SMALL SCALE GOLD MINING EFFECTS ON THE MINERS AND LOCAL COMMUNITIES IN SEMI-ARID REGION OF ETHIOPIA

Hailemariam Meaza
Department of Geography and Environmental Studies
Mekelle University,
P.O. Box 451, Mekelle, Ethiopia
e-mail: mushirjbd@gmail.com

Mushir Ali
Department of Geography and Environmental Studies
Mekelle University,
P.O. Box 451, Mekelle, Ethiopia
e-mail: mushirjbd@gmail.com

Solomon Hishe
Department of Geography and Environmental Studies
Mekelle University,
P.O. Box 451, Mekelle, Ethiopia
e-mail: mushirjbd@gmail.com

Zbelo Tesfamariam
Department of Geography and Environmental Studies
Mekelle University,
P.O. Box 451, Mekelle, Ethiopia
e-mail: mushirjbd@gmail.com

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Abstract
Small scale gold mining effects on the miners and local communities in semi-arid region of Ethiopia
North Ethiopian highlands are traditionally known for gold mining which has been means of livelihood of the rural community. The present work was conducted to investigate socio-economic conditions of gold miners, ways of obtaining the gold, their earning and negative consequences of the gold mining. On the basis of random sampling, 140 miners were interviewed. Moreover, focus group discussions transect walks and practical observations across the mining sites were made with team leaders on different issues of gold mining and its effects. Descriptive statistics was used to compute socio-economic characteristics, gold harvesting, and income dynamics. ANOVA was run to observe variations of income from gold mining and other sources, 2009 to 2012. The positive effects of gold mining for involved people were regarding income, employment, expenditure on education, health and food consumption. On the other hand, conflicting interest, communicable diseases, aggressive child labour, school dropouts, social disruptions and injuries were challenges of the small scale gold mining. The findings highlight that the income generated from small scale gold mining plays a pivotal role in reducing rural poverty. Therefore, providing integrated training for gold miners can mitigate the challenges of small scale gold mining and thereby to improve livelihoods of the small scale gold miners in Ethiopia.

Keywords
Gold mining, indigenous methods, highlands, society, transaction, Ethiopia
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1. Introduction

Ethiopian economy is dominantly based on the primary economic activities, which have left impacts on the society, traditions, working style, resource utilization and trade since millennia (Asiedu 2013). Ethiopia has favorable geological environment hosting varieties of mineral resources. Gold potentials sites are confined to Precambrian basement rocks known as Northern, Western and Southern greenstone belts. The Greenstone belts have large potential for any scale of gold mining. Small scale gold mining has been basic mineral and rocks production throughout the older civilianization of the country. The placer gold deposit has been mined traditionally for several thousand years back to biblical times (Young 1999).

Small scale gold mining has been a source of subsistence for the rural poor. Nearly one million people are engaged in small scale gold mining and about five million people are dependent on the gold mining occupation throughout the country (Schlüter 2006). The gold is mainly mined by individuals and cooperative units. About 10,000 miners are working collectively as organized cooperatives, the rest are individually informal workers. Both cooperatives and individual gold miners supplied about 20 tons gold to the National Bank of Ethiopia during last four years. Excluding the gold supplied by cooperatives and multi-national companies, Tigray regional state, Northern greenbelt, contributed 1733.42 kg gold to the National Bank of Ethiopia in 2012 (MoM 2012). There has been an increasing involving trend of multi-national companies to the gold mining sectors.

The small scale gold mining activities have played a role to reduce the poverty level of millions daily lives including 30 to 40% women participation (MoM 2012). Similarly, Bury (2004), Amunkete (2009) and Tieguhong (2009) revealed that small scale gold mining has been an important source of income for increasing the wealth of rural population by providing opportunities for alternative livelihoods; contributing to poverty reduction and for earning foreign currency. The small scale gold mining is considered as one of the new pacemakers for growth of the economy in Ethiopia. The government has started paying more attention to any scale of mining. Small scale gold mining legislations is promulgated to attract private investment to the mining sector in 2008. Consequently, unlike the previous years, mining sector contributes about 6% to the national economy from fiscal year 2008 (MoM 2012). However, the mining sector faces challenges due to high gold prices, conflicts, demographic disorder, biodiversity loss and climate change (Saldarriaga et al. 2013). It has also socio-cultural impacts including displacement, child labor, accidents, group quarrels and theft to the community (Benjamin 2002). The mining activity has resulted in prostitution, increase incidences of banditry, changes in indigenous lifestyle, and made competition among local residents for natural resources (Meisanti et al. 2012).

We have a knowledge gap on the activities of small scale gold mining to the public that area makes difficult to understand the existing condition of the small scale gold mining. There is fragmented study on the opportunities and challenges of small scale gold mining in the Northern Green Belt, Tigray Regional State. In order to understand the contribution of small scale gold mining activities to poverty reduction and boost the economic wellbeing of the involved peoples, the study was conducted in Asgede Tsimbla district with the following research questions: (1) What are the socio-economic conditions of the small scale gold miners? (2) How much gold is mined and income generated by small scale gold miners? (3) Which types of problems have appeared for gold miners and local communities?

2. Methods and materials

2.1 Geographical outlook of study region

The study was conducted in Asgede Tsimbla district, a part of the historical active mining region in the northern greenstone belt of Tigray (Fig.1) situated between $13^0$48' to $14^0$12'N latitudes and $37^0$32' to $38^0$12'E longitudes. Its elevation is 1800 masl of the plain in the East followed by mountain and hill ranges in the South West (2300 masl) in the catchment of the Tekeze River drainage system. The geology of the region includes sheared and deformed mafic and ultramafic rocks. The area is characterized by rugged topography forming steep ridges. Large shear zones contain several bedrocks, belonging to availability of gold composed with the oldest gold deposited rocks making the area richer in the most important mineral resources in the Northern Greenbelt (MoM 2012).

There are small gold mining sites situated near the farmlands, along the rivers and hillsides. Gold has been mined at different spaces of the study region in disorganized manner for many years. Mining is done by family landowners, workers hired by family landowners and immigrant from neighboring regions (Field work). There has been fast gold rush in the landscapes. Mixed farming produces food and cash crops along with livestock production. Livestock production is a major component of the livelihood system. Livestock herd sizes are substantial, supported by ample grazing pasture in the Tekeze gorge. There is abundant availability of water for livestock. Moreover, the study area is endowed with timber, gum Arabic production, wild and domestic animals. Due to its abundant natural resources endowment, the area is located in the regional growth corridor (Yirga et al. 2012).

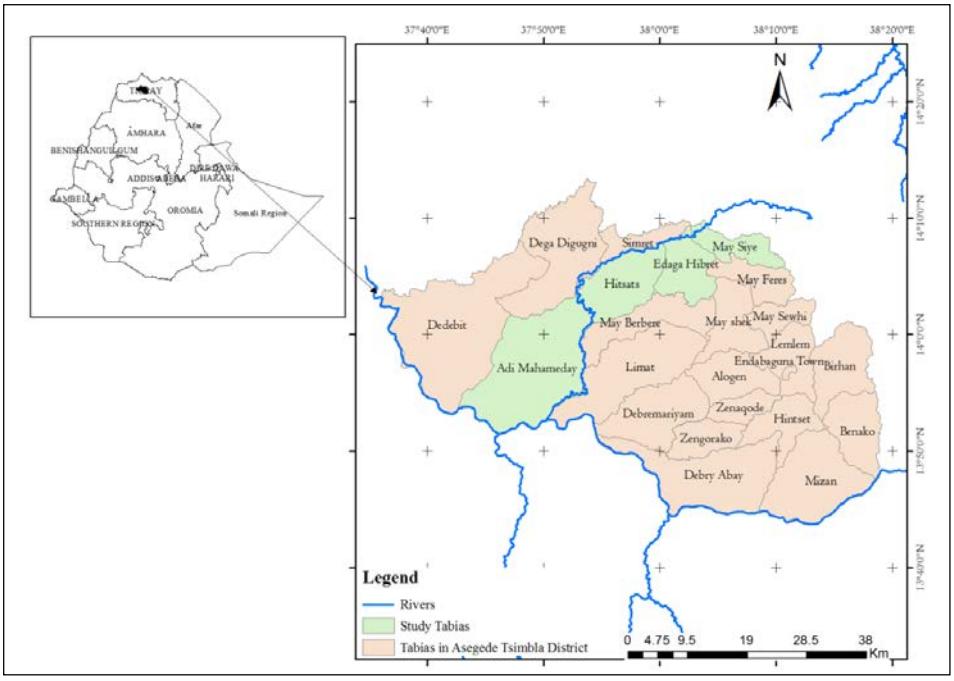

Fig. 1: Map of the study area.

2.2 Methods - Sample size and sampling procedure

We first visited Regional, Zonal and District Bureau of Energy and Mines to get practical knowledge about the potential gold areas in the Northern Greenstone belts. Then, Asgede Tsimbla was selected based on comparative reasons: the district accommodates large concentration of jobless youths (80,000 miners in 2012), the district has 217 mining sites (new mining sites have been emerging) and gold has been mined for many years in disorganized manner. Edaga Hibret, Hitsast, Mayhanse and Adi Mameday mining sub-districts were randomly selected (Tab. 1). There were total 140 sample of gold miners (both migrants and locals) drawn from the mining sites on random basis. Sampling was random to guarantee the representative.

Tab. 1: Basic information about the mining sites and sampled population.

Sub-districts	Mining sites	Population	N
May Siye	Eda Aram, Hiletay, Sur river, May Hamar, Genae,	4,064	35
AdiMahameday	Enda Setan, May Tselebadu, Enda Daero, EndaSaro, AdiGezemo, Endakofdad, Atsbi, Gubit	5,874	35
Hitsats	May Tiel, Kshewa, WshteGulti, Godgoday, Humerit, May wezer, May Aie, ElaAbadi, Daero	7,884	35
EdagaHibret	May Tsekente, Enda AbrhaHimo, Abi Kalay	5,036	35

Source: Based on field investigation, 2013.

2.3 Data collection techniques

Following the primary research approaches, consultation process was adopted to arrange national and district officials. Internal and external reports using a discussion sheet guide were collected from district and regional offices. Structured questionnaire was drafted to capture the background of the respondents, mining activities, the extent of gold mined from 2009 to 2012 (Gold price during mining season was collected to avoid inflation effects), and the negative impacts of gold mining for the migrated miners and the local communities.

We used the life histories of elderly people to understand the historical context in which the present development of small scale gold mining took place. Moreover, 10 focus group discussions were carried out about the emerging challenges of small scale gold mining. We also made interview of four Juwa leaders from each study site. Juwa is the small group gold miners who work on the basis of equal share in labor, profit and loss. In Juwa, every group member has indigenous knowledge to recognize the location of the gold pits headed by skilled elder miners for identification of the gold deposited plots based on the rock characteristics, soil texture and tree species. Transect walks with development agents, gold miners and local farmers were carried out to assess the challenges of the miners and local communities. Eight key informants from government offices were also considered to investigate the opportunity and challenges of the gold mining sites.

2.4 Data analysis

We assessed the assumption of normality of the observations using QQ and box plot to check out the observations in the study areas. Thus, creamy people having higher income were not considered in the statistical analysis. Descriptive statistics was used to compute social characteristics; income dynamics of gold mining. As the assumption of normality holded, we applied ANOVA model to recognize distribution of age, family size, Livestock (TLU), landholding, distance, mining experience and number of mining day per month (research question 1) across the study sites. In addressing research question (2), mined gold at individual and Juwa level were multiplied by current prices

to avoid inflation effects to compare income between 2009 and 2012. Moreover, ANOVA model was run to observe variations on gold income ranges 2009 to 2012 and among mining sites. Moreover, the same test was employed to investigate income among gold mining, their agricultural and non-farm activities. In addressing question (3), descriptive statistics was employed to investigate the negative impacts of gold mining for the individuals who engaged in the activity. Moreover, the negative impact of small scale gold mining for local community on their farmlands and downstream water pollution were narrated qualitatively to address research question (3). The 5% (α=0.05) level was considered in the entire test of significance.

3. Results and discussion

3.1 Socio-economic profile of small scale gold miners

The small scale gold mining work requires strong physical, mental strength to work the hilly tracks and insides of the caves, so it is prominently conducted by the males as Edaga Hibret (77.5%), Hitsast (72.5%), May Siye (80%) and Adi Mahameday (85%). Risky occupation, lack of resources, mining sites at remote spaces, and undulating relief as well as the prevailing culture discourage females for outdoor duties. In agreement with LU (2013), the respondents reflect that women are physically weak to be gold miners and most of husbands keep women at home. The study reveals that the participation of women in small gold mining is limited by the topography of the mining area and the local culture. Similar study indicates that geomorphology influences the role of women at artisanal and small-scale mine sites (Malpeli and Chirico 2013).

Tab. 2: Socio-economic characteristics of the respondents.

Miners characteristics	Mining site				Pooled Miners
	Edaga Hibret	Hitsast	May Siye	Adi Mahame	
Male (%)	77.5	72.5	80.0	85.5	78.87
Age (yrs)	25.74±1.3	28.86±1.33	28.34±1.8	26.69±1.76	27.71±1.55
Educated (%)	18.0	21.5	22.5	19.5	20.37
Married (%)	40.0	32.2	50.0	27.5	37.42
Family size (no)	4.43±0.38	4.43±0.36	4.74±0.33	5.31±0.43	4.72±0.37
Livestock size (TLU)	6.12±0.56	5.53±0.72	5.1±0.68	7.0±0.91	5.93±0.71
Land size (ha)	3.53±0.36	2.68±0.23	4.40±1.04	2.06±0.23	3.17±0.23
Farm and mining (%)	80.0	72.5	75	65	73.16
Migrant miners (%)	78	86.3	82.7	90	84.25
Distance to mining (km)	55.14±6.36	46.66±4.5	27.6±1.79	35.60±2.23	41.25±3.97
Mining days/month	18.57±0.89	20.7±0.59	18.9±0.98	21.29±1.06	19.91±0.88
Mining experience (yrs)	5.88±0.395	5.08±0.54	9.66±1.09	8.314±0.896	7.23±0.73

Source: Based on field investigation, 2013.

Age of workers has influence on the gold mining activities; generally require flexibility physical strength to enter the cave type of mines by rope in some specific cases to dig gold from the high-pitched slopes and muddy areas (see Fig. 2 and 3). It was recorded during investigation that small gold miners (male and female) belonged to mean working age from 25.74±1.3 to 28.86±1.33 years (M±SD) at different mining sites (Tab. 2). There was a majority of the teenagers (12-16 years old) involved for searching and digging the gold inside of the mines under the guidance of senior gold miners who have a skill to recognize gold. Engagement of children in the mining activities was common in the study areas. Family hardship and cultural values drive

child labor into the small scale gold mining communities. The involvement of teenagers was noted in processing to selling of the gold.

During the discussion with the officials, it was recorded that there was serious dropout from schools and educational process. Through gold mining earning, they support their family in many ways to economic survival and to take care of school going brothers and sisters. Such trendies retrogression in educational sector were similar findings of Andrea (2003) who sketched the situation of involved women, youth and teenagers in traditional gold mining in Ghana and Peru respectively. Due to prevailing poverty, child labor now widespread in many of the regions small-scale mining communities, is a product of a combination of cultural issues, household-level poverty, and rural livelihood diversification.

Small scale gold miners give priority to the life strategy; enabling themselves as well as their spouses skillful for gold mining profession instead of the education. The facts were recorded during field investigation that there were about 80% gold miners were illiterate, however, poor availability and accessibility of schools in the remote areas that decreases the miners and their children from the formal education (Tab. 2). It is a consideration that marriage is essential to live and enjoy productive life and one of the social indicators those make a person more acceptable in the society particularly Ethiopian traditional society (Ali 2012). But, occupational risk, remoteness and unreliable source of earning discourage marriages for the gold miners, the facts were probed during field surveys that there were 37.42% married gold miners (Tab. 2). Majority of them was forced bachelor who spent their times without wives at the mining sites. However, some miners, i.e., teenagers did not qualify age for the marriages.

Socio-economic aariables such as age category ($P=0.28$), family size ($P=0.15$), TLU ($P=0.06$) and landholding ($P=0.11$) of gold miners were homogenous across the study sites. The size of the family was 5.3 ± 0.4 in Adi Mahameday, followed May Siye (4.7 ± 0.3), Hitsast (4.4 ± 0.4) and Edaga Hibret (4.4 ± 0.4) respectively. We noted that with larger family size, more labor were allocated to gold mining. Moreover, gold miners from Edaga Hibret ($N=31$), Hitsast ($N=31$), May Siye ($N=24$) and Adi Mahameday ($N=35$) had good size of TLU (Tab. 2). It is remarkable that the gold mining is the seasonal occupation, the rest time of the years; they engaged themselves ranching of the livestock to earning and survival. However, the distribution livestock was more than six per miner at Asgede Tsimbla site because its vicinity covers abundant pasture and water availability which boot the livestock rearing. Though distribution of land holding (3.2 ± 0.2 ha) was among target respondents (Tab. 2), the number of individuals from Edaga Hibret ($N=19$), Hitsast ($N=17$), May Siye ($N=20$) and Adi Mahameday ($N=16$) who owned land were limited in size, fewer. However, 49% of the respondents were landless. This indicates small scale gold mining absorbs a number of landless youths, where landless is a critical problem due to the cease of land allocation to youths to arrest fragmentation, in the region.

Small scale gold mining is an attractive source of income to the livelihoods of landless farmers (52%) whose house construction is high in the region. May-August is the peak months for gold mining due to water availability for gold panning. The gold miners stayed 19.9 ± 0.6 days per month.

Fig. 2: Activities of small scale gold miners in the study sites.

Fig.3: Partial view of small scale gold mining, dangerous working condition (e.g. pit without support), in Asgede Tsimbla.

Most gold miners worked seasonally returning to their subsistence farms when agricultural work is required to supplement their insufficient incomes. It was recorded

during field investigation that, most of the gold miners have mining experience of four to eleven years. There were old miners (N=8) who had more than 18 years mining experience whereas they performed full time in small scale gold mining to earn income. As a result of the increase in gold price, there was a crowd of people who explore and pan the gold and other look for new mining sites. Unlike number of mining day per month (P=0.096), distance from home to mining sites (P=0.000) and mining experience (P=0.001) had significant variation among the mining sites. These factors can affect the income generated from gold mining. Gold miners mainly belonged to economically and socially marginalized communities. They move from one mining site to other site in search of gold in the enriched old rock deposits.

It was recorded that about 80% of the small scale gold miners were migrants who arrived from different corners of the country; Tigray, Amhara, Afar, and Addis Ababa by travelling distance from 10-700 km. It was recorded that distance and ethnicity still play role in small gold mining. A majority of miners arrived from within 40 km to join mining activities, belonged to Tigrayan ethnicity. They spent their time by taking self-cooked fast food items burkuta, kolo and kicha to fulfill the requirement of nutrition at working hours inside the mining. Such type of food was cooked on the site under open sky with help of a vessel by using cow dung and wild woods as fuel. Commonly abandoned mines were their home to spent nights where miners often used to victim of water borne diseases and malaria due to absence of civil amenities (Hilson et al., 2013). The combination of unbalanced meals and strenuous labor reduces the resistance of miners to disease in the study areas.

3.2 Production and income dynamics of gold mining

The streams, hillsides, farmlands and valleys are familiar sites for small scale gold mining operation. Dig and wash the soil and carry the soil to water methods were used to get gold. The miners dug to the depths of 7 m to 12 m both to the vertical and horizontal dimensions using rudimentary tools; shovels, picks, hammer, ploughshare, axes and metal bars to get gold rock-strewn. Later the extracted gold gravel soil was brought to wash nearby water bodies; streams, rivers, ponds and lakes. The dola panning indigenous method was popular to harvest gold (Fig. 2 and 3). Traditionally a gold panning method which was performed with the help plate made with local forest material, now plastic plate is used for the harvest the gold. The process of washing through pan is the most commonly used to separate gold from the silt, sand, and gravel. Any miner who panned the gravel for gold with hopes to be rewarded by the glitter fine material with the notion 'try the most to get the best'. Moreover, glittering gold was found along hillsides and stream sides due to the water wash from direct rainfall.

The mined gold size ranges from single big size (till 12 kg) in primary deposits to very fine gold (locally called Shihmet) in secondary deposits. The individual level, gold production varies with time and space (Fig. 4). Individual level harvested gold was 29.39±1.87 gm and 36.44±1.57 gm in 2010 and 2013 respectively. Excluding 10 outliers/unusual observations of gold grain, miners found different amount of gold ranges. Gold production at this scale in 2010 (P=0.000), 2011 (P= 0.013) and 2012 (P=0.000) was significantly varied among the mining sites. Such differences were determined by the number of mining days in a month, distance to the mining areas mining work, family size, experience, and skills of the gold miners.

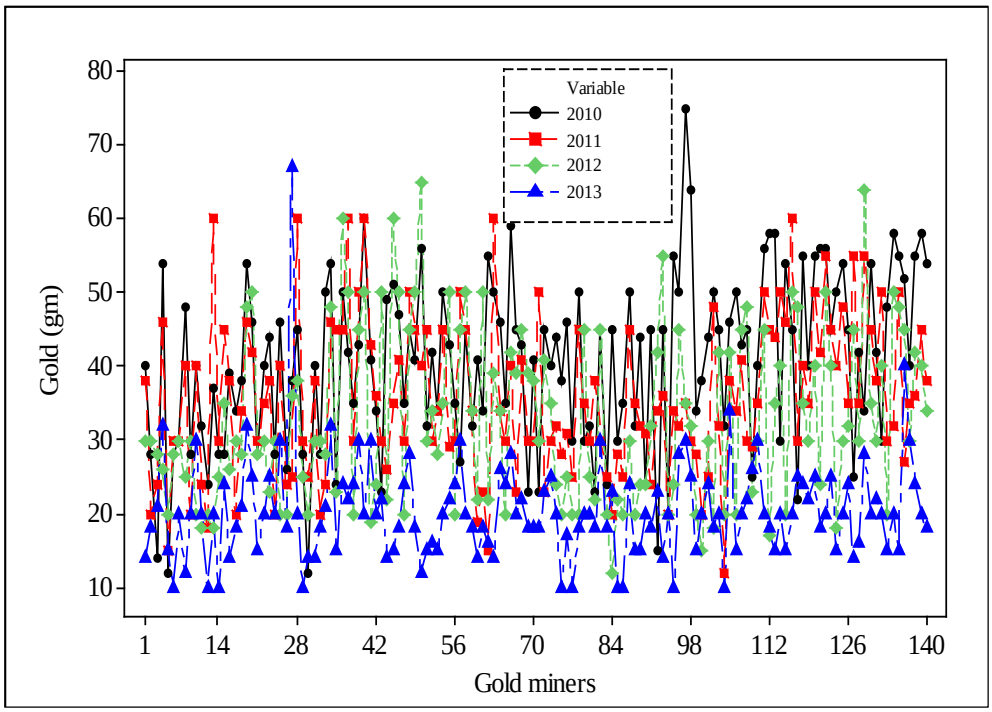

Fig. 4: Individual level obtained gold (gm).
Ethiopian Currency, 1US$=18.9 Birr, October, 2013.

Across the study sites, the gold was mined by small group/team of miners (Juwa) who obtained gold during 2013, about 2.5 kg, 12.6 kg, 60.3 kg and 70.2 kg in Edaga Hibret (N=4), May Siye (N=6), Adi Mahameday (N=5) and Hitsats (N=30), respectively. It was recorded during field survey that in spite of the reduction of the gold price due to high national inflation, the total mined gold both the individual and team level gold mining increased through time. According to the Ethiopian mining framework, gold is sold to licensed gold dealers and brokers. The licensed dealers (brokers and gold transaction cooperatives) are suppliers to National Bank of Ethiopia (MoM 2012). However, trade of gold was operating informally without valid gold mining license by between a majority of the gold miners and traders on sites, nearby rural service centres, towns where, gold smuggling was the common phenomenon. The community underscored that illegal gold transaction was worked with contrabands could erode the expected hard foreign currency from mining sector.

Small scale gold mining has been sources income earning opportunities for the rural poor who have limited opportunity for livelihood. In Edaga Hibret, the income individual gold miners obtained 43321±385 Birr, 46400±715 Birr, 36920±766 Birr and 18166±946 Birr from 2010 to 2013, respectively. Similarly, 57750±218 Birr, 58200±249 Birr, 47431±223 Birr and 17996±70 Birr were generated from Adi Mahameday in 2010, 2011, 2012 and 2013, respectively (Fig. 5). The annual gold income was significantly varied (P=0.00) across the study sites. Moreover, the pooled mining sites, the income generated from 2010 to 2013 was 50732±228 Birr, 50090±264 Birr, 42993±337 Birr and 17492±593, respectively with significant level of income variation (P=0.000). Team level gold mining shows that 11112500±5216

Birr, 23450000±2870 Birr, 21417500±7749529Birr and 30940000±9149 Birr was generated from 2010 to 2013.

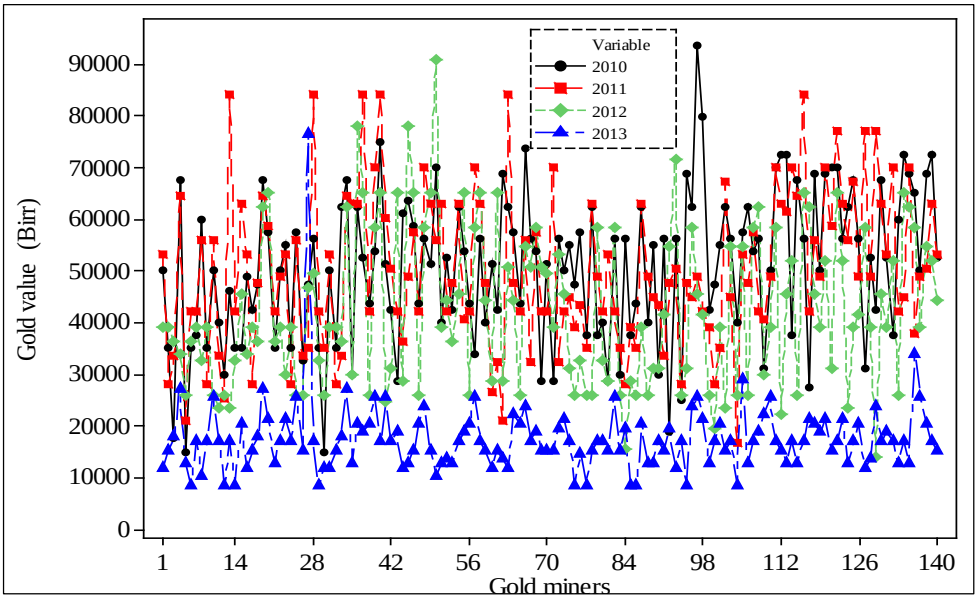

Fig. 5: Annual income of gold mining (Birr).

The income generated by team level is by far higher than at individual gold mining. This indicates that more work should be done to encourage small scale gold miners to work at team than individual level. Individual and team income declined in the year 2013 as compared the previous surveyed years due to rapid decline of national and international gold price. The time series gold price per gram (Birr) during 2010 to 2013 was 1250, 1450, 1300 and 800 respectively. Like most commodity prices in Ethiopia, gold price experiences significant fluctuations since the last decade. Shifts in supply arise from new gold deposits in the various mines across the world. The increase in gold price due to a shift towards safe investments in a period of crisis in the global economy, created a rapid increase in gold production.

The domestic inflation rate dropped the gold demand for jewelry, as result a decline in the income generation from small scale gold mining has declined in the recent months. Though price of gold has dropped, a continuous new entry small scale gold miner was recorded at mining sites due to limited alternative of livelihood strategies and poverty. The gold mining has been the lucrative profession a mass of rural population and immigrants for source of their incomes and livelihood (Bury 2004).

However, the miners have also their sources of earning from farm and non-form activities in which their family members were involved. The share of their earning was expended on food (30%), housing condition (20%) education (18%), health expenditure (15%), livestock (7%), farm implements (4%), money deposit (3.5%) and other assets (2.5%) respectively. The varieties food intake of their family improved shortly after they engaged in gold mining increased due to the gold income across the study areas. Majority of gold miners (78.6%) revealed that vegetables, milk, meat and indigenous fruits have been part of meals in their home. Moreover,

frequency of eating meals by family members per day (male child, female child, adult male and adult female) were reported double in the survey time than before joining the mining (Hilson et al. 2013; Tieguhong 2009).

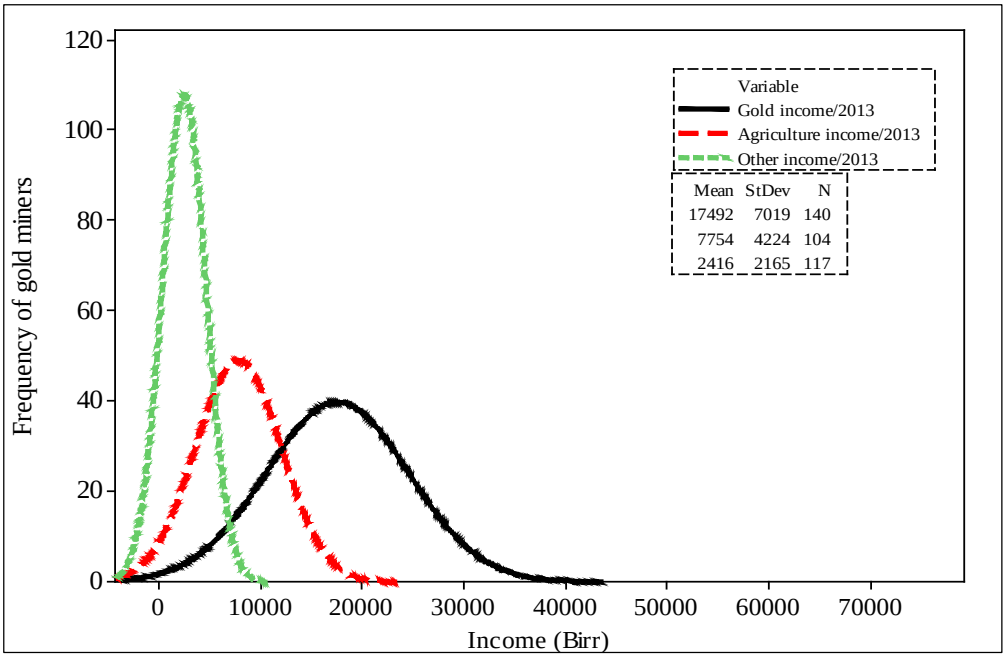

Fig. 6: Gold mining, agriculture and other sources of income at household level (ETB).

A chunk of the gold miners started their own business and also became transport operators to earn the income by increasing demand of mini trucks, taxies and three wheelers (bajaj) for passengers and freights. It was noted during discussion of gold miners at time of field investigation that the small scale gold mining has played role to afford basic needs and to reduce rural poverty as the miners. Recognition of the small scale gold mining as a formal mining activity has contributed a significant role in improving the living condition of the rural poor. In agreement with Crispin and Munyindei (2003), small scale gold mining is viewed in the national poverty reduction as it is effective vehicle of economic development if sound legislation and market chains are built. The findings communicate that small scale gold mining contributed to the sustainable development by providing employment, increasing local purchasing power, stimulating local economic growth and slowing urban migration. This could be then a source of sustainable livelihoods for millions of marginalized people in the Northern, Western and Southern belts Ethiopia (Hilson et al. 2013; Kuntala 2003; Tieguhong 2009).

3.3 Challenges for small scale gold mining

Small scale gold mining is significant livelihood activity within mining communities across the study areas. However, gold mining activity has left negative impacts on social, cultural and economic aspects. The incidence of child labor, alcoholism, banditry, change of lifestyle, conflict frequency, health risk, dishonesty and smuggling of gold miners and dishonesty mounted. It was recorded that the child labor was a widespread phenomenon whereas a number of school children who worked in gold

mines, and the trend was continued (Tab. 2 and 3). As a result, the rural youth of the mining areas as the school dropouts has been increased. Their presence (teens) was at gold deposit cites.

The presence of the gold mines changed the social structure of the farming society and affected their social interactions. There was a rise of local conflicts between the peasants and gold mining firms. The encroachment of farmlands for gold mining purposes caused conflict among the land users, locals and migrant miners regarding the claiming of ownership of the land resources. Gold miners invaded the lands of indigenous people which sometimes took the farm of serious. Besides, the competition to acquire, gold soil between miners and non-miners, local and migrants increased from time to time. Moreover, illegal gold merchants and absence of digital balance for gold marketing purpose caused continuous conflicts in the study areas. Other study confirms that artisanal mining sector is described as chaotic with little respect for law and order in mining areas (Hilson 2002; Michael 2003).

Though it is not inclusive for all miners, there was poor saving in the small scale micro finance. Using alcohol by small scale gold miners has been a common tendency at on/off mining sites. Moreover, the gold miners shifted lifestyle from cooperative to isolate. The insecurity regarding sheep/goats robbery, banditry, and road accidents; the rise of prostitution, alcoholism and the use of narcotic were recoded which continued the erosion on the social relations and solidarity. Analogous to this study, Dwomoh (2012) and Meisanti (2012) show that artesian mining alters the social and culture of the indigenous people.

Gold miners dig at the side of the hillsides, rivers, gullies and steep farmlands with less regard for slope stability. Stiff soil competition made them to have less attention to their safety. Underground pits were built that ranges from 1m to 2.7 m depth. These pits networked in underground channels that ranged from 6m to 27.5 m to allow light insides. As gold mines are unplanned where pit digs were structured in such a way that they concealed easily. Consequently, the incidence of injuries and deaths due to mudslides and boulder falls of ground were common whereas 38 people dead from 2008 to 2013. Moreover, 279 small scale gold miners were injured seriously. Measures for prevention of mining accidents and fatalities are not enforced so far that aggravate the situation in the future. The massive removal of trees and gold rich quaternary deposits reduces agricultural yields.

Tab. 3: Tabular trend of cultural and social impacts of small scale gold mining.

Impacts	EdagaHibret			Hitsast			May Hanse			AdiAhmeday		
	1	2	3	1	2	3	1	2	3	1	2	3
Child labor	86	10	4	94	6	0	78	10	12	76	20	6
Alcoholism	68	34	8	72	14	12	80	20	0	68	19	13
Banditry	30	70	0	20	71	9	28	67	5	24	71	5
Change of lifestyle	42	49	9	50	28	22	22	68	10	78	22	0
Conflict frequency	62	31	7	56	40	4	71	18	11	64	20	8
Health risk	85	6	9	92	0	8	77	18	5	91	9	0
Dishonesty	60	32	8	59	41	0	54	37	9	69	11	10

NB: 1 = Increasing, 2 = No change, 3 = Decreased; Figures in percentage
Source: Based on field investigation, 2013.

Gold miners exposed to malaria, water borne diseases and cholera as the mining sites had become breeding grounds for mosquitoes. The miners were exposed to dust, poor ventilation and water borne diseases. Dangerous working condition due to gold mining

in pit without support and ventilation aggravated health risks of the poor miners. As gold mining sites are in remote rural areas scattered, there was lack of basic road, health centers, potable and working water that ultimately bring health problem to the gold miners (Gajigo 2012; Stephens 2003).

Small scale gold mining increased drying up of drinking water; stream pollution; erupting marine habitats and farmlands erosion. This had deleterious health effects for miners and surrounding communities. Small scale gold mining is challenged by less technical assistance to identify the gold placer; informal mining operations without valid license and lack of basic infrastructures. Small scale gold mining manifests conflicts, land eviction, accidents, health problems, environmental damage, change in social order and resources depletion. In agreement with Nascimento et al., (2012) show that gold mining brings downstream impact of water reservoir which serves as a water supply for the local communities.

4. Conclusion

Ethiopia has experienced a gold boom from the small scale gold miners where the rural poor have become gold dependent by massive participation in the gold mining activities. The small gold mining has been a boon for the rural families those moved to mining areas from native places where poverty and limited livelihood was common. Therefore, small scale gold mining contributes to poverty alleviation through employment creation, income earning opportunities, and sustaining local businesses. It also generates revenue from sales, taxes, collecting royalty, source foreign currency earnings and saving of hard currency in substituting the imported mineral related inputs of the country. However, small scale gold mining operation has been challenged by less technical assistance to identify the gold placer; majority of miners and gold traders are operated informally without valid license, and lack of basic infrastructures. Moreover, the incidence of child labor, alcoholism, banditry, change of lifestyle, conflict frequency and dishonesty mounted across the study areas.

As a response to the challenges of small scale gold mining, we need to design strategies for sustainable development. Mining legislation, promoting awareness and providing training on the gold mining communities should be undertaken to improve the role of small scale gold mining for the future. There should be integrated work among the relevant stakeholders (e.g. Ministry of Mines and Regional Administrates) to tackle the challenges of gold mining and thereby enhance sustainable livelihoods for the rural poor. Particularly, co-operations with development partners in the areas of technical and material support to the small scale miners is required in order to overcome the challenges linked to small scale gold mining. As this study does not address the effect of traditional gold mining on environmental resources, we recommend further comprehensive study is required to fully capture the impact of any scale of gold mining on environmental resources. We are safe to conclude that improving small scale gold mining conditions as non-farm industry can absorb massive landless farmers (landlessness in increasing problem due to cease of land distribution in Tigray) and improving the contribution of small-scale mining to sustainable development in rural Tigray.

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SMALL SCALE GOLD MINING EFFECTS ON THE MINERS AND LOCAL COMMUNITIES IN SEMI-ARID REGION OF ETHIOPIA

Summary

Gold mining is one of the primary economic activities which have left impacts on the society, traditions, working style, resource utilization and trade since millennia on Ethiopian economy. Mainly gold is mined at highlands on the northern of the Ethiopia. But Small scale gold mining to the public that area makes difficult to understand the existing condition of the small scale gold mining. There is fragmented study on the opportunities and challenges of small scale gold mining in the Northern Green Belt, Tigray Regional State. In order to understand the contribution of small scale gold mining activities to poverty reduction and boost the economic wellbeing of the involved peoples, the study was conducted in Asgede Tsimbla district to assess socio-economic conditions of the small scale gold miners and to investigate contribution of gold mining in income generation by small scale gold miners, and describe problems faced during gold mining have appeared for gold miners and local communities.

The small scale gold mining work requires strong physical, mental strength to work the hilly tracks and insides of the caves, so it is prominently conducted by the males. It is a risky occupation performed lack of resources at remote spaces. There was a majority of the teenagers involved for searching and digging the gold inside of the mines under the guidance of senior gold miners who have a skill to recognize gold, processing for selling. Majority of gold miners were illiterate, whereas, poor availability and accessibility of schools that decreases the miners and their children from the formal education. A chunk of miners were either bachelor or forced bachelor who spent their times without wives at the mining sites. However, some miners, i.e., teenagers did not qualify age for the marriages. The gold mining is the seasonal economic activity, the rest time of the years; they engaged themselves ranching of the livestock to earning and survival. Most gold miners worked seasonally returning to their subsistence farms at different corners of the country by travelling distance till 700 km. Commonly abandoned mines were their home to spent nights where miners often used to victim of water borne diseases and malaria due to absence of civil amenities. They spent their time by taking self-cooked fast food items to fulfill the requirement of nutrition at working hours inside the mining. Such type of food was cooked on the site under open sky with help of a vessel by using cow dung and wild woods as fuel.

The dola panning indigenous method was popular to harvest gold. The process of washing through pan is the most commonly used to separate gold from the silt, sand, and gravel. At Individual level harvested gold was 29.39±1.87 gm and 36.44±1.57 gm during 2010 and 2013 respectively. The gold was mined by small group/team of miners (Juwa) who obtained gold during 2013, about 2.5 kg, 12.6 kg, 60.3 kg and 70.2 kg in Edaga Hibret, May Siye, Adi Mahameday and Hitsats respectively. Thus, small scale gold mining has played role to afford basic needs and to reduce rural poverty. In spite a significant role of small scale gold mining in improving the living condition of the rural poor, Child labor, alcoholism, banditry, change of lifestyle, conflict frequency, health risk, dishonesty and smuggling of gold miners and dishonesty, alcoholism, banditry, change of lifestyle, conflict frequency, health risk, dishonesty and smuggling of gold miners and dishonesty are common challenge of small scale gold mining.