Bulyanhulu and Kakola village at the time of the study.

In areas like Matabe mine rush areas, where artisanal and small scale miners were operating, a lot of people were dying everyday for lack of medicines.

Social Amenities and Shelters

Shelters for miners in mine rush areas are very poor. Most of these shelters are very temporary, mostly constructed of grass and wood felled from nearby forests. Most mining villages and camps do not have basic social amenities,. It was observed that there is poor drug handling and medical services in mining areas because there are no government dispensaries. Operators do not have licences nor the experience of dispensing medicines for appropriate diseases and conduct their business in hiding. Drugs and equipments are stored in poor hygienic environments.

(c) Contribution of Artisanal Miners to Household Income.

Artisanal miners can be classed into three groups as follows:- (as explained in outline in Section 3.1):

- Claim owners who are the land owners or landlords.
  They informally commission the running and supervision of the mining activities to the pit financiers, also known as pit owners.

- Pit financiers. These have agreements with claim owners to finance mining operations for a fixed duration of time. They provide rations to miners and pay for other expenses during non-production periods. They supervise the mining operations in a pit and usually have between 4 to 10 miners under their command.

- Miners who carry out actual mining or sink pits down to the mineralized zones. During non-production period they do not demand any pay or share of income distribution, but can be subsidized by the financiers on day to day requirements.

In addition to miners, there are ball mill operators and grinders who process the minerals under contract until final recovery. These are sometimes known as specialized service gang/operators. They operate on informal tributing system for non-mechanised operations such as manual ore crushing and grinding, panning, amalgamation; and mostly on formal enterprise systems to mechanised activities such as custom mills, where they are paid cash for every ore ground.

Income of an individual depends on his position and the type of production organisation structure in which he is involved; amount of production and revenue from mineral sale. Income distribution rations range from 20% retained by pit/claim owner and 80% remain with miners to 30% retained by pit/claim owners and 70% remain with miners if miners provide their own mining tools. The claim owner collects income from each pit located in his claim.

Because there are many miners at each pit, the income of individual mine worker in reef gold is less than that of claim owner or pit financier.

Appendix 3 shows average monthly income for miners, claim/pit owners and Appendix 4 shows income distribution arrangement for various locations and claims.

It was noticed during the study that most miners give first priority to their families in allocation of their expenditure. Some miners involve their wives and children in mining activities so that they can make ends meet. Such cases were noticed at Itilima, Mwime, Nyangh'wale.

However, not all wives and children benefit from mining activities. It was mentioned above that a lot of miners who were staying at Katente have migrated to Matabe mine rush area, leaving behind their wives and children without any income. Their wives and children have been left in absolute poverty.and are suffering from acute food shortages.

Successful claim holders invest very little in mining production activities, instead they open less risky businesses like shops, transport and guest houses. Miners and claim owners never keep bank accounts. The money obtained is spent immediately on non-essential activities like boozing and marrying women.

Social and economic impacts on households in terms of poverty elimination and the Community as a whole will feature once miners change their expenditure habits for the better and invest in useful assets and in mining activities to increase production.

(d) Expenditure Associated With Mining

As regards to expenditure of revenue obtained from mining operations, most of miners do not budget their expenditure. Despite the fact that they sometimes get good earnings, the money is spent on non-essential activities such as boozing and marrying women. Few miners have built houses, purchased farms and livestock.

Some miners have contributed money towards community development activities Appendix 11 shows how miners spend their money.

(e) Linkage With The Rural Economy

Interlinkage of artisanal mining activities with rural economy can be observed when miners get their basic needs from the nearby villages and when they supply labour force to the mines. The extent to which a village can benefit from mining activities depends on the level of economic development of the village, itself and active participation of its people to trap mineral accumulation.

For example Kakola village benefited a lot from mining activities at Bulyanhulu prior to evacuation of miners from the area. These included shop owners, food vendors, bar operators, carpenters, masons, butchery operators, tailors etc.

Such services have moved to other mining areas such as at Maganzo, Busulwangili, Kakole and Matabe. In these areas there are a lot of petty traders, food vendors, bicycle transporters for people and water, vehicle transporters who transport goods and people between the mines and nearby villages and towns. All essential commodities are available at the mines. Some of these come from as far as Mwanza. Hence, Shinyanga and Mwanza Regions benefit from these linkages. These linkages have enhanced welfare effects of the sector.

In areas close to locations with intensive mining activities there is a sharp price increase of basic commodities. The costs of living can also change once a mining activity decreases or stops. Such changes were noticed at Itilima, Mwime and Nyangh'wale. Petty traders in these localities were complaining that business has declined due to fall in mineral production..

(f) Participation of Artisanal Miners in Community Development Activities.

Participation of miners in community development activities depends on the stability of mineral production, existing authority structure and the previous experience of how their contributions were utilized.

Most districts rely on contributions from mining community for development projects. For example, at Maganzo, artisanal miners are constructing classrooms for the primary school; at Katente they constructed a dispensary. At Nyangh'wale M/S Soud Diamonds Ltd constructed a road from the nearest village and the mine; will provide sand and aggregate for construction of a school for Sunge and Nyanmbuta Villages. They also intend to sink a well for the village.

Miners in mine rush areas are not co-operative in contributing towards development projects of surrounding areas e.g. at Kakola Village, where there is no dispensary or school.

(g) Women and Children Participation in Mining.

(a) Women: The mineral sector study carried out by TAN DISCOVERY Consulting Company under World Bank financing has indicated that women are actively engaged in mining development activities: There are those who are directly involved in mining, processing and mineral business activities: and there are those who are indirectly involved such as involvement in social-and economic activities in mining communities (Appendix2).

A lot of women were noticed at Maganzo directly engaged in mining diamond gravels and washing these gravels to recover diamonds. At Mwime some women help their husbands in panning gold concentrates and others are reworking waste dumps by winnowing the same to separate fine material from coarse material. The coarse material is then sold to male miners to recover gold. At Nyangh'wale, women were found digging diamondiferous gravels in shallow pits and reworking waste dumps to recover diamonds.

Incomes of women are not equal to those of men because they rework dumps and alluvials only, compared to their male counterparts who are involved in mining in areas with rich mineral deposits such as gold reefs and rich alluvial deposits in deep pits. For example, at Mwime women in the gold mines earn between Shs. 10,000/= and Shs. 45,000/= a month. Women engaged in other businesses such as water or food vendoring may get more or less depending on the type of business they are engaged in.

There is another group of women involved in mining activities. These own claims and pits, but their number is small. This group normally employs other people (mainly men) to work under agreements in their claims and pits. Their income is comparable directly to that of men counterparts. There is one woman in the Region who has a gold claim and is active in mineral trading. She has master dealers licences for gold and diamonds and seems to be doing well.

Although these women participate in mining, yet many of them suffer from limited access to land, credit, education and information relevant to mining activities. In addition to these problems they face more specific gender related difficulties, such as social traditions.

(b) Children Participation.

Although child labour is strictly prohibited in Tanzania, yet the Consultant saw some children at Mwime involved in mining activities. These were young girls below the age of 15 who were helping their mothers during winnowing of waste dumps to recover gold.

Boys are also frequently employed in sieving gravel. This is a significant and growing problem. Parents of the children were requested not to involve their children in such activities which are dusty and dangerous to their health; instead they should send them to school in order that they can have a good future if they are educated.

7.0 ENVIRONMENTAL, HEALTH AND SAFETY ASPECTS

(a) Safety Aspects

Small scale and artisanal miners have total disregard of the laws covering human safety and hazardous practices. Pits or shafts are sunk without taking precautionary measures on safety. The human muscle is too often the dominant force form of energy. When sinking pits or shafts the miner is instructed to get down the pit and bring to the surface something useful. Hence ladders are not installed. Methods of decent underground are by using sisal ropes or by stepping on notches cut into the sides of the pit wall. If a fatal accident occurs, it is bad lack, another miner will he found. Ropes are not regularly inspected to see if there is any fatigue so that they can he changed before they break.

Ventilation in the mines is poor, resulting in miners contacting silicosis which causes death.

Blasting is being carried out by incompetent people, some of whom do not possess blasting certificates. Miners store explosives in houses/huts, instead of approved storage places.

Miners are carrying mercury in their pockets and touching mercury without gloves.

Lighting the mines is by the use of battery powered torches, but about 53% of miners use open flame lanterns called locally "vibatari" which are dangerous to human health.

There are no working gear such as boots, helmets, mouth masks, gloves and first aid Kits. Miners go underground bare footed or wearing sandles and unprotected head in case of rock falls.

Mines are not properly supported in areas where roofs and walls are soft. During the period 1978 - 1997 a total of 111 mine accidents occurred in the Region, out of which 87 miners died (See Appendix 12). Main cause of these accidents included roof failure. These are only the recorded accidents. There are many more unrecorded. For example, during the study the Consultant noticed a lot of pits at Matabe which had collapsed, burying miners.

In opencast mines there are no benches. Pit benches are too high to withstand pressure, hence caving in, burying miners.

(b) Environmental and Health Aspects

On human health, preventive measures are not taken. These include grinding ore in dry batch mills instead of using water. Miners are allowed to touch mercury with bare hands and heating amalgam in open air instead of using retorts, hence posing danger to people. People are crushing ore using hammers and wooden mortar and vehicle half shaft as pestle. Hence many of them get silicosis after working in dusty surroundings for few years.

(i) Mercury vapour

During the last stage of gold processing, tremendous amounts of mercury are vaporized to the atmosphere. A study carried out by the National Environmental Management Council (NEMC) in 1992/93 revealed that, about 60% of the mercury used to recover gold is vaporized to the atmosphere during firing of amalgam.

Mercury vapour is the most hazardous substance in inorganic form because it diffuses through the lungs into the blood and brain, where serious damage can occur.

(ii) Air Quality

Air in the mines is highly polluted. Most air pollution is mainly due to dust generated during milling. Sieving, loading and unloading of ore.

(iii) Community Wastes

The survey revealed that the mining community living nearby water bodies such as streams, rivers polluted them with solid wastes like cans, household wastes, faeces which impaired the quality of domestic water. Toilets are not constructed; this is common in mine rush areas, where miners do not spare time to construct them.

Washing and panning of amalgam is conducted mainly alongside and inside rivers. This causes pollution of rivers, streams water wells. Besides this practice also cases siltation.

(iv) Land

The areas affected by artisanal and small scale mining are forest and vegetation and abandoned pits. The study revealed that large parts of forest and vegetation; about 40,000 M^2 at Busulwangili 45,000M^2 at Kalole and 4 Sq. Km at Matabe, have been cleared for mining purposes and construction of camps. Trees are cut for construction of huts, firewood as well as timbering of the pits.

Miners normally do not replace vegetation destroyed during mining activity.

The number of pits in any one location is anywhere between 100 and 1000 in a closely knit "honeycomb" structure, many of which are inactive, hence abandoned without refilling or adequate protection installed. However, some pits at Katente have been filled, and natural trees allowed to grow.

Large stockpiles of excavated materials are left around mine pits which could be practically used for refilling. At Maganzo, for example, such stockpiles cover an area of 6 Sq. Km in the village housing yards and surrounding areas, a horifying scenery indeed.

Due to this there is a great competition between land for mining and agricultural/grazing land. Farmers and livestock keepers travel long distances to look for grazing land and farming. This case is acute at Maganzo and Nyangh'wale where diamonds are mined within the village boundary areas.

(v) Health Problems

Communicable diseases encountered in the field had a link to the inadequate supply of safe water. A common disease caused by unsafe water supply, diarrhoea was reported as a frequently occurring disease. The disease results from poor sanitation, inadequacy of water supply and unhygienic personal habits. Besides diarrhoea, other diseases caused by contaminated water supply are skin and eye diseases which were reported in most dust emission locations and where water is inadequate in supply such as at Itilima, Mwime, Busulwangili, just to mention a few.

All the mine camps visited do not have dispensaries nor do nearby villages have any, except at Katente where the miners helped to construct a dispensary. However, there are several Kiosks in most camps selling medicines by unqualified self - styled pharmacists.

Basically there is poor sanitation or digging shallow latrines.

Other diseases noted were malaria, one of water based diseases was common almost in every location visited. Poor environmental management lead to a conducive atmosphere for breeding mosquitoes.

Dysentery was also noted in some locations visited. There was an outbreak of meningitis at Kakola Village and Matabe mine rush area.

Sexually transmitted diseases STD including Acquired Immune Deficiency Syndrome (AIDS) were reported in some mine camps but cases were not alarming because those who contact the diseases go to towns and home villages to seek treatment.

8.0 OBSERVATIONS AND RECOMMENDATIONS

(a) Observations

1. Unauthorized mining and illicit trading in gold and diamonds are widespread and difficult to control.

2. An effort of establishing a legal system for buying from small-scale gold and diamond miners must be made by giving more dealers licences to discourage black market dealing. The present licenced dealers are too few to be able to purchase all the minerals in the Region.

3. There is lack of competitive pricing on the part of the Government approved buyers.

4. Annual illicit trading has been on the increase since the Banks and Tanzania Diamond Cutting Factory (TANCUT) stopped buying gold and diamonds respectively in 1993. This will continue unless steps are taken to control it or replace it with a legal system, by allowing private companies to be involved in the trade.

5. Any system for regularising small scale and artisanal mining and methods of purchase must be attractive to the miners, many of whom would then welcome a legal and fair system.

6. The introduction of an authorised system of purchasing is possible because it was done before, and will be of great benefit to the Region, the country as a whole and the people.

7. The present methods of operation are wasteful of resources. Recovery is low and unrecovered gold and diamonds are discarded in a manner that often precludes later retreatment; environmental, health and safety considerations are ignored; and many of the workings are dangerous. Implementation of proper mining and recovery methods cannot be achieved without involving private mining companies and Consulting companies.

8. It was noticed that there are frequent conflicts between artisanal miners and big mining companies over land because large areas of land have been licenced to the companies, leaving no land for artisanal miners. As a result artisanal miners have encroached upon many licenced areas.

9. Artisanal miners are using primitive tools for mining and processing minerals due to lack of capital to buy modern equipment and machinery. They have no operating funds and hence resort to tributing system methods of operations.

10. Financial institutions are reluctant to give loans or credit facilities to artisanal miners because miners lack the collateral security imposed.

11. Large areas of land have been allocated to large companies; leaving little or no land for small scale miners. This has caused antagonism between the two groups of miners.

12. Distribution of revenue between claim owners and pit operators/miners is by tributing system of 30% for claim owners and 70% for financiers/miners instead of salaries and wages.

13. There is misuse of income by miners. The money is spent on non-essential activities such as boozing and marrying women.

14. There is competition for land between miners and farmers in some locations and competition of skilled and semi-skilled labour among large companies.

15. There are various services offered by large companies to the rural community in areas of their operation. The community also offer services such as petty trading, transport facilities, kiosks, restaurants and recreational facilities to small scale/artisanal miners.

16. Environmental impact of mining in the Region is great. Large areas of land have been degraded.

(b) Recommendations

1. Regarding land conflicts between artisanal miners and large scale miners (companies):-

(a) The holders of Prospecting and Mining Licences should be required to justify all retention of land within their licences and should not be permitted to retain any land that they have no intention of working.

(b) The government should delineate areas for small scale and artisanal mining from shed-off concessions of large scale prospecting companies.

(c) The government should negotiate with existing mining companies to release areas not required for their mining operations but may be suitable for small scale mining.

(d) Small Scale and artisanal miners should be encouraged to form small groups, co-operatives or companies which may be registered so that they can be allocated mining areas in areas delineated. The same groups, co-operatives and companies may be used to channel through any financial help and technical know-how by any institution willing to do so. This can be done by the companies giving loans to applicants at nominal interest rates. Technical institutions and consulting companies may offer technical know-how to the groups, co-operatives etc which are ready to pay for the services.

2. The Mining laws should be reinforced so that there is no illegal mining. This was done at Merelani, Arusha in 1993. Regulations for purchasing gold and diamonds should be revised to make it illegal for any one without a licence to possess these minerals. The present illegal dealers, brokers or "makotas" as they are sometimes called, should be licenced so that their operations could be monitored. Licencing more buyers will introduce competitive pricing, and hence enable miners obtain good price for their minerals.

3. To prevent water contamination by mercury and other pollutants from mining activities, the government should:-

   (a) Provide improved technical assistance to small scale and artisanal miners.

   (b) Train extension and field officers in environmental aspects of mining .

   (c) Identify and disseminate improved mining and processing techniques that are environmentally responsible.

   (d) Provide adequate logistic support to extension staff.

4. On land and soil degradation, the Government should:-

   (a) Generate environmental awareness through targeted programs to miners, the community and extension officers;

   (b) Develop detailed guidelines for land reclamation.

   (c) Enhance capacity to enforce regulations and guidelines through logistical and manpower supports.

   (d) Provide incentive packages to miners to encourage rehabilitation of mined out areas.

5. In order to reduce health hazards to communities, the Government and mining companies should:

   (a) Provide improved technical assistance to miners through education and good mining practices;

   (b) Provide appropriate environment - safe and cost-effective equipment for mining and processing (e.g. encourage the use of mercury retorts and safety equipment).

6. Regarding health and safety aspects:

(a) There should be provision of training by mining companies and extension services to ensure effective training at District levels.

(b) The Government should improve the monitoring role of the Mines Division on Health and Safety.

7. On lack of sufficient working capital and equipment for artisanal miners:

(a) A revolving fund for small scale mining should be set up through any establishment system.

(b) Leasing of equipment on hire purchase

(c) Setting up equipment pool for rental

(d) Encourage partnerships

(e) Education on business management skills

8. In order to make artisanal miners credit worthy and encourage financial institutions to lend them money:-

(a) Miners should be encouraged to form associations or unions and co-operatives for the channelling of funds to members.

(b) Institute educational programs for small scale and artisanal miners so that they understand credit schemes.

(c) Building strong relationships between institutions and miners.

9. Savings and credit schemes for better use of income should be introduced.

10. Improved health education and domestic water services.

11. For large mining companies tight regulations of Investment Code should be introduced.

12. There are possibilities of linkages between medium scale mining companies and small scale artisanal miners whereby the medium scale companies can Sub-contract Small scale miners and offer technical services. For example, at Saza in Chunya District DEMCO Ltd, a company owned by Mr. Kessy, is using the system, and offering custom milling. The gold is purchased by the company, smelted and exported.

9.0 SHINYANGA REGION HUMAN DEVELOPMENT REPORT

Terms of Reference: *Sector Studies - Mining*

Main Objective within the overall objective of preparing a Human Development Report and Poverty Eradication Strategy for Shinyanga Region, the consultant will use information from the PPA and from other field work to examine the operation of the mining sector in the context of household poverty and identify locally - based, District and Regional opportunities to strengthen the impact of the sector on the income and well being of poor rural households.

1. Describe, on a district basis, the type of mining activities, their contribution to employment, income and local revenues.

2. Review the structure of ownership and the organisation of production processing and marketing.

3. Review the technology currently in use and its effect on competitivity, worker welfare, the environment and the distribution of income.

4. Examine the pattern of expenditure associated with mining related incomes and the implications for overall household welfare as well as that of individuals, distinguishing between men and women.

5. Examine the forward (consumption) and backward (production) linkages of the sector and assess the extent to which the Region - specific productive and welfare effects of the sector are enhanced by these linkages.

6. Review the impact of corporate, including multinational investment, in the sector and the costs and benefits associated with these for the Regional economy and individuals affected by them.

7. Examine the issue of social cohesion in the mining communities, including the impact of migration and of erratic income patterns and how cohesion changes over time.

10.0 ACKNOWLEDGEMENT

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I am specially grateful to United Nations Development Programme and Shinyanga Region Government Officials for assisting me in the implementation of this study

Last but not least, special thanks go to all informants met for the valuable information given.

Appendix 1

POPULATION CENSUS OF PEOPLE INVOLVED IN MINING OR MINING RELATED ACTIVITIES

COMMODITY	DISTRICT	MINE LOCATION	POPULATION		
			MEN	WOMEN	TOTAL
Gold	Shinyanga Rural	Itilima	140	60	200
Diamonds	- do -	Maganzo	1500	3500	5000
Diamonds	- do -	Mwadui (Williamson Diamonds)	787	85	872
		Sub - Total	**2427**	**3645**	**6072**
Gold	Kahama	Mwime	400	100	500
Diamonds	Kahama	Nyangh'wale	430	50	480
Diamonds	Kahama	Nyambula Village (Near Nyangh'wale)	300	1200	1500
Diamonds	Kahama	Soud Diamonds (Nyangh'wale)	18	-	18
Gold	Kahama	Kakola Village (Near Bulyanhulu)	23760	5940	29700
Gold	Kahama	Busulwanglli	3800	1200	5000
Gold	Kahama	Kalole	14000	6000	20000
		Sub - Total	**42708**	**14490**	**57198**
Gold	Bukombe	Nyakafuru	10	-	10
Gold	Bukombe	Bukandwe	150	50	200
Gold	Bukombe	Matabe	105000	45000	150000
Gold	Bukombe	Katente	1970	70	2040
		Sub - Total	**107130**	**45120**	**152250**
		GRAND TOTAL	**152265**	**63255**	**215520**

Source: **Data compiled from information submitted by claim holders and** village government leaders.

Appendix 2

WOMEN INVOLVED DIRECTLY IN MINING

COMMODITY	DISTRICT	MINE LOCATION	POPULATION	ACTIVITIES
Gold	Shinyanga	Itilima	15	Mine alluvial gold, panning and rework waste dumps and crush gold ore
Diamonds	Shinyanga	Maganzo	100	Mine alluvial diamonds
Gold	Kahama	Mwime	21	Winnowing gold waste dumps for sale to men miners to process one woman owns a claim she is a diamond and gold dealer
Gold	Kahama	Busulwangili	120	Pit owners, financiers and gold panning
Gold	Kahama	Kalole	600	Pit owners, financiers and gold panning.
Diamonds	Kahama	Nyangh'wale	15	Rework diamond waste dumps Mine alluvial diamondiferous gravels
Gold	Bukombe	Bukandwe	10	Mine alluvial gold
Gold	Bukombe	Katente	20	Pit operators/financiers
Gold	Bukombe	Matabe	4500	Panning alluvial gold
			5401	

Note: Population of 100 and above are in mine rush areas.

Source: Compiled from information submitted by claim holders.

Appendix 3

AVERAGE MONTHLY INCOME FOR MINERS AND OTHERS (T.SHS)

LOCATION	DISTRICT	MINERS/PIT. & CLAIM OWNERS	OTHERS (OFFERING SERVICES)	REMARKS
itilima (Mineral (Gold)	Shinyanga	60000 to80000	-	Mining Operations are Between July and December
- do -	- do -	-	3000	Women and girls water vendors
Williamson Diamonds D. (Mwadui)	Shinyanga Rural	66500 to 83000	-	Minimum pay
Maganzo lamonds)	Shinyanga Rural	-	36000	Water vendors using bicycles
4. Mwime(Gold)	Kahama	10000 to 90000	-	Depending on quantity of gold recovered
- do -	- do -	-	1500000 to 3000000/=	Ball Mill operator
- do -	- do -	-	50000 to 100000	Kiosk owner before mine was taken over by ANMERCOSA
- do -	- do -	-	18000 to 30000	Water vendors
- do -	- do -	-	600000	Butchery owner
- do -	- do -	45000		Woman miner helping her husband rework waste dumps.
- do -	- do -	18000	-	Women and girls winnowing waste dumps for sale to men miners.
Nyangh'wale (Diamonds)	Kahama	10000	-	Women reworking waste dumps and alluvial diamonds
- do -	- do -	2000 to 20000	-	Depending on luck to find diamonds
- do -	- do -	-	60000	Petty trader
- do -	- do -	-	21000	Women food vendors
			12000 to 150000	Woman operating a restaurant at mine camp
6. Bukandwe (Gold)	Bukombe	300000	-	When rich reef is struck
- do -	- do -	-	30000	Woman cooking for male miners
7. Katente (Gold)	- do -	100000	-	When rich reef is struck
- do -	- do -		150000	Woman food vendor
8. Busulwangili (Gold)	Kahama	-	900000 to 1200000	Ball Mill operator

Source: Compiled from information submitted by claim holders, miners and those providing services to the miners.

STRUCTURE OF OWNERSHIP, ORGANISATION OF PRODUCTION PROCESSING AND MARKETING

Appendix 4

Location	Claim Owner	No. of Workers	Organisation of Production
Itilima			
1.	Machembe	(a) 10 working in the pits (b) Crushing is done on contact by two men from neighbouring village. Paid Shs. 800/- daily.	(a) Share production after selling gold. (b) Buys ration for miners (c) Farming to feed miners (d) Production from July - December (dry season). During rainy season water fills the pits.
2.	Abdallah Kawika	(a) 6 miners (b) Pays 100/- to people who crush. can crush 3 times a week.	(a) Pays money to miners according to amount produced after gold sales. (b) Resorts to farming to feed miners. (c) Water for processing ore is puchased from women and children water vendors.
3.	Deo Chagula	(a) 4 miners (b) Crushing is done on contact as per above	(a) Farming and mining to subsidize mining.
4.	Mohamed Juma	(a) 8 miners	(a) Pays salaries
5.	Mohamed Salim	(a) 4 miners utilized at a time	Income 70% miners 30% claim owner.
6.	There are mixed feelings at Itilima, some say they have not benefited much from mining, especially food vendors who are not selling food because the miners have no money. There are those who have benefitted from mining activities e.g. bought livestock, farms, others got married. Others say dealers do not have enough money to buy gold. They buy gold for Shs. 4000/- per gram. They recommend that the banks should resume buying gold.		
7.	Ali Amali	(a) 10 miners, one who is operator of ball mill	(a) Has compessor, ball mill and metal windlass. (b) Food ration for miners. (c) Deducts crushing and water expenses. Balance left income distribution 50%/50%
8.	Neighbouring villages have not benefitted much from mining apart from selling water and firewood.		

Claim Owners	No. of Miners	Organisation of Production
Mwime		
1. Mihayo Ntinginya (Financier, Miner)	3	(a) Helena Nyingi. the claim owner has final say in mining operation. (b) Income distribution. 80% Miners. 20% Claim owner The miners share ore equally.

Between 4 and 5 Gold buyers visit the site 2 or 3 times a week, but no reliable market.

Nyangh'wale

1. Soud Diamonds	17	(a) Paying salaries. Has geologist Lorry and Excavator drivers. (b) Free food, medicines and transport
2. Mustapha	5	(a) Work in groups Claim owner is leader (b) Income distribution After encountering diamondiferous gravel each person including claim owner is allowed to mine 15 buckets of gravel each. It diamonds are found the claim holder asks the person who found the diamond the price and bargain until agreement is reached. Claim holder then buys the diamonds. He sells the diamonds to dealers. (c) Men mine 15 buckets on behalf of women. usually one man for one woman. (d) When diamonds are sold revenue is shared equally among miners (Men and Women).
3. Wilson Langela	6	
4. Andrea Mashauri	6	

Claim Owners:	No. of Miners:	Organisation of Production:
Bukandwe	44	Income distribution
1. Nogi	23	(a) Two types of income distribution:
2. Davda		1. The claim owner buys food
		2. Buys timber
		3. Pays for treatment (processing)
		4. Buys batteries
		5. Buys torch
		6. Buys Kerosine
		7. Fabrication of working toolds
		When production is obtained. claim owner is first allowed to mine for 10 ft to meet above costs. If gold is produced he sells it. If there is no gold, it is bad luck. After the claim holder has mined for 10 ft, mining by others starts. What is produced is shared at ratios of - 70% miners - 30% claim owner The ratio depends on ore produced.

When production is good 10 mineral brokers visit the site. At the time of the study when production is low, only 3 brokers visit the site.

Katente		
1. Co-operative Society of 240 members Owns 5 claims	240 No. reliable market for gold.	(a) Income distribution 30% claim holder (the Co-operative Society) 70% Mine workers Out of 70% - Those who sunk the pit to expose ore get 40% and those who help sinkers to start producing get 30%.

Many miners thought that it was a good job for them to be involved in mining for self employment. Many now regret to be involvd in mining. Comparing miners with nearest villagers, miners are better off but their expenditures are excessive. Miners also have farms to subsidize their income.

85% of mine camp people have emigrated to other areas. Their families face problems. Some children face food shortages and neighbours feed them.

There are very few miners who have been successful by opening shops in the nearest village.

Nyakafuru		
1. Mlaki	10 miners	Income distribution 70% miners 30% claim holder if mining tools are owned by miners.
2. Chumi		Income Distribution 30% claim owner) In terms of gold 70% miners) Miners provide own tools and own food OR 60% miners 40% claim holder if mining tools are owned by claim holers.

Source: Claim holders.

Appendix 6

MINERAL PRODUCTION PER MONTH

MINERAL	LOCATION	DISTRICT	ESTIMATED PRODUCTION	AVERAGE SELLING PRICE/UNIT (T.SHS.)	TOTAL VALUE (T.SHS.)
Gold	Itilima	Shinyanga Rural	180 gms	4500	810000
Diamonds	Mwadui (Williamson D.)	- do -	* 11510 carats	75600	870156000
Diamonds	Maganzo	- do -	45 carats	50000	2250000
			Sub - Total		873216000
Gold	Mwime	Kahama	648 gms	4500	2916000
Diamonds	Nyangh'wale (1)	- do -	225 carats	50000	11250000
Diamonds	Nyangh'wale (2)	- do -	8 carats	50000	400000
Gold	Busulwangili	- do -	1050 gms	4500	4725000
Gold	Kalole	- do -	3900 gms	4500	17550000
			Sub - Total		36841000
Gold	Bukandwe	Bukombe	480gms	4500	2160000
Gold	Nyakafuru	Bukombe	70gms	4600	322000
Gold	Katente	Bukombe	100gms	5000	500000
Gold	Matabe	Bukombe	30000gms	5000	150000000
			Sub - Total		152982000
			GRAND - TOTAL		1063039000

* Average of actual production for January - July, 1997

Source: Claim holders, miners and pit owners.

Apendix 6

DIAMONDS EXPORT BY WILLIAMSON DIAMONDS MINE

YEAR	QUANTITY	VALUE
	(Carats)	U.S. $)
1989	94,513	9,752,721
1990	75,979	7,393,459
1991	90,892	10,030,157
1992	70,706	8,300,500
1993	39,885	5,265,188
1994	22,567	2,898,383
1995	44,492	4,341,313
1996	118,538	11,566,362
1997 (Jan-July)	80,568	7,861,434
TOTAL	638,140	67,409,517

Source: Ministry of Energy and Minerals.

LOCATION	NO OF PITS	PRODUCTIVITY	NO OF WORKERS	WEIGHT MINED
Itilima	3	0.6 to 0.9kg/man/day	I0	I0-I5 drums of I5kg/day = I50-225 kg/day or 2-3 karai's of 20kg/week = 40-60kg/week or 6-9kg/day
Itilima (Kawika)	2	2.8 to 3.8kg/man/day	6	6-8 karai's of 20kg/week I20-I60kg/week or I7-23kg/day
" (Juma)	7	25kg/man/day -	8	Dewatering flooded pits
" (Amali)	2	4.8kg/man/day	Has 9 Ball Mill	300kg/week or 43kg/day
Mwime (Ntinginya)	3	20 to 23kg/man/day	I2 Has Ball Mill	6-7 bags of 40kg/day 240-280kg/day
Nyangh'wale (Soud)		2.9 tons/man/day to 5.9 tons/man/day	I7 Has Excavator Processing Plant Trucks	50-I00 Tons/day (dry season) 50 Tons/day (wet season)
Nyangh'wale		35kg/man/day	5) 6) 6) I7	90 buckets of 20kg per 3 days 600kg/day
MUKANDWE (NOGI) (Danda)	5 2	8.5kg/man/day	44) Has 23) Ball Mill	20 bags of 200kg/week 57I kg/day
Katente	4	0.95kg/man/day	240 Have Ball Mills	I0 buckets @ 40kg/week per pit 229 kg/day

Source: Claim holders

EXISTING GOLD MINING METHODS

Appendix 8

DISTRICT / MINING METHOD	SHINYANGA RURAL		KAHAMA		BUKOMBE		TOTAL	
	NUMBERS	%	NUMBERS	%	NUMBERS	%	NUMBERS	%
1.0 OPENCAST MINING								
1. Open pit	-		2	100	2	67	4	80
2. Benching	-		-	-	1	33	1	20
TOTAL			2	100	3	100	5	100
2.0 UNDERGROUND MINING								
1. Windlass (wood)	8	22	5	42	14	44	27	34
1a. Windlass (Steel)	1	3	-	-	-	-	1	1
2. Accesibility rope	9	25	5	42	-	-	14	17.5
3. Pit with ladders	-	-	-	-	-	-	-	-
4. Pit without ladders	9	25	-	-	-	-	9	11.25
5. Pit with rope	9	25	-	-	11	34	20	25
6. Pit without rope/has notches	-	-	2	16	7	22	9	11.25
TOTAL	36	100	12	100	32	100	80	100
3.0 MINE SUPPORT								
1. Soft rock (Timbering)	-	-	3	30	7	35	10	31
2. Hard rock (Natural Support)	1	50	3	30	4	20	8	25
3. Soft rock (No. support)	1	50	4	40	9	45	14	44
TOTAL	2	100	10	100	20	100	32	100
4. VENTILATION								
1 I.P.V.C	-	-	-	-	1	6	1	4
2. Compressor	1	17	-	-	-		1	4
3. Natural Ventilation (Shallow Pits)	2	33	3	100	4	27	9	38
4. None (Deep Pits)	3	50	-		4	27	7	29
5. Natural Ventilation (Connecting pits by crosscuts)	-	-	-	-	6	40	6	25
TOTAL	6	100	3	100	15	100	24	100

Source: Claim holders and miners

EXISTING GOLD MINING METHODS

Appendix8

DISTRICT / MINING METHOD	SHINYANGA RURAL		KAHAMA		BUKOMBE		TOTAL	
	NUMBERS	%	NUMBERS	%	NUMBERS	%	NUMBERS	%
5.0 EXTRACTION								
1. Moll point	4	40	3	50	5	45	12	44
2. Pick and Shovel	4	40	3	50	5	45	12	44
3. Jackhammer/Compressor	1	10	-	-	-	-	1	4
4. Blasting	1	10	-	-	-	-	1	4
5. Sokomoko	-	-	-	-	1	10	1	4
TOTAL	10	100	6	100	11	100	27	100
6.0 HOISTING METHODS								
1. Buckets/Plastic drums	4	22	-	-	5	46	9	26
2. Sisal bags/Gunny bags	3	17	3	50	3	27	9	26
3. Leather bags	2	11	-	-	-	-	2	5
4. Rope and windlass (wooden)	9	50	3	50	3	27	15	43
TOTAL	18	100	6	100	11	100	35	100
7. LIGHTING METHODS								
1. Torch	1	25	3	60	4	50	8	47
2. Vibatari (Open flame lantern)	3	75	2	40	4	50	9	53
TOTAL	4	100	5	100	8	100	17	100
8.0 DEWATERING METHOD								
1. Pumping	-	-	-	-	1	25	1	14
2. Use of buckets	1	100	1	50	3	75	5	72
3. Plastic drums	-	-	1	50	-	-	1	14
TOTAL	1	100	2	100	4	100	7	100

* **No water problem at Itilima. The water in one claim is rain water which flooded the pits.**

Notes shown on separate paper attached.

Source: Claim holders and miners

NOTES:

1. The survey aimed to assess the existence of particular mining methods in various mining areas visited and not aimed to determine how many miners use these methods.

2. The figures have been compiled from localities in the districts.

3. Where there are no figures, the methods are not practiced.

4. Where ventilation is reported "none" means that pits are deep but without ventilation measures taken.

5. Dewatering: There is no water problem at Itilima (Shinyanga). The figure shown under Shinyanga is rain water which flooded the pits during the rainy season.

   Underground water is a major problem at Nyakafuru, Bukandwe and Katente in Bukombe District.

6. Ventilation: The P.V.C. is used at Bukandwe (Bukombe District).

   It is a plastic pipe of 6 inches diameter installed from the top to bottom of the pits.

7. There is only one steel windlass at Mr. Amalis's claim at Itilima (Shinyanga). The other windlass reported are wooden windlass, made out of tree trunks and sisal rope tied around them.

8. Leather bags are used for hoisting at some of the pits at Itilima (Shinyanga) because they are wear resistant compared to sisal/gunny bags.

DISTRICT / MINING METHOD	SHINYANGA RURAL		KAHAMA		BUKOMBE		TOTAL	
	NUMBERS	%	NUMBERS	%	NUMBERS	%	NUMBERS	%
1.0 CRUSHING								
1 Mechanical jaw crusher	-	-	-	-	-	-	-	-
2. Manual hammer	6	100	3	100	4	100	13	100
TOTAL	6	100	3	100	4	100	13	100
2.0 GRINDING.								
1. Mchenical Batch/Ball Mill	1	17	10	40	2	40	13	36
2. Manual)Mortar and axle)	5	83	15	60	3	60	23	64
TOTAL	6	100	10	100	6	100	22	100
3.0 CONCENTRATION								
1. Panning/Sieving (Manual)	-	-	4	40	1	17	5	23
2. Sluice boxes	-	-	3	30	2	33	5	23
3. Amalgamation	6	100	3	30	3	50	12	54
TOTAL	6	100	10	100	6	100	22	100
4.0 REFINING								
1. Open heating	1	100	1	100	1	100	3	100
2. Mercury retort	-	-	-	-	-	-	-	-
TOTAL	1	100	1	100	1	100	3	100

Source: Claim holders and miners

DISTRICT / MINING METHOD	SHINYANGA RURAL		KAHAMA		TOTAL	
	NUMBERS	%	NUMBERS	%	NUMBERS	%
1.0 OPENCAST MINING						
1. Open pit	1	100	-	-	1	50
2. Benching	-	-	1	100	1	50
TOTAL	1	100	1	100	2	100
2.0 UNDERGROUND MINING						
1. Windlass (Conveyor belt Rollers)	-	-	4	36	4	36
2. Accesibility rope	-	-	4	36	4	36
3. Pit with ladders	-	-	-	-	-	-
4. Pit without ladders	-	-	-	-	-	-
5. Pit with rope/notches	-	-	3	28	3	28
TOTAL	-	-	11	100	11	100
3.0 MINE SUPPORT						
1. Soft rock (Timbering)	-	-	3	100	3	100
2. Hard rock (Natural Support)	-	-	-	-	-	-
3. Soft rock (No. Support)	-	-	-	-	-	-
TOTAL			3	100	3	100
4.0 VENTILATION						
1. Natural (Shallow pits)	-	-	4	100	4	100
2. None (Deep pits)	-	-	-			
TOTAL			4	100	4	100
5.0 EXTRACTION METHODS						
1. Picks and Shovel	1	100	1	50	2	67
2. Moil Paint	-	-	-	-	-	-
3. Sokomoko	-	-	-	-	-	-
4. Excavator	-	-	1	50	1	33
TOTAL	-	-	2	100	3	100

Source: Claim holders and miners

EXISTING DIAMOND MINING METHODS

Appendix 10

DISTRICT / MINING METHOD	SHINYANGA RURAL		KAHAMA		TOTAL	
	NUMBERS	%	NUMBERS	%	NUMBERS	%
6.0 TRAMMING METHOD						
1. Wheelbarrow	-	-	-	-		
2. Shovel	-	-	-	-		
3. By hand using bucket	-	-	1	50	1	50
4. Trucks	-	-	1	50	1	50
TOTAL			2	100	2	100
7.0 HOISTING METHODS						
1. Buckets/Plastic drums	-	-	1	50	1	50
2. Gunny Bags	-	-	-	-	-	-
3. Rope and Windlass	-	-	1	50	1	50
TOTAL	-	-	2	100	2	100
0.0 LIGHTING METHODS						
1. Torch	-	-	-	-	-	-
2. Vibatari (Open flame Lantern)	-	-	1	100	1	100
TOTAL	-	-	1	100	1	100
9.0 DEWATERING METHOD						
1. Pumping	-	-	1	50	1	50
2. Use of buckets	-	-	1	50	1	50
TOTAL	-	-	2	100	2	100

NOTE: 1. **Medium Scale Opencast mining is being carried at Mr Soud's Blocks, Nyangh'wale (Kahama) using excavators, pumps and trucks. The neighbouring artisanal miners use picks and shovels in the pits 10 to 15 metres deep.**

Source: Claim holders and miners

Appendix 11

EXPENDITURE ASSOCIATED WITH MINING

		Average Family Size
ITILIMA		
Claim Owner:	Buys ration for miners some own farms to feed miners Purchase of livestock, bicycles. Buy clothes shoes for women and children Operating cost Shs. 15,000/- per week Getting married Buy medicines for miners	6
Miners:	It has been noted that miners give first priority to their families in allocation of their expenditures and usually spend surpluses by investing in non-production assets. Some miners buy farms Few have savings. Most of them have no savings Buy food.	15
MWIME:		
Miners:	Buy cattle Supports family 50% of income	9
NYANGHWALE:		
Claim Owner:	Buys food and medicines for employees Food purchases, First aid Purchase working tolls	8 6

Woman Built a house at home village and paying school fees for children. Food vendor.

BUKANDWE:

Miners:	Buys timber Ore processing costs (Batch milling & hand crushing Buys torch, batteries and Kerosene Purchase tools Bought a farm and built a house at Masumbwe	

KATENTE:

Contributions towards village development activities such as schools, dispensaries	7
Construction of dispensary, and District Commissioners office Contribution towards purchase of a lorry, maize mill. Three miners started shops.	9

NYAKAFURU:

Miners: Purchase own mining tools

MATABE/BUSULWANGILI/KALOLE:

Boozing and women

KAKOLA:

One miner built a house and started pombe shop
One miner invested in construction of mineral processing area.
One miner (Pit owner) built houses at Kakola and Bariadi (home village)
Started hotel and bar.

MAGANZO:

Construction of classrooms at the village Primary School
Building their own houses.

Source: Claim holders and miners.

UNREPORTED ACCIDENTS IN SHINYANGA REGION

YEAR	DISTRICT (Location)	NUMBER OF VICTIMS	INJURIES			CAUSE - REMARKS
			MINOR	SERIOUS	FATAL	
1978	BUKOMBE (Kalente)	1	-	-	1	Roof Fall
1993	BUKOMBE (Kalente)	3	-	-	3	Roof Fall
1993-1997	KAHAMA (Nyangh'wale)	5		5	-	Roof Fall
1997	KAHAMA (Busulwangili)	53		10	43	Roof Fall
1997	BUKOMBE (Malaba)	36	-	-	36	Roof Fall
	TOTAL	98	-	15	83	

REPORTED ACCIDENTS IN SHINYANGA REGION

YEAR	DISTRICT (Location)	NUMBER OF VICTIMS	INJURIES			CAUSE - REMARKS
			MINOR	SERIOUS	FATAL	
1993	KAHAMA	2				Extent of injury and cause not established
1994	KAHAMA	5				Cause not established
1996	KAHAMA (Nyangh'wale	4		2	2	Fatal - collapse of trench Non-fatal- dropped into pit
1997	KAHAMA (Nyangh'wale	1			1	Roof Fall
1997	BUKOMBE (Kalente)	1			1	Roof Fall
	TOTAL	13		2	4	

Source: Zonal Mines Office, Shinyanga

Appendix 13

LOCATIONS VISITED DURING SECTOR STUDY

NO.	LOCATION	DISTRICT	DATE	MINERAL MINED
1	Itilima	Shinyanga Rural	28/08/97	Gold
			29/08/97	
2	Maganzo	Shinyanga Rural	15/09/97	Diamonds
3	Mwadui (Williamson Diamond)	Shinyanga Rural	16/09/97	Diamonds
4	Mwime	Kahama	02/09/97	
			04/09/97	Gold
5	Buzwagi Exploration	Kahama	02/09/97	Gold exploration
	Project, Mwime			
6	Nyangh'wale	Kahama	05/09/97	Diamonds
7	Soud Diamonds	Kahama	03/09/97	Diamonds
	(Nyangh'wale)		03/09/97	
8	Busulwangili	Kahama	06/09/97	Gold
9	Kalole	Kahama	06/09/97	Gold
10	Bulyanhulu	Kahama	06/09/97	Gold Mine Development
	(Kahama Mining Corp.)			
11	Kakola village	Kahama	06/09/97	Former Mining Village
12	Nyakafuru	Bukombe	08/09/97	Gold
13	Bukandwe	Bukombe	08/09/97	Gold
14	Matabe	Bukombe	09/09/97	Gold
15	Katente	Bukombe	10/09/97	Gold

LIST OF PERSONS MET

1. Madini Officials in Shinyanga and Kahama

   Mr. F. Nkwanga, Shinyanga Zonal Mines Officer
   Mr. O. Chambo, Shinyanga Region Mining Engineer
   Mr. Karunde, Shinyanga Mines Technician
   Mr. A. Samaje, Kahama District Mining Engineer

2. Shinyanga Region Miners Association
   Mrs. H. Nyingi, Chairperson
   Mr. D. Chagula Secretary

3. Claim holders and/or mine operators etc.

   Mr. Mahembe, Claim Owner (Itilima)
   Mr. A. Kamika, Claim owner (Itilima)
   Mr. D. Changula, Claim owner (Itilima)
   Mr. T. John, Food vendor and miner (Itilima)
   Mrs. T. John, Food vendor and miner (Itilima)
   Mr. M. Juma, Claim owner (Itilima)
   Mr. S. Mageshi, Miner (Itilima)
   Mr. H. Yusufu, Gold dealer and miner (Itilima)
   Mr. M. Salim, Claim owner (Itilima)
   Mr. D. Katunge, Miner (Itilima)
   Mr. D. Maduka, Miner (Itilima)
   Mr. A. Amali, Claim Owner (Itilima)
   Mr. M. Ntinginya, Financier/Pit owner (Mwime)
   Mr. M. Spemba, Kiosk owner (Mwime)
   Mr. C. Singu, Water vendor (Mwime)
   Mr. S. Shabani, Butchery operator (Mwime)
   Mrs. A. Kubiluha, Food vendor (Mwime)
   Mrs. M. Damino, Miner (Mwime)
   Mrs. C. Mabala, Miner (Mwime)
   Mr. K. Juma, Miner (Mwime)
   Mr. G. Mamboleo, Miner (Mwime)
   Mr. M. Manyanda, Mwime Village Chairman
   Mr. P. Paul, Mwime village Executive Officer
   Mr. Badar Soud, Claim Owner (Nyangh'wale)
   Mr. Kashabano, Geologist (M/S Soud Diamonds, Nyangh'wale)
   Mr. J. Mastapha, Claim Owner (Nyangh'wale)
   Mr. W. Langela, Claim Owner (Nyangh'wale)
   Mr. A. Mashauri, Claim Owner (Nyangh'wale)
   Mr. S. Lubegesela, Petty trader (Nyangh'wale)
   Mrs. L. Misana, Food Vendor (Nyangh'wale)
   Mrs. J. Paskali, Food vendor (Nyangh'wale)
   Mrs. C. Bundala, Food vendor (Nyangh'wale)
   Mrs. K. Mshali, Food vendor (Nyangh'wale)
   Mr. J. Lushu, Nyambula Village Chairman
   Mr. M. Ntalimbo, Nyambula Village Executive Officer

Mr. W. Langela, Chairman. Nyangh'wale mining camp
Mr. J. Mtengwa, Secretary, Nyangh'wale mining camp
Mr. M. Sitta, Miner (Nyangh'wale)
Mr. T. Lupilya, Miner (Nyangh'wale)
Mr. H. Ntinda, Miner (Nyangh'wale)
Mr. P. Malezu, financier and Foreman (Bukandwe)
Mr. A. Joel, Claim Owner and Businessman (Mwagi Magi)
Mr. Z. Bariabaza, Acting chairman. (Katente)
Mr. L. Masanja, Miner (Katente)
Mr. S. Nyalali, Miner (Katente)
Mr. B. Saidi, Foreman, Mlaki's Claim (Nyakafuru)
Mr. E. Chumi, Claim Owner (Nyakafuru)
Mr. P. Ngemwe, Claim owner (Nyakafuru)
Mr. J. Magulu, Chairman, Matabe Mining Camp
Mr. S. Nkamba, Secretary, Matabe Mining Camp
Mr. S. Mbambo, Kakola Village Butchery Operator
Mr. M. Chagula, Trader, Kakola Village
Mr. S. Gwanona, former Pit owner, Bulyanhulu
Mr. Z. Rwezama. Miner (Kakola)
Mr. M. Kadu, Mine Security Chairman (Kalole)

4. Others

Mr. Lopa, Administrative Manager, Kahama Mining Corporation, Mr. P. Songo Williamson Diamonds Ltd. Mr.. R. Theron, Exploration Manager, ANMERCOSA Mr. Makene, Kahama District Forest Officer.

MAP II

MAP SHOWING AREAS VISITED