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Tanzanite Processing in Tanzania: Challenges and Opportunities

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Abstract

This study sought to evaluate factors that hinder processing[1] of rough tanzanite in Tanzania with greater emphasis on availability of raw materials, financial resources, skills and market. In addition, the study examined contribution of tanzanite processing activities to employment and revenue. This study used structured interviews to collect information from tanzanite miners, brokers and dealers. Information was also collected from the Ministry of Energy and Minerals, Tanzania Audit Agency and the State Minerals Company on the opportunities and challenges facing the industry.

The findings suggest that contribution of processing activities to employment and revenue in the country is still low. The factors hindering processing of tanzanite locally are diverse and they include unpredictable supply of rough tanzanite, which is constrained by the use of poor mining technology, high competition for the rough tanzanite and small size of recovered stones. Other challenges are related to accessibility to financial resources, tanzanite processing technology and skills, as well as unreliable markets for cut and polished tanzanite.

The study recommends that the government could consider the need to establish a tanzanite cutting and polishing export zone at Mirelani area, where tanzanite is mined. This would serve as marketing centre for rough tanzanite. The efforts to establish a special economic zone in the area could be hastened to enable ease access to market information, and promote processing activities locally facilitated by predictable supply of rough tanzanite. In addition, the government might provide tax incentives by reducing multiplicity of taxes payable to central and local governments as well as waive import duties on start-up equipment for both mining and processing activities.

Keywords: Gemstones, Gemstone processing, Tanzanite, Mineral Policies, Mining in Tanzania

1. Introduction

1.1 Background to the Study

Tanzania is endowed with huge natural resources. In terms of diversity and richness of minerals, the country is ranked fourth in Africa, after South Africa, Democratic Republic of Congo and Nigeria. Tanzania's proven mineral reserves include more than 2, 000 tons of gold, 50.9 million carats of diamond, 12.6 million grams of tanzanite, 209 million tons of Nickel, 13.6 million tons of copper, and 880 billion cubic feet of natural gas deposits (Ndulu, 2012). The government's more liberal and private-sector friendly policies pursued particularly since 1991, and for the mining sector from 1998, have encouraged private sector investment including in mining of gold and gemstones. According to TCME and ICMM (2009), a number of large international mining companies have collectively invested over USD 2 billion in the mining sector.

Reflecting the success of the reforms, the mining sector has been growing at about 10.2 percent since 2000 and accounts for about 45 percent of Tanzania's total merchandise exports. Despite the high growth, the sector's contribution to GDP is still low at 3.3 percent (in 2011) and it absorbs only one percent of the labour force (Kabwe, 2012). Also, to the extent that 35 percent of Tanzanian population still live on extreme poverty (PHDR, 2011), some policy observers argue that mining activities have not played a catalytic role in generating large indirect employment, income and investment benefits (TCME and ICMM, 2009). Partly contributing to this is export of some minerals including gemstones unprocessed thus limiting job creation and revenue generation (URT, 2009; Ihucha, 2014). Ihucha argues for example that the exported rough tanzanite has generated about 250,000 jobs in Jaipur city of India compared to 119 jobs created

[1]Tanzanite processing entails cutting and polishing of rough tanzanite for domestic or export markets.

in Tanzania. Likewise, tanzanite trade globally earns USD 500 million a year, with Tanzania—the only source of the precious stone-recording export revenues of USD 20.75 million, or equivalent to 4.15 percent of the global export value.

The Tanzanian government has been developing various policies to enhance the contribution of the mining sector to the economy. The Mineral Sector Policy of 2009 for example promotes mineral value addition activities within the country to increase income and employment opportunities. In line with this, in 2010, the government banned export of rough tanzanite weighing more than one gram with the view of promoting value addition in the country. Four years later, available statistics indicate that the lion's share (about 89.9 percent) of tanzanite still finds its way to the world market unprocessed (BOT, 2013).

1.2 Objective of the Study

This study sought to evaluate factors that hinder processing of rough tanzanite in Tanzania with greater emphasis on availability of raw materials, financial resources, skills and market. More specifically the study investigated the nature and volume of tanzanite mined at Mirelani; supply chain of rough tanzanite to formal domestic market; the nature and extent of tanzanite processing in the country as well as contribution to employment and revenue; and explore factors explaining the low response of the private sector to processing tanzanite locally.

1.3 Organization of the Paper

The paper is organized as follows: after the introduction, section two covers the policy evolution and descriptive analysis on tanzanite processing in Tanzania. Theoretical and empirical literature reviews follow in section three and methodology in section four. Section five presents discussions of field findings. Section six covers the conclusion and policy recommendations.

2. Stylized Facts on Policy Evolution and Tanzanite Industry in Tanzania

2.1 Mining Policy Evolution

Policy evolution for tanzanite industry revolves around strategies and policy development for the Tanzania's gemstone or the entire mining sector. The evolution started in the 1960s, the independence era, during which mining was construed to play a limited role in the country's development. This situation was evident in the first Five Year Development Plan presented to the National Assembly in May 1964, which anticipated only a limited contribution of mining to Tanzania's development (TCME and ICMM, 2009). The condition did not change with the adoption of the Arusha Declaration Policies starting 1967. As reflected in the Mineral Policy of Tanzania of 1997, efforts undertaken within the framework of state-directed development strategies and policies did not succeed in mobilizing the necessary investable resources in the mining sector. This was attributed to, among other things, late recognition of the sector's role in revamping the economy; lack of appropriate and consistent macroeconomic policies; absence of appropriate and consistent mineral sector policies oriented towards private sector participation; and limited use of appropriate technology and skills.

The U-turn in the role of the mining sector to the economy unfolded in the second half of the 1990s, following policy changes largely building on the comprehensive economic reform programmes started in the mid-1980s with the view of restoring macroeconomic stability. Here, the emphasis was put on, among other things, promoting private sector investment in the mining sector to accelerate economic growth, while the government's role shifted from that of owning and operating mines to that of providing clear policy guidelines, and stimulating private investment in mining.

In order to maximize the contribution of the sector to the economy policies and laws have been put in place to guide the sector[2]. These have also been amended from time to time to accommodate new developments. For example, the Mineral Policy of Tanzania (1997) and the Mining Act of 1998 were replaced by the Mineral Policy of 2009 and the Mining Act of 2010 to address the challenges of low integration of the mining sector with other sectors of the economy; low contribution to the GDP compared to the sector growth; slow development of small scale mining; low capacity of the government to administer the sector; low level of value addition of minerals; and environmental degradation (URT, 2009). These changes are expected to, among others, strengthen integration of the mineral sector with other sectors of the economy; improve economic environment for investment; maximize benefits from mining; improve the legal environment; strengthen capacity for administration of the mineral sector; develop small scale miners; and to promote and facilitate value addition to minerals.

[2]This entails contribution to GDP, foreign exchange earnings, government revenue, and gainful and secure employment (The Mineral Policy of Tanzania, 1997).

2.2 Policy Statements on Gemstone Mining Industry

Statements on gemstones from the Mineral Policy of Tanzania (2009) build on the fact that exploitation of these resources should maximize their contribution to socio-economic development and also increase the involvement of Tanzanians in gemstone mining. One of the options of doing that is to enhance Tanzanian investors' access to adequate capital and modern technology. These will be achieved within the framework of:

a) Promoting and developing Tanzania as a gemstone centre of Africa;

b) Ensuring that large scale gemstones mines are owned by Tanzanians to not less than 50 percent shares;

c) Ensuring that medium and small scale gemstones mines are entirely owned and operated by Tanzanians;

d) Promoting participation of local investors in gemstone mining; and

e) Improving its collaboration with the private sector to develop gemstone mining.

Related to these is promotion of mineral value addition activities. The Mineral Policy of Tanzania (2009) underscores the importance of mineral value addition activities that include gemstone cutting; polishing; as well as metal smelting and refinery. This is because value addition activities create employment, improve local skills in mining industry and increase income. According to the Policy, these benefits can be realized if and only if value addition activities are undertaken within the country. To be able to carry out value addition activities locally, the government aims at promoting investment in the fabrication and manufacturing sectors to stimulate minerals beneficiation; promoting investment in lapidary, stone carving and jewellery making; and collaborating with the private sector, regional and international organizations to strategically invest in smelting and refining industries. These initiatives are important to enable the country acquire the necessary technical skills, access to capital and adequate infrastructure and facilities.

The Mining Act of 2010 directs that the mineral right holder should be required to set aside certain amount of minerals for processing, smelting or refining within the country. Such percentage to be set should be determined by the Minister in consultation with the mineral holder. The Act sets out requirements for application and grant of license for processing minerals and for smelting or refining minerals. Procedures for application and granting of license issued under these categories are prescribed in the Mining (Mineral Trading) Regulations of 2010.

2.3 Institutional and Regulatory Setting

The Ministry of Energy and Minerals is the main overseer of the mining sector including the tanzanite industry. It provides policy direction; issues mineral rights; enforces laws and regulations and resolves conflicts. Other line ministries such as Ministry of Water; Lands and Human Settlements Development; and Natural Resources and Tourism regulate issues related to water; lands; and natural resources & environment respectively. The Ministry of Finance has the role of collecting revenues and overseeing budget allocation of the government departments.

Tanzania Minerals Audit Agency (TMAA)'s mandate is to monitor and audit financial and tax records of mining entities. As it will be discussed later, TMAA is mandated to counteract minerals smuggling and minerals royalty evasion in collaboration with relevant government authorities. The State Mining Corporation (STAMICO) is entrusted with the role of providing technical services and coordinating the development of small scale mining sub-sector with a view of transforming it into a regulated, safe, productive and environmentally sustainable sub-sector. Currently, STAMICO aims at facilitating artisanal small-scale miners in accessing:

a) Appropriate mining equipment and mineral processing technologies;

b) Grants and loans from financial institutions;

c) Reliable mineral markets information; and

d) Research-based trainings on improved mineral processing.

2.4 Tanzanite Mining and Processing

2.4.1 Discovery and Characteristics of Tanzanite

Tanzanite was discovered in1967 by Ali Juuyawatu, a Maasai tribesman who first shared his blue-violet crystal with Manuel de Souza. It was christened 'tanzanite' by Henry Platt in 1968 and introduced to the world at Tiffany & Co. Tanzanite is the crystalline form of the mineral ziosite and occurs as a transparent rough with different colours including brown, blue, greenish-blue and khaki. The most common and expensive crystals are the ones with blue colour. Tanzanite is found only and only at Mirelani in Manyara region.

The deep blue (A-grade) is obtained by heating tanzanite crystals in controlled temperature but also occurs naturally. The crystals are normally heat-treated to drive off impurities and produce the famous beautiful purplish-blue colour. Tanzanite is one of the top-selling coloured gemstones of all time and because of its popularity, it was added to the December birthstone list in 2014. Colour and size are the main drivers of the value of tanzanite.

2.4.2 Profile of Tanzanite Mining Area

According to Shamika (2013), tanzanite mining area is around 8 kilometers long and one kilometer wide. In 1971, the tanzanite mines were nationalized and the extractive activities were taken over by the State Extractive industry Corporation, STAMICO. The period before the 1990s saw decline in production mainly attributed to haphazard extraction, theft, and increase in informal artisanal activities[4]. To formalize the activities, in 1990, the government demarcated the tanzanite area into four Blocks: A, B, C and D. Block A was awarded to Kilimanjaro Mines Limited, Blocks B and D to small-scale miners and Block C to Graphtan Limited, a graphite extractive industry company. Graphtan stopped operating in 1996 and Afgem took over its activities in Block C. The Tanzanite One Group acquired Afgem's tanzanite business and assets in 2004, which were later sold to Sky Associates in 2014. Block C is the largest of these four mining blocks.

Geological testing indicates that tanzanite layers exist down to 2000 meters, which at the current rate of mining would see another 30 years left in the measured deposits. As mining goes deeper in the earth, sophisticated infrastructure is increasingly required to access the gemstone.

2.4.3 Performance of Tanzanite Processing in Tanzania

For the case of Tanzanite One, the dominant firm in the industry, processing and sorting of rough tanzanite takes place on-site within purpose-built facilities. Tanzanite One uses an ore treatment plant, which includes a Dense Media Separator (DMS) with a capacity of approximately 10,000 tonnes per month on a single shift. The DMS concentrate passes through a fully automated optical sorting system, where the 'super concentrate' is hand sorted and graded. Rough Tanzanite is sorted both manually and using a fully automated optical sorting/primary grading system. Meanwhile, rough tanzanite mined by artisanal miners is sold to Tanzanite One or/and dealers located in Arusha city for processing. Usually, brokers intermediate between small-scale miners and dealers. The graded tanzanite crystals are then cut and polished or subjected to controlled heating before cut and polished.

In order to promote locally cutting and polishing of tanzanite, in 2010, the government banned export of rough tanzanite stones weighing more than a gram. Figure 2.1 depicts trends in tanzanite exports both rough and cut after the imposition of the export ban. Tanzanite export value rose from USD 21.7 million in 2010 to USD 36.8 million mainly driven by increase in earnings from cut tanzanite as export of rough tanzanite remained fairly stable at USD 15.0 million (Figure 2.1a). The volume of cut tanzanite rose from 109.6 thousand kilograms in 2010 to 689.4 thousand kilograms in 2013. The development in cut tanzanite could be reflecting two things. First, the lapidary industry has reacted positively to the ban leading to increased value-addition before export. The second point, as Shamika (2013) argues, it could be that the tanzanite is now exported in pre-form cuts rather than the standard cuts. Pre-form cut tanzanite stones—analogous to beads (or interim) cuts[5] —can be processed further in the export markets.

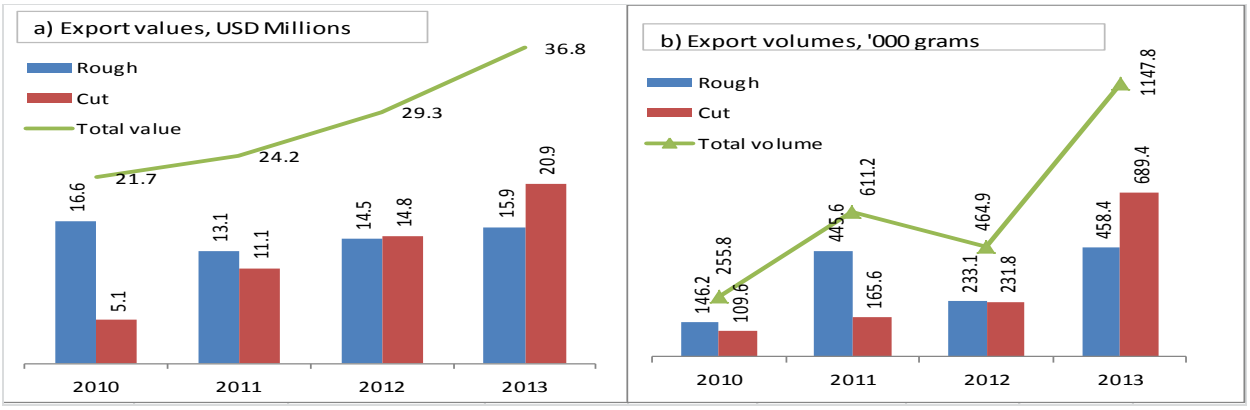

Figure 2.1 Rough and Cut Tanzanite Exports

Source: Tanzania Minerals Audit Agency

As shown in Figure 2.2a, export of beads cut tanzanite rose slightly in 2011 and 2012 and then sharply in 2013. Shamika (2013) suggests that due to the ban the traders could be switching to beads cut which are apparently made of above one-gram rough tanzanite crystals that attract royalty of one percent on the value of exported amount compared to royalty of 5 percent imposed on unprocessed tanzanite. The price of beads cut is less when compared to the standard

[4] According to Shamika (2013), by 1989, about 30,000 artisanal miners were working in tanzanite area.

[5] Beads cuts can be reshaped into other cuts.

cut tanzanite. Partly reflecting this fact, the value of rough and cut tanzanite exported from 2011 through 2013 differed by a small amount, with the average unit value of cut tanzanite standing at 43,062.20 USD compared to 38,255.21 USD for rough tanzanite (Figure 2.2b). The share of beads cut exports relative to total exports of cut tanzanite was the highest in 2013 (Figure 2.2c).

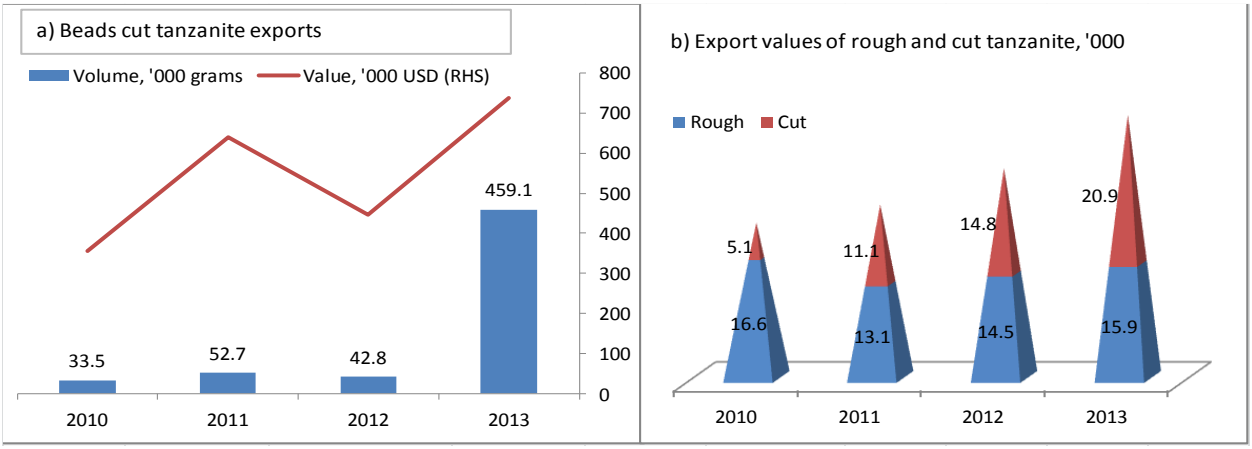

Figure 2.2 Rough and Cut Tanzanite Exports by Categories

Source: Tanzania Minerals Audit Agency

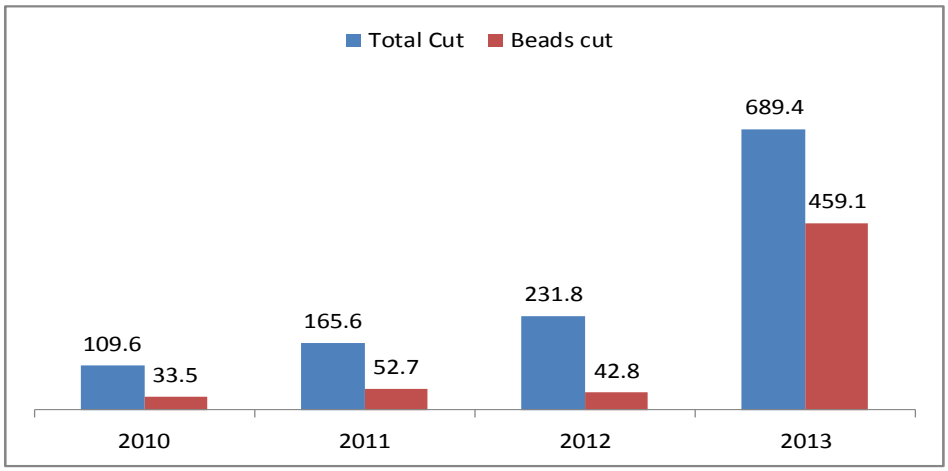

Figure 2.2c. Beads Cut and Total Cut Tanzanite Exports (in '000 Grams)

Source: Tanzania Minerals Audit Agency

3. Literature Review

3.1 Theoretical Literature

In the literature, gemstone processing is normally evaluated on the premise that gem cutting (lapidary) and finishing add value by turning a rough gemstone into something more beautiful than original. Generally, gemstone processing starts with production or purchase of raw gemstones and selling after cutting and polishing. Figure 3.1 depicts a general gemstone processing flow chart.

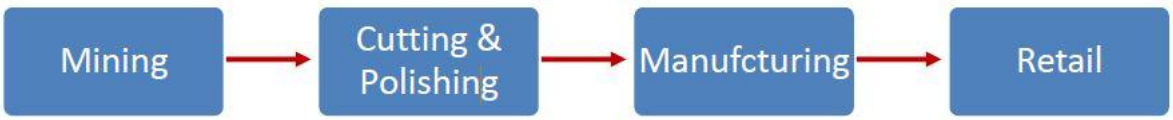

Figure 3.1 Gemstone Processing Flow Chart

Source: Adopted from Collet, at al (2013)

The assumption is that once mined (stage one)—mainly on small-scale or large-scale— the rough stones are traded on markets, with varying numbers of brokers and dealers involved. The next step a gemstone passes through is that of

cutting and polishing. After cutting and polishing, manufacturing follows in which gemstones are turned into jewelry and integrated in rings, bracelets, necklaces, earrings, watches, etc., which are then sold in retail markets.

While any jewelry quality gemstone passes through these stages, the number of sub-stages included may vary from one situation to another. Similarly, the number of actors may differ considerably and they may intervene at different stages (Collet, et al, 2013). According to Cross, at al (2010), people tend to earn less every step down the gemstone supply chain.

3.2 Empirical Literature

Evident in the empirical literature is that lapidary is a highly sophisticated area. The quality of technology and skills are vital in enhancing the value of gemstone. In addition, a lot of human skills and technological advances have been recorded during the recent years, but much of these are concentrated in advanced countries.

Collet, et al (2013) argues that local gemstone cutting is currently increasingly encouraged by governments of producing states as a measure to retain value of the stone in the country since the margins of value added at the cutting stage tend to be among the highest throughout the downstream chain. According to Collet, et al, notable examples of such efforts are found in South America, specifically in emerald-producing Colombia and Brazil—where the lapidary sector is comparatively well developed— and large shares of stones are exported after being cut. Also, a number of other countries including Nigeria, Sri Lanka, Tanzania and Madagascar are currently trying to develop their local lapidary capacities and legal frameworks so as to increase the export of cut vis-à-vis that of rough gemstone.

In countries with no local processing, the rough gemstones are transferred to a handful of places that have emerged as global cutting centers. Most of today's cutting and polishing of coloured stones takes place in South East Asia, with India (Jaipur), Thailand (Bangkok) and China being the most named lapidary hubs (Collet, at al, 2013). In addition to this, reference is made to Sri Lanka (Colombo), Tucson (USA) and more recently the UAE (Dubai).

Ali Consultants (2006) indicate that value addition due to lapidary can be as much as 1:100 over the uncut form. Through enhancement of cutting and polishing techniques, Pakistan for example was able to raise the price difference between uncut and cut and polished gemstones from 1:30 to 1:100 in five years to 2006 (Ali Consultants, 2006). This was a result of a combination of two factors: the use of appropriate technology as well as skilled and experienced work force.

Specifically, a number of studies have identified factors, which contribute to the development of gemstone industry including processing. The factors differ across countries. The review follows hereunder in two categories: unsuccessful and successful stories.

CRC Sogema (2014) carried out scoping study of the mining supply chain in Ethiopia with a view of exploring what needs to be done to ensure that Ethiopia maximizes domestic employment and supply opportunities from the expansion of the mining industry. The study points out the key constraints to gemstone industry development including polishing and cutting in Ethiopia to comprise, lack of geological data, lack of lapidary and business skills, lack of market outlets and networks, limited support from Ethiopian institutions and insufficient information dissemination. Bowersox, at al (2007) carried out intensive interviews with various stakeholders in the gemstone industry in Afghanistan to assess factors constraining small-scale gemstone mining, processing and marketing. The limiting factors found by the study include poor technology including rudimentary tools and equipment in mining, disconnect between the Afghan government and the miners complicated by inadequate and unfinished legal and regulatory reform, and excessive fees & royalty rates.

Relatedly, the study by Henney (1999) assessed the best practices in Sri Lanka's small-scale gemstone mining, and highlighted factors which limit development of the gemstone industry. The factors include, lack of access to information and technology for more efficient and safer mining practice; poor working conditions and lack of regulation; smuggling and corruption; lack of records; gem dealer monopolies and intermediation; lack of clarity on legal rights, institutional roles and responsibilities; inability to access financial information as well as markets. The study recommends, among other things, that the state should actively stimulate local value-adding industries to encourage the transition from a raw material producing industry to one exporting value-added material, and also increase the skills base of the economy.

In contrast, countries, which have successfully promoted local processing of gemstone, include India and China. Contributing to this success includes availability of skilled craftsmen, the use of modern gemstone processing technology, favourable government policies particularly those related to export policies and import duties. India for example has set up various Special Economic Zones (SEZs) to provide special incentives to the highly export-oriented sector[6]. The SEZs have units catering for designing, cutting, and polishing of jewelry. Also, the government has set up

[6] Indian Gems and Jewelry Sector, downloaded on: http://www.dnb.co.in/IndianGemsJewelerySector/Overview.asp, April 10, 2015.

various training institutes to produce quality personnel to cater for international market and to focus on constant innovation of globally-acceptable designs. These initiatives, among others, have helped the gems and jewelry sub-sector provide employment to about a million people directly and indirectly, with the total market size of the sub-sector standing at USD 23.44 billion (in 2008) of which exports accounted for 90.5 percent[7].

For China, Hsu et al (2014) contend that the creation of the Shanghai Diamond Exchange and Shanghai Gold Exchange led to the reform of import and export protocols including revision of tax policies, and this fueled the growth of the domestic jewelry industry. For example, no VAT is applied to rough gemstone polished in China and returned to the country of export. The adoption of new technology; the move to the high-end market; and adherence to industry standards have also kept the industry competitive globally despite the rising labor costs. Emphasis has also been put on acquiring training facilities with the view to producing skilled workforce competent in, among others, jewelry design, jewelry manufacturing, and jewelry business management. As Hsu et al (2014) argues that China is now moving from a primarily low-cost manufacturing model to one with a highly skilled workforce and state-of-the-art technology including laser sawing for diamonds, computer-aided diamond cut planning, highly precise robotic cutting for coloured stones, and vacuum-casting in platinum.

With these efforts, China has created a lot of jobs for its people. The number of people involved in the jewelry industry went up from only 20,000 people in 1980 to more than three million people thirty years later (Hsu, et al, 2014).

Only one detailed study was identified on Tanzania. This is the study by Saitoti (2012), an MBA thesis aiming at identifying challenges and opportunities in the tanzanite value chain mainly using Tanzanite One as a case study. The findings suggest that tanzanite value chain includes inbound logistics (license acquisition, mineral prospecting and machines acquisitions); mining operations; marketing and sales activities. The factors affecting the value chain specially on mining side include the use of poor mining technology, unskilled human force, corruption leading to smuggling of rough tanzanite to export markets, poor infrastructure particularly roads, and weak regulatory framework.

4. Methodology

4.1 An Overview

Because of the undeveloped nature of the tanzanite industry, the current study assumes three stages of tanzanite processing in Tanzania: mining of rough tanzanite; cutting and polishing of the rough tanzanite by dealers. The cut tanzanite is then sold to export market for further processing or manufacturing of retail products. On policy direction and regulation, the Ministry of Minerals and Energy plays a greater role.

In line with this framework, information was collected from tanzanite miners, brokers and dealers/processors. No interviews were made to local manufacturers of tanzanite related items as well as retail buyers because of limited activities. Checklist questions were distributed to key policymaking institutions i.e. the Ministry of Minerals and Energy, Tanzania Minerals Audit Agency (TMAA) and STAMICO to get their views on the opportunities as well as challenges facing the tanzanite industry and ways of addressing them.

4.2 Sampling and Sample Size

A random sampling technique was used to accommodate both small-and large-scale miners, brokers and processors in the interview. The sample was drawn from the list of registered miners, brokers and processors provided by the Ministry of Minerals and Energy available at the Northern zone mining office. In 2013/14, registered tanzanite miners were 186, dealers were 113 and brokers were 17. The number of registered brokers was construed to be on the lower side and so sampling on unregistered brokers was done with the help of the Ministry's Mirelani resident mining office.

The plan was to interview 120 tanzanite miners, 50 dealers and 30 brokers, but the outturn was as follows: 182 respondents were visited and interviewed, out of whom 127 respondents were miners; 23 respondents were dealers/processors; 28 respondents were brokers; and 4 respondents were involved in both mining and processing of tanzanite.

4.3 Data Collection and Analysis Techniques

The questionnaires were administered on the spot by Bank of Tanzania Arusha Branch staff, mainly to allow questioners to explain the objective of the study as well as collect additional information through follow-up questions. Both qualitative and quantitative information from the respondents were analyzed. Information collected through questionnaires was coded and analyzed using the Statistical Package for Social Scientists (SPSS), which is a special computer package for data analysis. The findings were summarized in tabular form for descriptive analysis, whereby graphs and tables were used in the discussion of the field findings.

[7] Indian Gems and Jewelry Sector, downloaded on: http://www.dnb.co.in/IndianGemsJewelerySector/Overview.asp, April 10, 2015.

5. Discussion of Field Findings

5.1 Demographic Characteristics of Respondents

5.1.1 Age and Gender Structure of Heads of Firms

The demographic characteristics of interest were gender and age. In Tables 5.1 and 5.2 are age and gender structures of the respondents who also were heads of mining, brokering and dealing firms. The findings suggest that about 70 percent of the interviewees in mining are aged between 30 and 45 years. For brokering, the response for this age category was 61 percent, while for dealing firms it was 48 percent. Coming second in importance is the age structure of 46-60 years (Table 5.1). The dominance of young age is not surprising as the job requires energy and involves close supervision of the business. Usually, drilling activities are carried out 24 hours and sometimes take place in excess of hundreds of meters below the earth surface. The dominance of young generation could be good news for the sustainability of the mining activities. This is because productivity of a worker is said to increase with age.

Table 5.1 Age Structure of Heads of Firms

	Miners	Brokers	Dealers/Processors
Below 30 years	5%	0%	4%
30 - 45 years	70%	61%	48%
46 - 60 years	21%	39%	35%
Over 60 years	4%	0%	13%
Total	100%	100%	100%

Source: Field findings, December 2014

Partly mimicking the difficulty with heading mining related activities, the gender of the respondents is skewed towards men. This view is supported by results in Table 5.2, where 100 percent of the respondents who headed mining firms were men, and for brokering and dealing firms, responses were 86 percent and 91 percent respectively. As Salinas at el., (2010) note gender inequality is dominant in mining sector not because of sex segregation and employment discrimination but because of the nature and type of activities performed.

Table 5.2 Gender of Heads of Firms

	Miners	Brokers	Dealers/Processors
Male	100%	86%	91%
Female	0%	14%	9%
Total	100%	100%	100%

Source: Field findings, December 2014

5.2 Ownership Structure of Firms

Respondents were asked to indicate the ownership structure of firms they headed. The findings in Table 5.3 put forward that sole proprietorship dominates the ownership structure of firms in mining and brokering as alluded to by 72 percent of the respondents in mining and 89 percent in brokering. Dealing activities were in contrast handled in form of companies as referred to by 87 percent of the respondents. The dominance of sole proprietorship in mining and brokering is not surprising as it reflects the informality of these activities, which are characterized by artisanal mining and unregistered brokers respectively.

Table 5.3 Ownership Structure of Firms

Ownership	Miners	Brokers	Dealers/Processors
Sole Proprietor	72%	89%	13%
Company/Firm	28%	11%	87%
Total	100%	100%	100%

Source: Field findings, December 2014

5.3 Education and Experience of Employees

When asked about education level of employees, the responses indicated that 74 percent and 46 percent of employees in brokering and mining were class seven leavers. In processing activities, about 39 percent and 33 percent of the employees had secondary and certificates/diploma education (Table 5.4). Very few employees had university degree. These findings could be reflecting two things: first, the unique characteristics of tanzanite mining and trading activities, which are dominated by informal activities, the larger extent of which are unregistered. The second point is related to high school dropouts on one hand, and on the other, child labour. Amarasinghe (1999) argues, for example, that majority

of mineworkers belong to low income families and have very poor living conditions.

Table 5.4 Level of Employees' Education

Education	Miners	Brokers	Dealers/Processors
No formal education	7%	3%	0%
Primary education	46%	74%	21%
Secondary education	31%	21%	39%
Certificates/Diploma	10%	0%	33%
University degree	6%	3%	6%
Total	100%	100%	100%

Source: Field findings, December 2014

5.3.1 Experience

Since most of employees in mining and brokering activities are less educated, learning by doing (apprenticeship) is fundamental for them to acquire requisite knowledge. Learning by doing takes time. The findings suggest that 40 percent and 33 percent of employees in mining and brokering activities had stayed in the job for about 25 years. Another sizeable amount 25 percent and 26 percent had spent between 11 and 25 years in the job (Table 5.5). For processors, 52 percent and 39 percent of workers had experience of 1 to 10 years and 11-25 years respectively. The long experience for workers in processing activities suggest that tanzanite processing in the country has long history and may not have been ignited by the export ban of 2010.

Table 5.5 Number of Years Involved in Mining, Brokering and Processing

	Miners	Brokers	Processors
Less than 1 years	13%	18%	9%
1- 10 years	21%	23%	52%
11 - 25 years	25%	26%	39%
Above 25 years	40%	33%	0%
Total	100%	100%	100%

Source: Field findings, December 2014

5.4 Sources of Finance

In the list of key sources of finance, own funds dominated, being cited by about 100 percent of the respondents engaged in mining and brokering activities, and for dealers, the response rate was relatively low at 76.9 percent (Table 5.6). About 23 percent of the respondents in tanzanite dealing business indicated that they also used funds from banks. The high shares of firms which use own funds to support their operations could partly portray difficulty in accessing loans from formal financial institutions, thus constraining expansion of the industry. This situation should attract policy attention because by its nature, tanzanite mining and processing require considerable investments, which cannot be met solely by own funds. The interviewees were of the opinion that any efforts to expand the scale would require soliciting funds from other sources such as the banking sector. Respondents supported the idea of putting in place credit schemes to support small-scale and artisanal tanzanite miners because commercial banks shy away of supporting tanzanite mining activities due to high risks as there is no guarantee of striking rough tanzanite. Mineral recovery in a pit takes long time so a mismatch occurs between long-term maturing loans required by miners and short-term nature of banks' liabilities (deposits).

Table 5.6 Sources of Funds

Sources	Miners	Brokers	Dealers/Processors
Own/family funding	100.0%	100.0%	76.9%
SACCOS	0.0%	0.0%	0.0%
Banks	0.0%	0.0%	23.1%
Government	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%

Source: Field findings, December 2014

As indicated earlier, the government's plan is to financially support artisanal and small-scale miners. However, no respondent indicated to have received funds from government institutions. As discussed under government plans on

developing the tanzanite industry, this situation is expected to improve going forward.

5.5 Mining Technology

Tanzanite mining requires breaking and drilling hard rocks. This necessitates the use of specialized equipment, the quality of which differs across scales of production. The more advanced equipment is the higher the probability of precisely locating the position of tanzanite close-up and also the lower the time spent to hit the point. Discussions with respondents indicated that most of the miners relied on experience unlike modern equipment used by Tanzanite One in tracing closets of tanzanite. Hereunder, a discussion is made for equipment commonly used by the interviewees.

5.5.1 Explosives

Explosives are used for breaking hard rocks. Two types of explosive are commonly used: those which utilize electricity and those which do not. The findings indicate that most of the respondents (70 percent) used non electrical explosives. About 27 percent used electrical explosives while only 3 percent used both types of explosives (Figure 5.1). One disadvantage of excessive use of explosives, as indicated by most of the respondents, is that it could cause damages to rock structures as well as unwanted carvings increasing costs of operation, mainly connected to removal of debris.

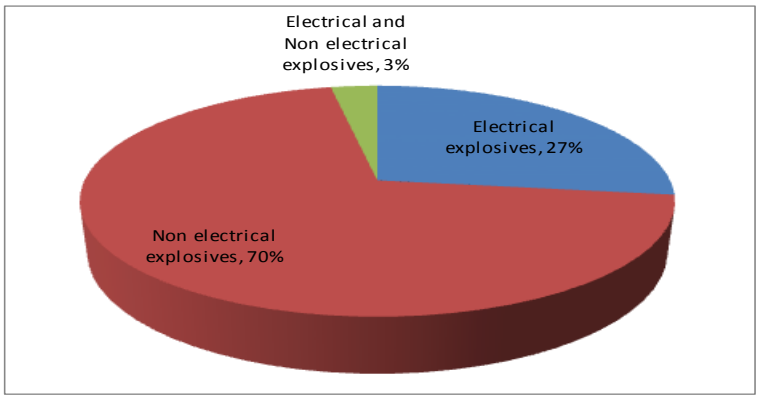

Figure 5.1 Types of Explosives

Source: Field findings, December 2014

5.5.2 Drilling Equipment

Drilling activity involves three types of equipment, the difference between which is made on the type of energy used to run them i.e., fuel, electricity and air. About 55 percent of the respondents indicated to have used electrical compressed drilling machine, followed by 26 percent who used fuel compressed drilling machines to pierce through rocks. Air compressed drilling machine technology is less important as only 11 percent of the respondents used it (Figure 5.2).

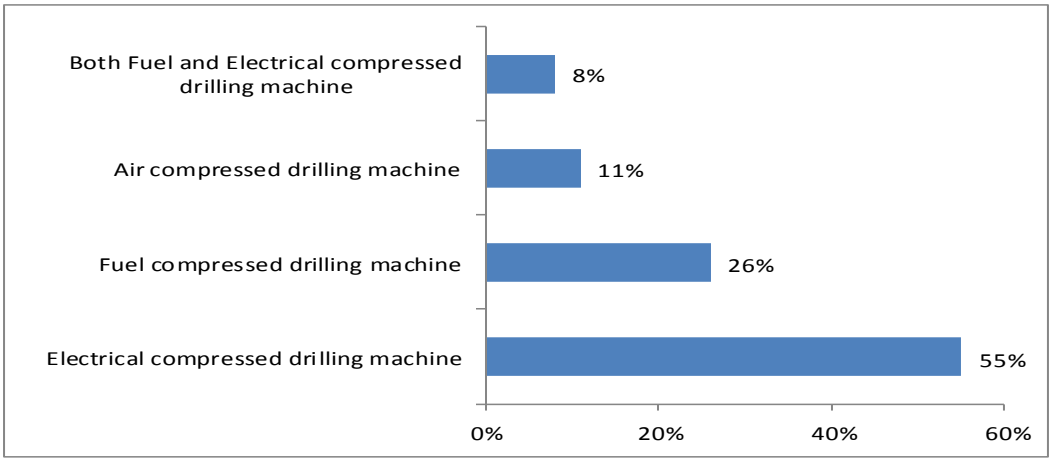

Figure 5.2 Drilling Equipment

Source: Field findings, December 2014

5.5.3 Waste Removal Equipment

After breaking rocks, the next step is the removal of rock waste (debris) and, this process goes on and on after rock explosion. Here, a number of techniques were mentioned as depicted in Figure 5.3. In relative importance, 53 percent of the respondents employed mono rope waste removal system, followed by bingo (manual) waste removal system (29 percent). Only 15 percent of the respondents used rail, winch, and *kitoroli* (trolley) waste removal systems. Once rock debris are removed from the pits, they are transported to nearby designated deposit areas using a lorry or a tractor-trailer.

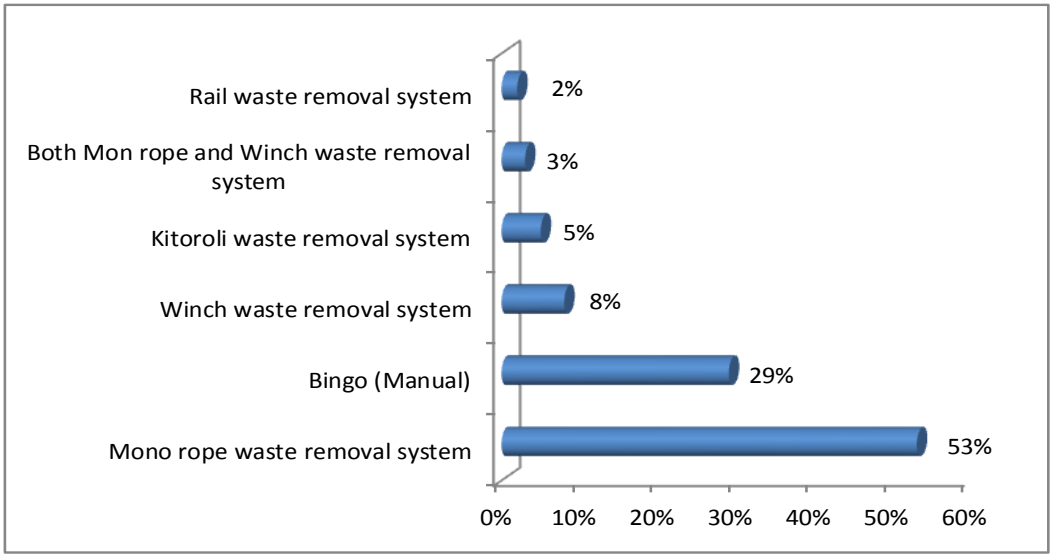

Figure 5.3 Waste Removal System

Source: Field findings, December 2014

5.5.4 Hand Harmer

In sighting tanzanite, controlled blasting is carried out. To the vicinity of tanzanite lock up, hand hammer is largely employed. Then, the crystals are hand sorted mainly underground for security concerns. Panning is also done outside the pit mainly to recover smaller pieces of rough tanzanite. The recovered quantity, size and quality remain a secret to the pit owner.

5.6 Nature and Volume of Tanzanite Mined at Mirelani

5.6.1 Nature and Volume

Ranking basing on quality, tanzanite crystals at Mirelani are classified as *blue*, *asali* or *mkojo* (honey/urine colour), and *mfupa* (bone colour). This classification also features in the prices offered per gram. Besides colour, other two important factors which influence price are clarity and size of the crystal. Larger and clearer crystals fetch higher prices per gram. As indicated earlier, tanzanite recovery volume and quality remain a secret to the pit owner. Some of the respondents indicated that involvement of government institutions is very limited and these institutions solely rely on pit owner's reports who may under-declare production figures to evade tax. This makes it difficult to establish actual tanzanite recovery and makes supply of rough tanzanite to the local market unpredictable.

Interviewees were asked to indicate amount of tanzanite recovered by their firms in 2012 and 2013. Somewhat reflecting the difficult in identifying the actual quantity, size and quality of tanzanite recovery, out of 127 respondents, only 9 indicated that their firms recovered tanzanite in 2013, while for 2012 they were 10 respondents, and for 2009-2011, they were 23 respondents. Some respondents claimed to have not recovered rough tanzanite in more than five years. This reasoning is unjustifiable if one considers heavy investments in terms of equipment and the number of workers hired in the mining pits. In addition, other respondents attributed the mushrooming of real estate in Arusha city to tanzanite fortune.

Shown in Table 5.7 are respondents' estimate of what their firms recovered in 2012 and 2013. During the period, 539,241 grams of blue tanzanite were recovered, followed by 1,051 grams and 575 grams of *asali/mkojo* and of *mfupa* respectively. Crystals with less than a gram accounted for 74.2 percent of the total response followed by 1-10 grams (25.5 percent). Meanwhile, blue colour crystals ranked high, implying that no heating was required before cutting and polishing.

Table 5.7 Production of Rough Tanzanite in 2012 and 2013 (in Grams)

Weight	Blue	Asali/mkojo	Mfupa	Total
Less than one gram	400,000	15	525	400,540
1 - 10 grams	137,600	96	50	137,746
11 - 100 grams	516	525	0	1,041
More than 100 grams	1,125	415	0	1,540
Total	539,241	1,051	575	540,867

Source: Field findings, December 2014

5.6.2 Average Prices of Rough Tanzanite

Respondents' estimates of prices of different qualities of rough Tanzanite are in Table 5.8. The average price of blue crystals is the highest and ranges from TZS 550,000 to TZS 1,450,000 per gram. For asali/mkojo crystals, the prices range between TZS 350,000 and TZS 1,000,000, and for mfupa, between TZS 250,000 and 1,000,000.

Table 5.8 Average Price of Rough Tanzanite for 2012 and 2013 (in TZS)

Weight	**Blue**			***Asali/mkojo***			***Mfupa***		
	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
Less than one gram	200,000	1,000,000	550,000	100,000	700,000	350,000	50,000	400,000	250,000
1 - 100 grams	300,000	1,400,000	1,000,000	100,000	1,200,000	700,000	50,000	600,000	450,000
More than 100 grams	500,000	2,800,000	1,450,000	300,000	1,200,000	1,000,000	100,000	1,000,000	1,000,000

Source: Field findings, December 2014

5.7 Supply Chain of Rough Tanzanite

Having analyzed respondents' views about the mining technology, as well as the nature and volume of recovered tanzanite at Mirelani, assessment is made to determine the supply chain of the gemstone in the local market. The concern is whether local tanzanite processors can easily access rough tanzanite. A predictable supply of rough tanzanite in the local market could generate incentives for locally cutting and polishing activities.

Respondents both miners and brokers were asked to indicate to whom they sold their rough tanzanite. Table 5.9 summarizes the responses. About 59.1 percent of the interviewed miners sold their rough tanzanite to master dealers from outside the country, 35.4 percent sold to brokers and only 5.5 percent sold to local master dealers. As for brokers, 48.2 percent sold their rough tanzanite to "other" brokers and 44.4 percent sold to local master dealers. Discussions with the respondents tend to support the view that the amount sold to "other" brokers some of whom are unregistered could have also found its way outside the country. With these developments, it is evident that the amount of rough tanzanite sold outside the country could be much higher than that available to cater for demand in the local market.

Table 5.9 Buyers of Rough Tanzanite

Buyer	Respondents in mining	Respondents in brokering
Local master dealers	5.5%	44.4%
Brokers	35.4%	48.2%
Master dealers from outside the country	59.1%	7.4%
Total	100.0%	100.0%

Source: Field findings, December 2014

The major local dealers earmarked by the respondents include Tanzanite One Trading Limited, Prima Gems, Crown Lapidary Limited and Signature Gems Limited. Respondents indicated that dealers from outside the country use agents located in Arusha city to access rough tanzanite. However, it was difficult to ascertain the names of the agents and their

offices. In relative importance, the Asian countries dominate as the main market of tanzanite. This was alluded to by about 74.0 percent of the dealers, with India alone contributing 35.0 percent (Table 5.10). Other markets include USA as indicated by 11.1 percent of the respondents, German (7.4 percent) and UK (3.8 percent).

Table 5.10 Rough Tanzanite Export by Destination

Processors	Frequency	Percent
India	7	25.9
USA	3	11.1
Siri Lanka	3	11.1
Hong Kong	4	14.8
Thailand	4	14.8
German	2	7.4
China	3	11.1
UK	1	3.8
Total	**27**	**100.0**

Source: Field findings, December 2014

Summarized in Figure 5.4 is the supply chain of rough tanzanite basing on respondents' responses. A tanzanite miner has three options to directly sell rough tanzanite crystals: local dealers, local brokers, and dealers not registered in Tanzania. For small-scale miners, they can as well sell their produce to large-scale miners who own processing facilities. In the second stage dealers registered and those not registered in the country buy rough tanzanite from both registered and unregistered brokers. Local dealers can as well sell their rough tanzanite to dealers outside the country.

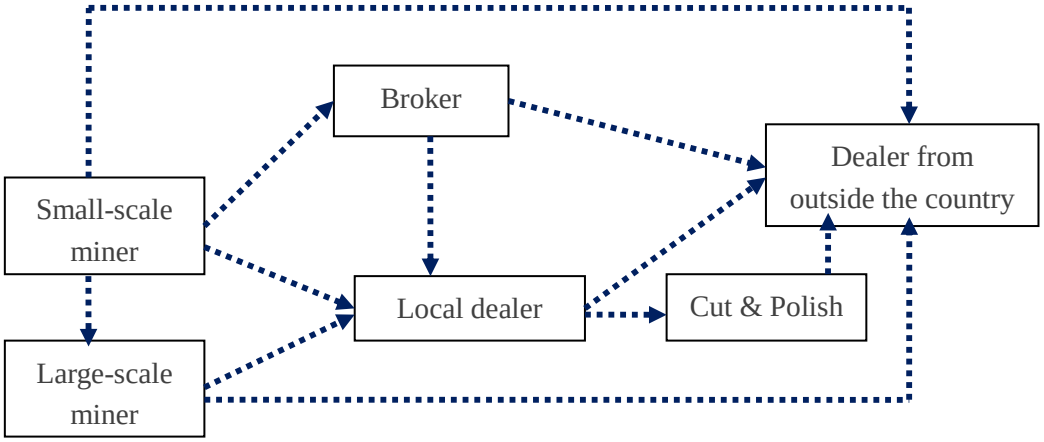

Figure 5.4 A Simplified Supply Chain of Rough Tanzanite

Source: Field findings, December 2014

Discussions with brokers suggest that a crystal of tanzanite can change many hands before reaching dealers. This situation also drives prices up as sellers add some margin on price at each point to cover for operational costs and profit. The quantity of tanzanite supplied along the chain hinges on two factors: i) amount of tanzanite recovered from pits and ii) hoarding tendencies by market agents.

5.8 Price Setting Mechanism

Most of the respondents indicated that rough tanzanite sellers and buyers negotiate the price with the response rates of 76.0 percent for those engaged in mining, 85.7 percent in brokering, and 88.5 percent for those in dealing activities (Table 5.11). Buyers also determine price to charge, suggesting existence of monopolistic trading tendencies, which tend to depress prices in favor of the buyer. Discussion with respondents in mining and brokering activities reveals further that trade is settled in informal ways as there are no formal markets where sellers and buyers meet to trade. Also, buyers tend to benefit more, first, because they have higher ability in determining the quality of a tanzanite crystal, and second, because they have more information on market prices and demand. As such, a tanzanite crystal earns more as one goes up the chain.

Table 5.11 Price Setting Mechanism

Market agent	Mining	Brokering	Dealing/processing
Buyer	20.2%	14.3%	3.8%
Seller	3.8%	0.0%	7.7%
Buyer and seller negotiate (market price)	76.0%	85.7%	88.5%
Total	**100.0%**	**100.0%**	**100.0%**

Source: Field findings, December 2014

5.9 Nature and Extent of Tanzanite Processing in the Country

5.9.1 Cutting and Polishing Equipment

A number of equipment and materials are required in value-addition activities. These can be put in four groups: cutting equipment; heating equipment; sorting equipment; and diamond powder. Over 90 percent of the respondents used sorting and cutting machines and diamond powder in tanzanite processing (Table 5.12). Relatively, low response on heating machine usage (81.5 percent) confirms the finding discussed earlier that most of tanzanite crystals have blue colour, thus requiring no heating before processing.

Table 5.12 Equipment and Materials used for Processing Tanzanite

Equipment/Materials	Yes	No
Cutting machines	92.6%	7.4%
Heating machines (oven)	81.5%	18.5%
Diamond powder	92.6%	7.4%
Sorting equipment	96.3%	3.7%

Source: Field Survey, 2014

5.9.2 Firm Processing Capacity and Installation Cost

Notwithstanding the private sector participation in tanzanite processing, the achievements recorded so far are below expectation. For example, the interviewees indicated that an average firm processed only 11.5 percent of rough tanzanite procured in 2012 through 2013 and the rest (88.5 percent) was exported unprocessed. As depicted in Figure 5.5, the high export of unprocessed tanzanite is attributed to absence of technology to process small size tanzanite crystals (37.5 percent) and absence of local market for small size tanzanite (37.5 percent). Other factors are related to limited skills and the need to abide by demand in the international market.

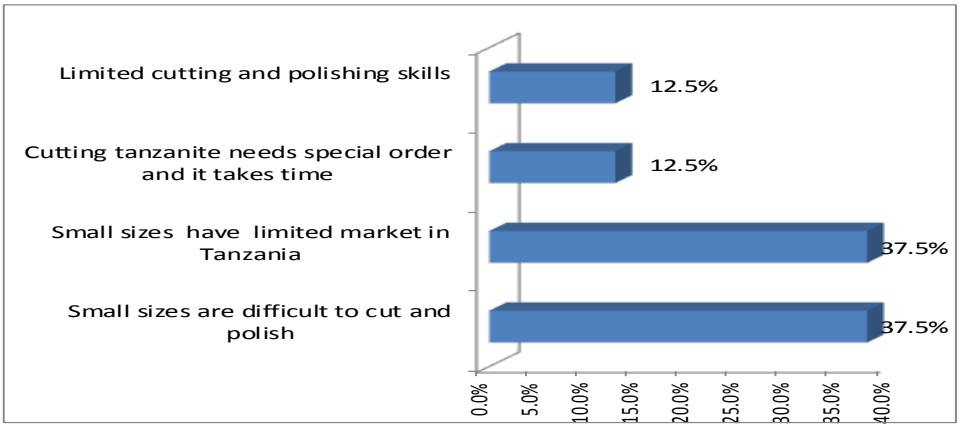

Figure 5.5 Factors Influencing Processing of Only Part of Rough Tanzanite

Source: Field Survey, 2014

Equally important is the initial cost of setting up a processing firm. Respondents in dealing were asked to estimate costs

they incurred to set up their processing firms (excluding costs related to buildings). The results are summarized in Figure 5.6. About 44 percent indicated that it cost them less than TZS 50 million (i.e., less than USD 25,000) to put up a processing firm, while 36 percent indicated TZS 51 million to TZS150 million. It was indicated that the cost of setting up a firm is a function of the number of cutting equipment. As the number of cutting equipment increase, workers and other raw materials also go up proportionally.

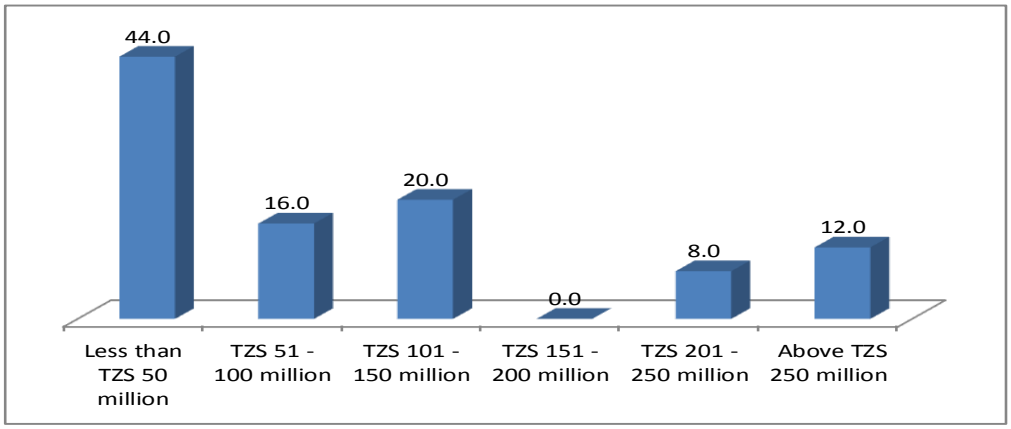

Figure 5.6 Average Cost of Setting up a Processing Firm

Source: Field Survey, 2014

6. Lowest Permissible Size of Rough Tanzanite by Local Processing Firms

Tanzanite weighing less than one gram is allowed for export on the ground of absence of requisite processing technology locally. The findings in Figure 5.7 suggest the contrary. About 80 percent of the respondents mentioned that they could process a rough tanzanite weighing less than a gram, and 52 percent indicated a capacity to process a crystal of less than 0.5 gram. The minimum size was put at 0.1 gram. Only 20 percent indicated to have processed tanzanite crystals weighing a gram and above.

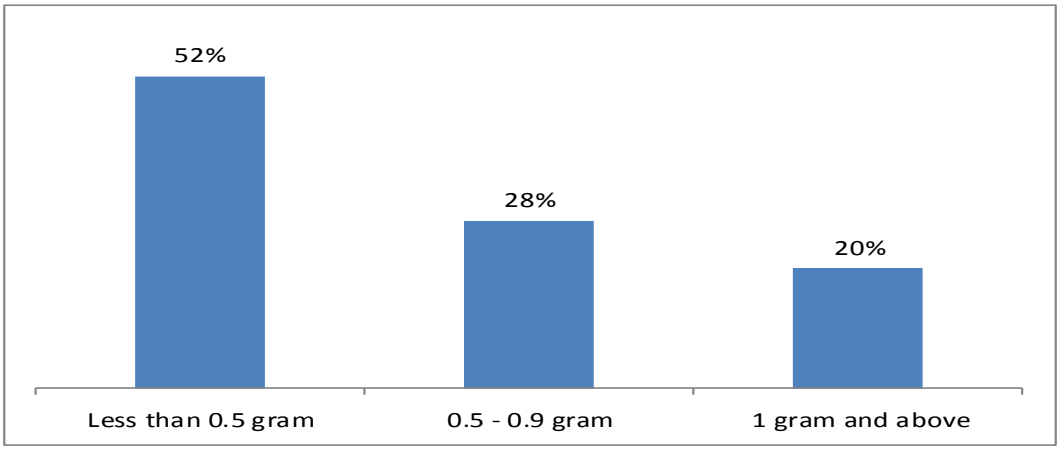

Figure 5.7 Lowest Size of Rough Tanzanite Crystal that can be Processed

Source: Field findings, December 2014

With the foregoing assessment, it is likely that the finding that about 37.5 percent of respondents could not process all rough tanzanite mined or bought due to absence of technology could be explained by difficulties associated with adapting to the existing technology. Another reason is that exports are allowed for tanzanite crystals weighing less than a gram and the demand for these is very high in the international market.

6.1 Factors that Influenced Respondents to Process Tanzanite Locally

When asked to rank factors, which influenced them to process rough tanzanite before selling them, respondents' responses were mixed as indicated in Table 5.13. Ranking high though is the need to benefit from lower royalty charged on cut tanzanite against rough tanzanite exports, and all respondents alluded to this. About 80.8 percent of the respondents indicated value addition to gain more per unit of tanzanite crystal as the motivating factor, while market

availability and employment creation were supported by 52.0 percent and 28.0 percent of the respondents respectively.

Table 5.13 Motivating factors to enter Tanzanite processing business

Factor	Less important	Important	Very Important
Advantage of low royalty	0.0%	0.0%	100.0%
Add value	3.8%	15.4%	80.8%
Market for cut and polished tanzanite	32.0%	16.0%	52.0%
Generate employment	48.0%	24.0%	28.0%
Law requirement	60.0%	24.0%	16.0%

Source: Field Survey, 2014

Unexpectedly, only 16 percent of the respondents cited law requirement as the compelling factor. This implies that profitability motives override other policy initiatives such as employment creation and revenue generation. Thus, any meaningful measure in boosting processing of tanzanite locally would require starting with the facilitation of value-addition initiatives. One way of doing that is through the provision of incentives including tax relief. Other strategic interventions as pointed out by respondents are discussed in section 5.6.

6.2 Contribution of Tanzanite Processing Activities to Employment and Revenue

In order to gauge the role of tanzanite processing activities to the economy, interviewees were asked to indicate: a) the number of people employed both on temporary and permanent contracts; b) costs incurred on wages; and c) the firm's contribution to revenue.

About 62.5 percent of the respondents indicated that their firms employed less than five people permanently, followed by 20.9 percent who employed 5-10 people on permanent contracts, probably suggesting that operations are on small-scale or firms opt for temporary employment (Figure 5.8). The former group of respondents indicated their firms engage employees on temporary contracts partly reflecting the difficulties firms face to sustain employees when there are no production. As it will be explained later, some firms do not have incentives to take more employees or employ staff on permanent contracts as they strive to sell their tanzanite in rough form, the more wanted form in the international market.

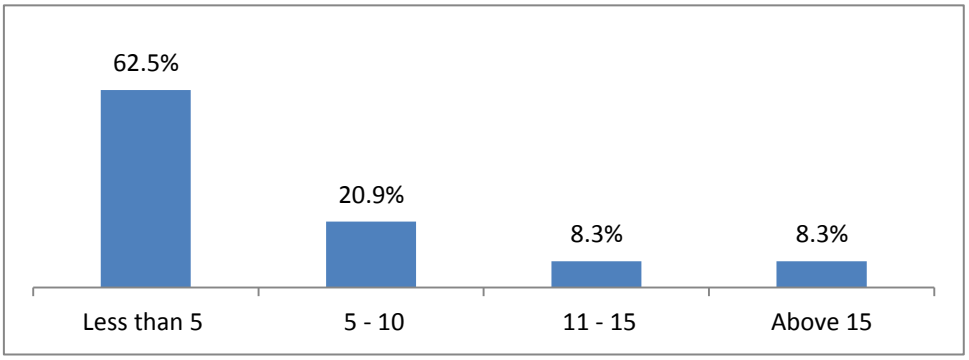

Figure 5.8 Employment in Tanzanite Processing Firms

Source: Field findings, December 2014

Only 8.3 percent of the respondents mentioned that their firms employed more than 15 people and on permanent basis. The respondents were of the view that any efforts to enhance jobs creation in this industry require, among others, expanding the scale of operations. In addition, it would require widening the number of products along the chain to go beyond selling of rough or perform (beads cut) tanzanite to include manufacturing activities in which tanzanite is turned into consumer products such as jewelry and integrated in rings, bracelets, necklaces, earrings, watches, and so forth. All these require political will and proactive engagement and facilitation of the private sector.

Consistent with the employment scale, one third (33.3 percent) of the respondents showed that costs incurred on wages were less than TZS 5 million per annum, while 33.3 percent their costs on wages were above 15 million (Figure 5.9). The findings on wages are not surprising given the level of education of most of employees in processing activities. Most of them have primary or secondary education. Assuming that a wage per worker increases with the level of education then lowly educated employees would earn less whose impact on firms' operational costs would also be small. The respondents observed that measures to push up wages in the industry should be reflected in productivity boost, partly contributed by higher usage of modern technology and educated work force both in mining and processing activities.

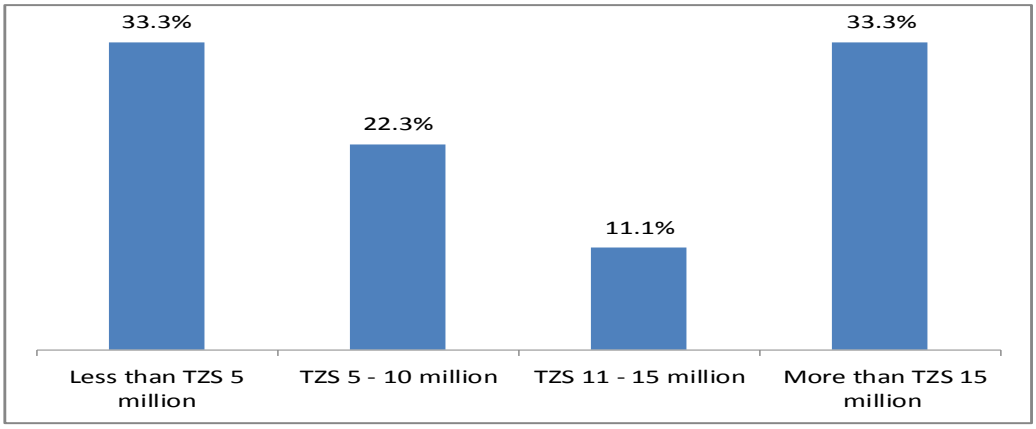

Figure 5.9 Firms Costs on Salaries (%)

Source: Field findings, December 2014

On revenue, respondents were asked to indicate their contribution to tax revenue in 2012 and 2013. Out of 27 interviewed processors 17 responded to the question. Contribution by more than half of the respondents (58.8 percent) was less than TZS 20 million, followed by 17.6 percent who paid between TZS 20-50 million. Only 11.8 percent contributed above TZS 100 million (Figure 5.10). The respondents hinted that enhancing the extent and quality of processed tanzanite could earn more to the revenue.

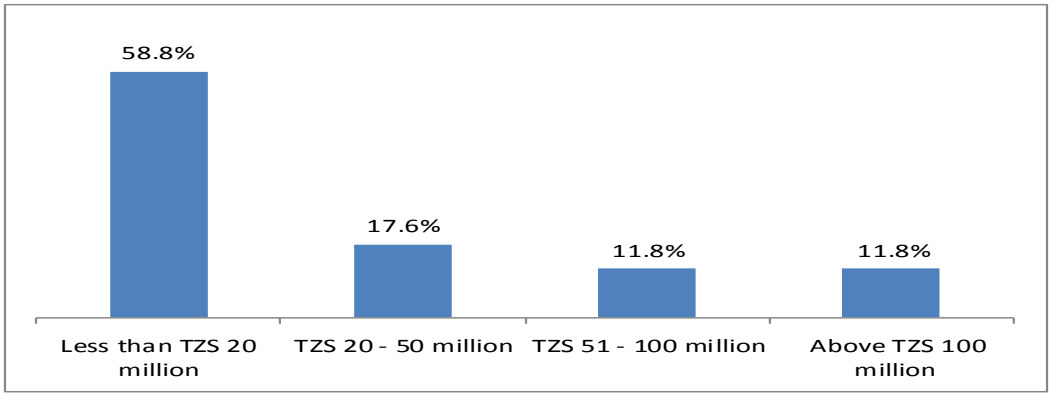

Figure 5.10 Processing Firms' Contribution to Revenue

Source: Field findings, December 2014

6.3 Ranking of Factors Hindering Investment in Tanzanite Cutting and Polishing

It was pointed out earlier that investors' response to invest in tanzanite processing is still low. A number of factors could explain this anomaly. The interviewed miners and dealers had common views on the constraining factors. These comprise unavailability of finance and skilled work force; multiple taxes; and difficulties in securing processing equipment.

It was indicated that a new investor is required by the law to meet minimum requirement before being granted a license. For example, for non-Tanzanian investors, they must partner with Tanzanian(s); they much have a minimum of USD 300,000 as capital plus a minimum of two cutting machines-one machine roughly costs USD 5,000. In addition, the investor is required to have a well-established office with weighing machines and other machines related to sorting, heating and polishing of rough tanzanite. As for a local investor, required are a capital of USD 50,000; two cutting machines; and a well-established office.

These requirements aside, investors are required to pay import duties and VAT on imported equipment; annual license application fee of USD 200; annual license fee of USD 1,000; export permit application fee of USD 100 per trip; royalty of 5.0 percent on the value of exported rough tanzanite and one percent on the value of exported cut tanzanite. Further, investors are to pay 30.0 percent corporate tax annually.

Mirroring the severity of the constraints, as shown in Tables 5.14 and 5.15, about 81.9 percent of the respondents in mining and 53.8 percent in dealing indicated inadequate finance to be one of the key constraining factors respectively. Miners also ranked other important factors as follows: multiple taxes (75.6 percent), inadequate market (73.2 percent) and inadequate skilled manpower (62.2 percent) (Table 5.15). As for dealers, other factors besides finance include inadequate skilled work force (46.2 percent), multiple taxes (42.3 percent), problems in securing processing equipment, as they need to be imported (42.3 percent), and inadequate rough tanzanite (30.8 percent).

Table 5.14 Miners' Perception on Factors hindering Investment in Tanzanite Processing

Constraint	Less important	Important	Very Important
Unavailability of Finance	15.7%	2.4%	81.9%
Multiple taxes	18.9%	5.5%	75.6%
Inadequate markets	19.7%	7.1%	73.2%
Unavailability of skilled manpower	28.4%	9.4%	62.2%
Difficulties in securing processing equipment	37.8%	3.1%	59.1%
Erratic power supply	0.0%	0.0%	0.0%
Inadequate rough tanzanite	0.0%	0.0%	0.0%
Insecurity	0.0%	0.0%	0.0%

Source: Field findings, December 2014

Table 5.15 Dealers' Perception on Factors hindering Investment in Tanzanite Processing

Constraint	Less important	Important	Very Important
Unavailability of Finance	23.1%	23.1%	53.8%
Unavailability of skilled manpower	26.9%	26.9%	46.2%
Multiple taxes	34.6%	23.1%	42.3%
Processing equipment	42.3%	15.4%	42.3%
Inadequate rough tanzanite	42.3%	26.9%	30.8%
Erratic power supply	46.2%	30.7%	23.1%
Inadequate markets	53.8%	30.8%	15.4%
Insecurity	69.2%	15.4%	15.4%

Source: Field findings, December 2014

The response on market is not surprising because of demand influences. Some dealers argued that customers do not only look for cut tanzanite, but also choose who to cut, design, polish and set their jewelries. This is to say that cut and polished tanzanite has a well-defined market. It is because of these complications that successful countries in this area decide to prepare places and people to do this business without government intervention (Shamika, 2013).

Other factors hindering investment in tanzanite processing and mentioned by miners and dealers consist of high market risk associated with cut stones; price fluctuations; bureaucratic procedures in securing permit to export minerals; and smuggling of rough tanzanite thus lowering the supply amount for the local market. Varying customers' preferences and tastes, as well as lack of marketing strategy were also pointed out to be equally important.

It was indicated that some miners have established contacts with dealers located in Nairobi. Some of the dealers have agents who act as brokers buying rough tanzanite from small-scale miners. The brokers also provide finance to small-scale miners on the promise that they will sell rough tanzanite once recovered. This development is occasioned by slack control by the responsible government institutions. With weak screening mechanism and partly due to corrupt practices, some respondents argued that some of the recovered rough tanzanite is illegally exported to the neighboring country and later to some Asian countries.

TMAA, Zonal Mines Office and TRA are mandated to witness tanzanite earmarked for export, which comprises checking the authenticity of the reported colour, clarity, size and weight, but to some respondents the task is not done thoroughly. Also, due to this, some businesspeople illegally mix tanzanite weighing less than a gram with those of above one gram before exporting.

6.4 Policy Makers' Views on Tanzanite Mining and Processing

a) Ministry of Energy and Minerals

Discussion with the Ministry of Energy and Minerals sought to gather information on the legalized Tanzanite mining arrangement in the country; marketing arrangement; regulatory framework; the reasons for the low response by the private sector to process tanzanite locally; government support to tanzanite miners and processors; critical constraints that hinder processing of rough Tanzanite locally and measures to address them. The discussion is summarized hereunder.

6.4.1 Legalized Tanzanite Mining Arrangement in the Country

Tanzanite is mined at Mirelani, the only source in the world. All mine sites are legal, whereby the Ministry has granted Licenses in four designated blocks: Block A licensed to Kilimanjaro Mines LTD (Mining Licence); Block B granted to 183 holders of Primary Mining Licenses (small-scale mines); Block C granted to Tanzanite One Ltd (Mining License); and Block D licensed to 368 holders of Primary Mining Licenses. In addition, there are sub-blocks A1 licensed to some 100 holders of Primary Mining Licenses and D1 licensed to 3 holders of Mining Licenses.

6.4.2 Marketing Arrangements for Tanzanite

Tanzanite like all other minerals is traded in accordance with provisions of the Mining Act 2010. There are licensed dealers and brokers who are authorized to conduct the trade. Brokers are only authorized to deal within the country, whereas miners and holders of Dealer Licenses are authorized to export minerals from Tanzania. A certificate of Origin accompanies all parcels containing tanzanite exports. The Government is also collaborating with the Tanzania Mineral Dealers Association in organizing annual Arusha Gem Fair since 2012.

6.4.3 Regulatory Framework for Tanzanite Mining and Marketing

The Mining Act 2010, and the Mining (Mineral Trading) Regulations are the key legal instruments regulating mineral trading including Tanzanite. The arrangement on how this operates and its effectiveness is discussed below under Tanzania Minerals Audit Agency (TMAA).

6.4.4 Reasons for the Private Sector's Low Response to Process Tanzanite Locally

Local cutting and polishing is increasing especially after the Government introduced a ban on export of gemstones weighing above one gram. Factors which could be reducing the volume of cut and polished gemstones include awareness and relatively difficult in marketing arrangements for cut and polished gemstones in comparison to rough gemstones. Money from rough gemstones can be recovered quickly after being sold to foreign buyers, which is not the case with cut and polished gemstones.

6.4.5 Government's Support to Tanzanite Miners to Increase Production and Quality

The important thing is to have a clear policy and law as demonstrated in the Mineral Policy of 2009 and the Mining Act 2010. The Government also provides extension services to small-scale miners, as well as providing financial support to some.

6.4.6 Government's Support to Tanzanite Processors

Apart from providing legal and regulatory framework, the Government provides training to cutters at the Tanzania Gemological Centre in Arusha. The Centre, which was inaugurated in April 2015, offers lapidary courses including on gemological science; jewelry design and manufacturing; ornamental stone working (carving, tumbling, beading); and gemstone treatments.

On specific plans to enhance locally processing of rough Tanzanite, the Ministry engages in promotions, awareness raising and law enforcement. In addition, it has established a section under the office of the Commissioner for minerals to oversee value addition. The Section is working with stakeholders to promote value addition as well as conduct monitoring and awareness campaigns. Recently, under the Arusha Gem Fair, the Government and the Mineral Dealers established special training for women in gemstone cutting and polishing at the Tanzania Gemological Centre in Arusha. The first batch of 15 women graduated in April 2015.

These efforts notwithstanding, the Ministry underscores that the under mentioned institutions should actively be engaged in ensuring effective processing of rough Tanzanite locally:

- Commissioner for Minerals: accountable for advising and setting the right legal environment and incentives.
- Zonal mines office: responsible for monitoring and regulation.
- Tanzania Gemological Centre: liable for training artisans in gemstone cutting.
- Tanzania Revenue Authority: responsible for setting the right fiscal environment to enhance value addition.

b) Tanzania Minerals Audit Authority

The Tanzania Minerals Audit Authority (TMAA) was asked to explain how audit exercise on tanzanite is carried out; indicate amount of rough tanzanite that was identified as illegally being exported in the period 2012 to 2013 as well as

actions taken against the culprits; mention the major challenges facing TMAA in auditing rough tanzanite both for local and export market and the strategies to address the challenges. In addition, they were asked to give opinion on the low response by the private sector to cut and polish tanzanite locally. The responses are summarized below.

It was indicated that TMAA is mandated to audit and monitor all minerals produced, exported and imported in the country. Therefore, it has authority to conduct audit of rough tanzanite as well. At Mirelani, TMAA has two auditors stationed to make follow up on production and sales of tanzanite both at local and export market in line with the Minerals Act 2010 and its Regulations. At Tanzania One Ltd, one auditor is stationed at the Sort house and another at the underground site. There is also an auditor at airports such as Kilimanjaro International Airport, Arusha Airport and Julius Nyerere International Airport. However, no auditor is stationed to monitor tanzanite production by small-scale miners on daily basis; this is done periodically in collaboration with the Zonal Mines resident office at Mirelani.

Among the duties done by the auditors include recording all tanzanite production and exports; apprehend smugglers; witness tanzanite before sales/export is done and this is done in collaboration with officials from Zonal Mines office and Tanzania Revenue Authority. For tanzanite exporters they should have export permits, payment evidence and verification is done to ensure the rough tanzanite crystals are less than one gram. According to TMAA, the major market for tanzanite are Kenya, India (Jaipur), USA, Thailand and Hong Kong.

TMAA indicated further that, for small-scale and medium-scale miners at Mirelani, jointly with staff of Ministry of Energy and Minerals at Mirelani office, they do periodic strategic audit to establish the amount of tanzanite produced. The law requires miners as well to report after three months the production and sales from their mining area. Failure to do that leads to revocation of license.

As for tanzanite curbed during smuggling, the culprits normally pay penalties or the tanzanite crystals are confiscated. It was indicated that TMAA auctioned all minerals and gemstones accrued for years at Arusha Gem Show of 2014.

The challenges facing TMAA include the fact that it is not an authority; hence, it has no mandate to prosecute. As for small-scale and medium-scale miners, it is very difficult to trace their actual production and sometime they sell secretly in black market to Kenya from where the rough tanzanite are then exported to India (Japur) and USA. To illustrate the difficulty, it was indicated that, for small-scale and medium-scale miners, they stop operating when they see auditors or they operate confidentially during the night when auditors are absent.

Another challenge is related to higher demand for rough tanzanite than cut one. According to TMAA, buyers from abroad prefer rough tanzanite for them to be able to cut and polish in the shape and sizes they want. Moreover, cutting and polishing standards in Tanzania are still low; this necessitates for a second cut when exported and thus increasing costs. To address the problem, TMAA is of the opinion that the capacity (skills) of cutting and polishing should be improved up to the international standards. One of the government's efforts towards attaining this is the establishment of the Tanzania Gemological College in Arusha.

c) State Mining Corporation (STAMICO)

The State Mining Corporation (STAMICO) was enquired to explain the role played by the corporation in boasting tanzanite mining; indicate tanzanite activities which were supported by the institution in 2012 to 2013; and highlight major challenges facing mining and marketing of tanzanite in the country. Their responses were as follows:

At Mirelani, STAMICO owns jointly with Tanzanite One Ltd mines in Block C since July 2013. The corporation undertakes various training programmes to support artisanal and small-scale miners to operate their mines safely and friendly to environment, but the corporation did not support any activities in 2012 to 2013. According to STAMICO, the key challenges facing small-scale miners include lack of reliable geological information; lack of modern mining equipment; low safety knowledge; and absence of reliable market for rough tanzanite locally.

On why Tanzania still exports rough tanzanite, they attributed that to inadequate control of the industry leading to smuggling of rough tanzanite outside the country. There is a need therefore to enforce the law.

6.4.7 Opportunities for Tanzanite Processing

The development of the tanzanite industry will greatly depend on the extent to which the challenges facing the industry are addressed. Equally important is the effective utilization of available opportunities. Highlighted below are opportunities followed by recommendations on measures to address the challenges in section 6.2.

The opportunities for investing in tanzanite processing include: First, tanzanite is found only in Tanzania making it rarer than diamond. Tanzanite is one of the top-selling coloured gemstones of all time and because of its popularity it was added to the December birthstone list in 2014. For example, in the USA market, the largest market for Tanzanite, the demand growth was driven by consumer's appreciation of this beautiful gemstone, largely driven by proactive marketing strategies. Blue to violet tanzanite are also becoming popular in Chine (Hsu, 2014), which is the world's largest economy.

Second, geological testing indicates that tanzanite layers exist down to 2000 meters, which at the current rate of mining could take another 30 years before depleting the deposits.

Third, generally, tanzanite mining is done at small-scale so that raising the scale could increase the supply to the local market, thus providing enough raw materials for processing firms.

Fourth, currently, value addition is limited to primary cutting providing room for investment in improved cutting consistent with international standards as well as investment in manufacturing activities including turning cut tanzanite into, among others, jewelry and integrated in rings, bracelets, necklaces, and earrings.

Fifth, the government's determined move to establish the Tanzania Gemological Centre provides room for grooming talents and skills important for promoting tanzanite processing. Investors may as well take the opportunity to further invest in training institutes on gemstone processing and marketing.

The sixth opportunity is the existence of minerals policy and legal frameworks which support and encourage investment in value-addition activities in the country.

7. Conclusion and Recommendations

7.1 Conclusion

In 2010, the government banned export of rough tanzanite weighing more than one gram, for them to be processed before export, with the view of creating employment for Tanzanians, recouping profits and thus boosting the economy through tanzanite gemstone. Despite the efforts, over 80 percent of rough tanzanite still finds its way to the export market unprocessed.

This study used structured interviews to collect information from tanzanite miners, brokers and dealers to investigate factors which hinder processing of rough tanzanite in Tanzania with greater emphasis on four key areas: availability of raw materials, financial resources, skills and market. In addition, information was collected from the Ministry of Energy and Minerals, Tanzania Audit Agency and the State Minerals Company on the challenges facing the industry and ways of addressing them, as well as available opportunities. Also, the study attempted to establish the extent of tanzanite processing activities' contribution to employment and revenue.

The findings suggest that contribution of processing activities to employment and revenue in the country is still low. The factors hindering processing of tanzanite locally are diverse and they include unpredictable supply of rough tanzanite, which is constrained by the use of poor mining technology, high competition for the rough tanzanite and small size of recovered stones. Other challenges are related to accessibility to financial resources, tanzanite processing technology and skills, as well as unreliable markets for cut and polished tanzanite.

It is recommended that the government could consider establishing a tanzanite cutting and polishing export zone at Mirelani area, where tanzanite is mined. This would serve as marketing centre for rough tanzanite. The efforts to put in place a special economic zone in the area could be hastened to enable ease access to market information, and promote processing activities locally facilitated by predictable supply of rough tanzanite. Also, the government could provide tax incentives by reducing multiplicity of taxes payable to central and local governments as well as waive import duties on start-up equipment for both mining and processing activities.

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