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# Assessment of the Scale of Artisanal Mining in Bangwe Township, Blantyre

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## Abstract

Even though mining contributes less than 1 % to Malawi's gross domestic product (GDP), it is central to the government's sustainable development goals strategy and spearheaded to be the backbone of Malawi's economy. Little is known about the scale of artisanal quarry mining production, mining methods used, capital requirements, its diversity and distribution across different areas in Malawi. Present study seeks to fill that gap by assessing the scale of artisanal and small scale quarry mining activities in Bangwe Township. With a population of 170, 350, it represents 21% of the total population of Blantyre city which has 809, 397 people. The township was chosen as it is the main hub and supplier of artisanal aggregates to surrounding areas in Blantyre. In addition, the township has many unemployed youth with a high potential to get involved in artisanal mining thereby improving their lives. Most youth have a negative perception about artisanal mining as it is viewed as a non-profit making and labour intensive business. There are no gemstone mining sites in Bangwe Township. It was also found that there are 7 artisanal quarry mining sites in the township comprising Ntopwa, Mpingwe, Mvula, Number One, Namatapa, Namiyango and Chikunda. On average, each quarry mining site produces 5 wheelbarrows per day and sells at US\$2.66 per wheelbarrow. As most builders require quarry for construction projects, the quarry miners sell at least 0.5 tonnes per day. The output of this study has created a database of artisanal quarry mining activities and the level of active youth involvement in artisanal mining in Bangwe Township. Policy makers will use the new knowledge to develop strategies that will foster the growth of artisanal quarry miners and empower the youth to join the artisanal mining business.

**Keywords:** Bangwe Hill, Mpingwe Hill, Mining Method, Quarrying, Small Scale Mining, Social Enhancement

## 1. Introduction

Despite limited technical knowledge, low productivity, dishonest buyers, lack of finance, equipment and cooperative groups, artisanal and small scale mining is an important entrepreneurial activity carried out in communities to make a living, support families and create employment. Little is known about the scale of artisanal mining production, mining methods used, capital requirements, its diversity and distribution across different areas in Malawi. The questions that arise are: "who is mining and for what purpose; what do different groups of artisanal miners require to improve their operating conditions and living conditions". Present study seeks to fill the artisanal mining technical information gap through the assessment of the scale of artisanal mining activities and level of active youth mining knowledge in Bangwe Township as it has an impact on socio-

economic development, environmental management, health and safety. Bangwe Township was chosen as it is the main hub and supplier of artisanal aggregates to surrounding areas in Blantyre, Malawi. In addition, the township has a lot of unemployed youth with a high potential to get involved in artisanal mining thereby improving their lives. Malawi youth unemployment rate for 2019 was 7.52%, a 0.04% increase from 2018.

According to Zvarivadza (2018), a research drive towards sustainable means of undertaking artisanal and small-scale mining (ASM) has to be developed to bring sanity and transparency in the minerals industry. Peaceful and all-encompassing approaches have to be devised in order to formalise ASM because ASM is a significant source of livelihood for mainly the poor and those who are unemployable due to lack of professional skills, a vivid fact governments cannot afford to ignore (Zvarivadza, 2018). In many developing countries such as Malawi, ASM is largely a poverty-driven activity which plays an important economic role (Hentschel, 2002). According to Hentschel (2002), many of the potential economic benefits of the ASM sector are lost through poor practice in mining, processing and marketing the target minerals; absence of adequate legal frameworks and secure rights for miners and communities; underdeveloped local governance structures and institutions.

According to Phoya (2015), artisanal mining is a livelihood strategy for between 13,500 to 40,000 people in Malawi and many continue to operate informally thus making it difficult to obtain statistics on their production and sales. Phoya (2015) further explains that Malawi's government must employ other strategies for managing and regulating ASM that go beyond legislation to ensure sustainable development outcomes. To effectively develop and deploy policy responses to reclaim ASM sites, an understanding of the locations and spatial distribution of the ASM sites is a necessary prerequisite (Kumi-Boateng & Stemn, 2020). Malawi was admitted as an Extractive Industries Transparency Initiative (EITI) candidate country in October 2015 and the MWEITI process covers three sectors: mining, oil and gas, as well as forestry (Stephens, 2015). Stephens (2015) further explains that ASM in Malawi is generally carried out through labour intensive methods for: limestone for lime production, terrazzo for the construction industry, rock aggregate crushing for quarry stone, river and dambo sand extraction for construction, clay for ceramics and pottery, extraction of saline soils for salt making gemstones and gold panning. ASM requires a Mineral Permit, Mining Claim Licence and Reserved Mineral Licence (Government of Malawi, 2014).

It is hoped that the output of this study will help create a comprehensive artisanal mining technical database, foster the growth of artisanal miners, and empower the youth to join the artisanal mining business.

## **2. Materials and Methodology**

### *2.1. Study Area*

Bangwe, a peri urban Township of Blantyre, Malawi is located at Latitude -15.813976 and Longitude 35.096475 to the east of Blantyre central business district. With a total area of 1020 hectares, Bangwe is one of the most populous townships in Blantyre city with a population of at least 170,350 people distributed in 33 villages and 41,456 households (Kaonga, Kambala, Mwendera & Mkandawire, 2013) representing more than 21% contribution to total population of Blantyre city which has 809, 397 people. Within its vicinity are Mpingwe Hill and Bangwe Hill. The study areas mainly comprise of biotite gneiss, granitic gneiss, feldspar gneiss and weathered gneiss. The granitic gneiss and biotite gneiss being stronger rocks are suitable for quarrying as compared to feldspar gneiss and weathered gneiss which are weaker. Table 1 shows the physical properties of rocks mined and processed by artisanal miners in Bangwe Township. These properties are a determining factor on what type of mining method to use for crushing the rock. The geology of Malawi is part of Kibaran orogeny formed through continental collision that constructed Rodinia as known in Africa (Malunga, 2018). Malawi is primarily composed of Archean and Paleoproterozoic (Ubendian) terrain which is dominated by the Basement Complex rocks later overlain by Karoo sedimentary rocks and intruded by basaltic/dolerite dykes and sills. The Permo-Triassic period was later followed by Upper Jurassic – Lower Cretaceous period which saw the intrusion of syeno-granitic and nepheline syenite rocks later intruded by volcanic rocks infilled by carbonatite and alkaline dykes. As shown in Figure 4, the Southern part of Malawi is dominated by these rocks and have been grouped as Chilwa Alkaline Province. The same period saw sedimentary deposition characterized by Dinosaur Beds. The above rocks have been overlain by Tertiary – Pleistocene rocks characterized by consolidated to semi

consolidated beds grouped into Timbiri, Chiwondo, Chitimwe and Alluvial. Minor volcanic activities have been witnessed through existence of Songwe Volcanics (Malunga, 2018).

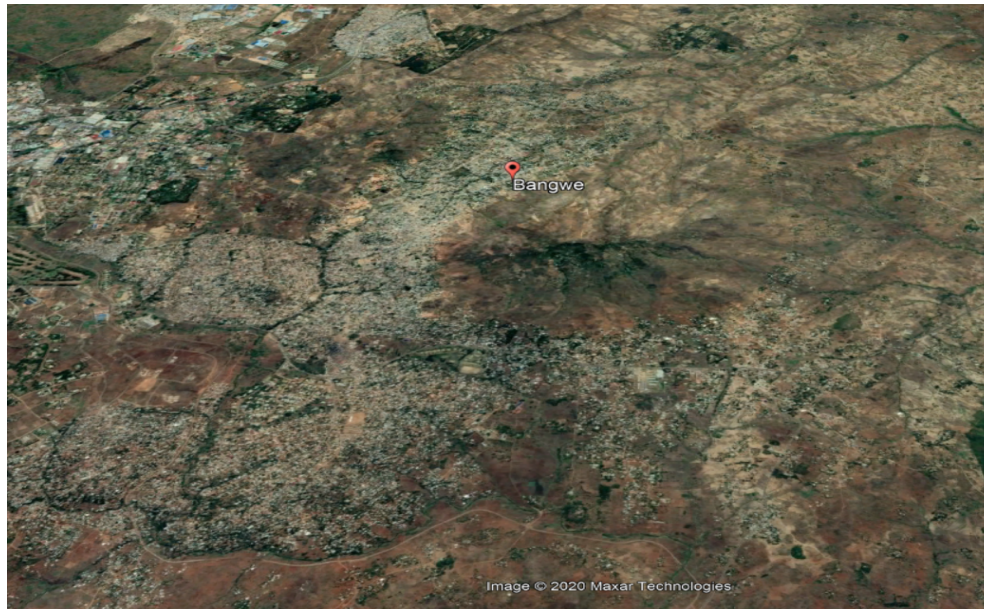


Figure 1. Aerial view of Bangwe Township (Google Earth 2020)

Table 1. Physical properties of rocks

Rock Type	Density [g/cm <sup>3</sup> ]	Abrasion Index [-]	Work Index [kWhr/ton]	Minerals
Limestone	2.69	0.0256	11.61	Calcite
Granite	2.68	0.3937	14.39	Quartz, Feldspar, Potassium Feldspar, Biotite, Muscovite, Amphibole
Sandstone	2.64	0.1831	12.77	Quartz
Basalt	2.94	0.2	19.72	Olivine, Pyroxene, Plagioclase Feldspar, Iron oxides
Gneiss	2.77	0.45	15	Feldspar, Quartz, Biotite, Muscovite, Amphibole

## 2.2. Procedure

The following steps were followed in the methodology:

- Conducting a scoping study to determine the scale of artisanal mining activities in the township and to design the reporting procedure
- Collection of data which provide basis for the present study. This involved visiting artisanal mining sites and collecting data comprising: equipment/tools used, quantity and quality of aggregates produced, customer base, capital invested, sales/earnings, labour requirements and mining methods
- Statistical analysis of production rates, cost expenditures and revenue generated

## 3. Results and Discussion

The researcher found that there are no gemstone mining sites in Bangwe Township. Approximately, 7 artisanal quarry mining sites are located in various areas of Ntopwa, Mpingwe, Mvula, Number One, Namatapa, Namiyango and Chikunda in Bangwe Township. The daily rate of productions, mining methods and equipment used are similar on all mining sites. The cost per wheelbarrow has a mean of US\$2.66 and a standard deviation of  $\pm 0.01$ . The daily rate of production has a mean of 5 wheelbarrows per 8 hour working day and a standard deviation of  $\pm 1.00$ . Therefore, to illustrate the scale of production in Bangwe, one mining site was used as a proxy because of its centrality to Limbe. The proxy mining site located in Ntopwa area at Latitude  $-15.820998^\circ$  and Longitude  $35.072593^\circ$  (Figure 2) has a team of two miners that collect, heat and crush the stone. The work is



physically demanding and poses a lot of health and safety risks comprising bodily injury to fingers and eyes by hammers and flying stone chips respectively, and respiratory problems through inhaling of dust.

The mining tools are summarized in Table 2 and shown in Figure 3 where one of the miners at Ntopwa mining site is conducting preliminary works by following the rock vein using a chisel. Table 3 shows the cost of the tools and materials used for the artisanal mining activity. The mining method summarized in Table 2 involves digging/excavating around the rock to a depth of 1.5m, placing tyres, firewood and charcoal at the bottom of the exposed rock (Figure 4). A match/lighter is used to ignite the fire while ensuring proper coverage around the rock to minimize escape of heat or entering of air which would affect the loosening of the rock. The rock is left to burn for 24 hours and then the next day after it cools crushing takes place using chisel, 7 and 14 pound sledge hammer. The procedure is labour intensive and requires a lot of energy as well as safety precaution to hammer the rock using the 14 pound sledge hammer as it is heavy.

The mining site produces 5 wheelbarrows of rock aggregate (1 inch and  $\frac{3}{4}$  inch sizes as shown in Figure 5) per day working 8 hours. The cost per wheelbarrow is US\$2.66. A 1 tonne lorry gets filled with 10 wheelbarrows (implying that 1 wheelbarrow equal 0.1 ton) equivalent to US\$26.20. Challenges faced comprise lack of equipment, lack of finance, unwillingness of the youth to work for the miner, few customers, competition from big quarry companies and lack of shelter from the sun/rain. Availability to work depends on demand and orders for the aggregate. The typical customers are home owners and private individuals. Large abandoned pits without reclamation leads to environment, health and safety concerns to the general public (Figure 6).

Table 2. Artisanal quarry mining tools used in Bangwe Township

Step	Mining Method	Mining Tool	Purpose
1	Demarcation	Hoe, crowbar, chisel	Marking the area to be excavated
2	Excavation	Hoe, pickaxe, crowbar, chisel	Excavate large rock boulders up to 1m in diameter. Penetrate deep rock joints and break apart.
3	Heat/fire setting	Wood, tyres, charcoal	Spalling. Crack and loosen large rocks to a depth of 1.3 m.
3	Pre-crushing	14 lb sledge hammer, chisel	Reducing large boulders of rock to $\frac{1}{4}$ - $\frac{1}{2}$ m diameter stones to be carried by buckets
4	Transportation	Buckets, trolleys, wheelbarrow	Carrying stones to crushing/selling point
5	Crushing	6-7 lb sledge hammer, Hammer	Crushing stones to final sizes: $\frac{1}{2}$ ", $\frac{3}{4}$ " or 1" diameter
6	Sieving	Metal screen, shovel	Removing fines from product

Table 3. Cost of mining tools and materials in Limbe hardware shops

Tool/Material	Cost (US\$)
Used tyres	2
Firewood	1
Charcoal	5
Chisel	6.63
14 lb sledge hammer	25.86
7 lb sledge hammer	19.23
6 lb sledge hammer	12.60
Hammer	7.89
Pick	7.82
Hoe	3.98
Shovel	7.89
Slashers	3.91
Wheelbarrow	52.38
Rake	9.95
Panga Knife	1.99

Spirit Level	5.24
Crowbar (locally known as 'Mgwala')	12.60

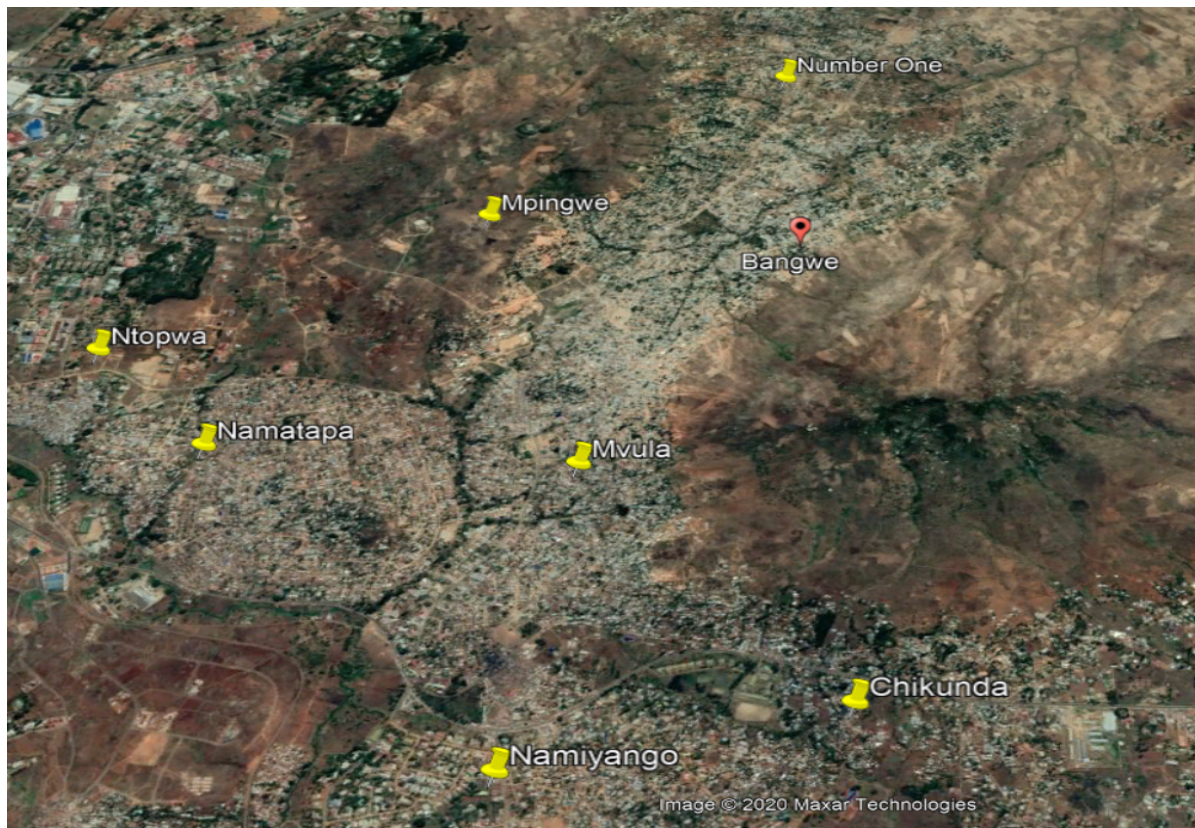


Figure 2. Location of quarry mining sites (Google Earth, 2020)



Figure 3. Artisanal quarry mining tools (14 lb sledge hammer, chisel, hoe and crowbar)





Figure 4. Excavation and heating procedure (Left: unburnt; Right: burnt)



Figure 5. Crushed rock aggregate sizes (6", 1" to ½ inch)



Figure 6. Pits left behind by ASM

#### 4. Conclusion and Recommendation

In Bangwe Township, artisanal small-scale mining is characterized by limited capital investment, little to no technology, lack of personal protective equipment, high intensive manual labour, improvised/primitive mining methods, poor entrepreneurial and management skills, community employment opportunities, limited knowledge about legal procedures, lack of knowledge about tax payment and insurance, limited access to mining titles, seasonal alternation of mining with farming and piece jobs, and negative impact on environment, health and safety. According to World Bank (2019), a notable region-wide policy initiative that could act as a vehicle and impetus for data collection and sharing is the Africa Mining Vision (AMV) which was established in 2009 by the African Union in partnership with numerous international agencies to act as the blueprint for mineral led development in the region over the next 50 years. World Bank (2019) further explains that the AMV calls upon signatories to commit to “fostering the establishment of resilient artisanal and small-scale mining (ASM) communities” through formalization, and in order to do so underscores the need to “improve the understanding of ASM issues” through data collection.

Therefore, present study assessed the scale of production of artisanal rock aggregate miners in Bangwe Township. It was found that there are 7 artisanal quarry mining sites and no gemstone sites in the township. On average, each quarry mining site produces the equivalent of 5 wheelbarrows per day and sells at US\$2.66 per wheelbarrow. As most builders require quarry for construction projects, the quarry miners sell at least 0.5 tonnes per day. In Tanzania, artisanal aggregate quarrying is characterized by low productivity as it takes a man 3 weeks and a woman 4 weeks to produce a 7 ton lorry of limestone aggregates worth US\$80 less production costs (Elisante, 2009). In addition, Elisante (2009) estimates that more than 15,000 people in Tanzania earn a living through artisanal quarrying activities. Hentschel (2002) estimates 40,000 people working in the Malawian ASM sector. Despite limited technical knowledge, dishonest buyers, low productivity, lack of finance and equipment, the artisanal mining business is used to make a living, support families and create employment thereby impacting society development and social stability. Policy makers will have access to updated new knowledge on the welfare and scale of production of these artisanal miners which in turn will lead to strong government legislation, policy enforcement, easy licencing procedures and favourable business environment.

It is recommended that Government fully support the operations of artisanal miners by training them on necessary technical skills and technology, creating a repository and data sharing platform for the ASM sector, formalizing the sector through streamlined licensing, geological data & access to finance, and making it a centerpiece in economic and poverty alleviation plan. With good machines and technologies, these artisanal miners can grow big, increase their productivity and supply at both local & national level. There is also need to sensitize the nation on the importance and diversity of artisanal mining so as to encourage more youth and women to join the ASM sector. Future research work can look into the development of a business model which the artisanal and small scale miners can use to sustain their businesses, increase productivity, get better prices, cut down on costs and find better markets.

### Conflict of Interest

The author has not declared any conflict of interests.

### Acknowledgements

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