Economic, environmental and social impacts of small-scale mining

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ABSTRACT: For many years, large-scale mining has supported the social and economic development of many countries. In the developing world, it will continue to provide the technological development and employment. In Africa, particularly in some Southern Africa Development Community (SADC) countries, large-scale mining has contributed over 90% of all foreign exchange earnings, 60% of gross national product, 50% of total government revenue and 30% of total employment. Similarly, small-scale mining is expanding rapidly providing a source of livelihood for people in many developing countries particularly those in rural and semi-urban Africa, Asia and Latin America. There are currently 13 million small-scale miners in the world today, out of which as many as 4 million is female, though many work part-time. In Africa the participation of women is up to 60 per cent in some mining areas, actively involved in processing of raw materials, including crushing, grinding, sieving, washing and transporting of minerals. In the Sub-Saharan Africa, particularly, Zambia, Zimbabwe and Tanzania, women have formed associations of "Women in Mining" to spearhead their mining activities, and women and children crushing marble for sale is a common feature on Lusaka roads. In Latin America women undertake similar activities and, women and children can often be found scavenging for ore and gemstones. Hundreds of thousands of children as young as 9 also work in small-scale mines in the world, often in intolerable conditions simply to enhance family earnings or to earn just enough food to live. Unfortunately, this trend will continue as shown by International Labour Office (ILO) survey of small-scale mining activity in 35 countries in Africa, Asia and Latin America, which showed that the sector grew by an average of 20 per cent in the last five years, and that levels of growth are expected to continue. Zambia, for example, since early 1960's, has become an important producer of gemstones including a significant amount of the world's emeralds, amethysts and aquamarines. In certain places, this has lead to changes of cultural, social and economic patterns as infrastructure and transportation has brought some development. In Tanzania, it is estimated the labour involved in artisanal gold mining rose from 100 000 in 1989 to more than 500,000 in 1995 conducted in informal, poor mining and processing technology. The construction industry in Zambia, for example needs more resource reserves to match with the growing urban population as more and more people are becoming urbanised. However, despite the anticipated economic returns, small-scale mining is often uncontrollably, employing large numbers of women and children in dangerous conditions with fatality rate of up to 90 times higher than mines in industrialized countries, says a report by the International Labour Office (ILO).

Small-scale mining is mainly concerned with the exploitation of industrial minerals and rocks (Table 1), precious and semi-precious metals, and energy resources such as coal. However, depending on the size of a mine working (production of ≤ 50,000 metric tons of unprocessed material annual – UN 1972 definition of small-scale mining), some base metal mining often in the large-scale mining can be classified as small-scale undertaking. Small-scale mines can account for as much as 80 to 100 per cent of gold, diamond or gemstone production in Burkina Faso, Cuba, Guyana, Mozambique, Myanmar and Niger and more than 50 per cent in Bolivia, Mexico, the Philippines and Tanzania, says an ILO report. Evidently, depending on the size of deposits, the economic significance of small-scale mining can be considerable, particularly for communities lacking any alternative sources of employment or income. On the industrial mineral and rocks, Zambia, for example produces garnets, tourmaline, smoke quartz, topaz and small amounts of ornamental stones, such as sodalitic syenites, marbles and many types of granites in addition to the gemstones above. Industrial minerals such as limestone, talc, gypsum, fluorspar, clays, feldspar, mica, barite, corundum, graphite and phyllite occur but their potential is not known in Zambia, but are mined in many parts of the world. Gold, silver, selenium and platinoid group of metals are produced as by-products of other metals by Zambia Consolidated Copper Mines and currently gold is mined in the re-opened Dunrobin Mine.

The economic significance of small-scale mining is seen in the provision of basic necessities, particularly to rural communities in the developing world as source of income,

though it slowly becoming an economic spinner for most countries. The export of high-value metals and minerals from small-scale mines can make a major contribution to foreign exchange earnings. In China, gold production from small-scale mining is currently worth about US$200 million a year; in Bolivia and Brazil about US$180 million; US$140 million in Indonesia and about US$250 million in Peru. Gold and gemstones worth US$1 billion a year are estimated to be produced in sub-Saharan Africa. In Zambia, for example, the European Union estimates about $200 million dollars annually from the mining of gemstones alone if the industry is coordinated properly. However, because of lack of infrastructure and coordination, Zambia's earnings are below $20million a year.

The environmental aspects result from the activities involved in small-scale mining including exploration, mine development, exploitation and refining. In the exploration and mine development stages, techniques include sampling, pitting and trenching, sometimes involving the removal of the overburden either manually or machine digging, hydraulic methods or blasting. The development of mine site may take place including the sinking of shafts, open-pits, surface facilities including roads. In the exploitation and refining stages, the mineral is delivered from the mine site to the processing facilities where the waste material is separated from the ore, and further refined if necessary. The ore is concentrated through various methods including gravity separation for gold, gemstones, iron ore, asbestos and coal. Since small-scale mining has been operating informal, these activities have become uncontrolled resulting in environmental degradation including loss of biodiversity and ecological systems at mining and waste disposal sites, settlement areas, change in landscape and degradation of suitable land. Health effects may include inhalation of toxic gases and vapours, unsanitary and unsafe working conditions. However, real problems in many small-scale mines are the inadequate, and use of inappropriate or unsafe equipment. Cave-ins from unsupported tunnels, rock falls, perpetual dampness, inadequate ventilation, exhaustion and constant exposure to heat, noise and dust also take a toll on miners health and safety. Accidents and deaths are prevalent in small-scale mines, perhaps highest in small-scale underground coal mines of China, India and Pakistan. In China more than 6,000 fatalities are estimated to occur in small-scale mines each year whereas in Pakistan, in 1998, 64 miners lost their lives in mines producing 1.6 million tons of coal, a fatality rate of 40 workers per million tons. Natural disasters also exact a high toll in miners' lives, for example, 100 gemstone miners were killed in Colombia in 1998 by a mudslide; more than 100 miners were killed by floods in Tanzania in 1997 and about 70 in 1998. In China in 1996, more than 400 coal miners died in three separate gas explosions. In Bolivia, as many as 3 fatalities and 15 serious injuries occur each month during the exploitation of a closed tin mine. A similar situation prevails in Zimbabwe, mainly due to miners re-entering closed mines to illegally mine gold from pillars and alluvial mining of uncompacted river banks. However, lack of sanitation facilities and water pose a more acute health hazards and sickness than mine accidents. The mining communities are commonly overcrowded, consisting of makeshift huts with most of the processing of raw minerals often done at home and water sources that may also serve as domestic water supply. Silicosis and mercury poisoning are occupational hazards of the mining community, including the wives and children of miners. In Ghana, women and children as young as 14 have been diagnosed with advanced stages of silicosis from grinding gold-bearing ore at home.

The frequent rush-in by members of the public to prospective areas means that health and safety considerations are often ignored resulting in dislocation of local population due to influx of workforce and families. This may result into loss of religious, historic, cultural and game reserve sites, often leading into conflicts over water, land and wildlife resources.

Changes in the physical environment and biodiversity due to mining activities have a social and cultural impact on the population. It is important to take into consideration all these activities in the planning, mining and at closure in order to have a sustainable exploitation of resources and a clean environment. This paper outlines some of these vices in the hope that better methods would be found that would take into consideration the various activities of small-scale mining and their impact on the environment and society for a better future.

Table 1. Industrial rocks and minerals

GROUP	ROCKS AND MINERALS
Construction Materials	a) cement raw materials b) crushed stone, gravel, sand c) dimension stone d) lightweight aggregate e) slag f) gypsum g) marble, slate
Chemical stone and minerals	h) limestone i) dolomite and magnesite j) rock salt (NaCl) k) metallurgical additives
Fertilizer Minerals	l) phosphate m) nitrate n) potash d) sulphur
Abrasives and clays	a) corundum and emery b) garnet c) diamond d) quartz e) diatomite f) pumice and scoria g) Tripoli and novaculite
Ceramic materials	a) clays b) refractory minerals c) quartz sand
Miscellaneous	a) pegmatite minerals: e.g. emeralds, amethyst, aquamarine b) graphite c) asbestos d) talc e) zeolites f) borates g) bromine