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An Assessment of the Lapidary Industry in Zambia

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AN ASSESSMENT OF THE LAPIDARY INDUSTRY IN ZAMBIA

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DECLARATION

This is to declare that this dissertation has been written in accordance with the rules and regulations governing the award of the Degree of Master of Mineral Sciences of the University of Zambia.

It is further declared that the dissertation has not been submitted for a Degree in another University or similar institution and that the contents in this dissertation are my original work. Where other people's work has been drawn upon, acknowledgement has been made.

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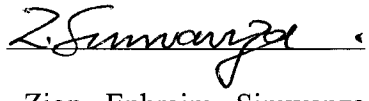
Candidate's signature:  Date: Monday, June 24, 2002

Zion Ephraim Simwanza

ABSTRACT

Zambia is one of the major gemstone producers of the world. The global value of rough Emerald production is estimated at US$1 billion a year. Available data indicate that Zambia accounts for about 20% of this value. Apart from emeralds, there are also several other important gemstones produced in Zambia. These include beryl, aquamarine, tourmaline, garnets, amethyst, citrine and rock crystal. Although the country is endowed with an abundance of these precious stones backed by a long history of gemstone mining, there has been no corresponding growth in downstream processing i.e. the lapidary industry. Zambia exports almost all of its gemstones as rough material. This obviously costs the country value-added earnings. The importing countries cut and polish gemstones and sometimes set them in jewellery, which they later re-export to major markets of the world under their respective national identities at a far higher value. Despite the national mining policy stressing downstream processing before export of any mineral commodity with penalties imposed for flouting, there has been laxity in its application to gemstones. Paradoxically, rough gemstones have even been granted a Non-Traditional export Status although they do not enjoy the 15% income tax, which the members of this category normally pay.

Given the significant economic potential of setting up a lapidary industry, this study provides a major attempt at investigating problems (constraints) that have adversely affected the development of the sector. Included in the study are issues, affecting production (i.e. supply) as well as marketing constraints. Finally based on the findings of the study, recommendations are proposed.

ACKNOWLEDGEMENTS

This work is a contribution towards finding lasting solutions to the revamping the Zambian gemstone industry particularly the lapidary sector. I would like to thank other organizations that have attempted to address the various problems besetting this industry for their previous efforts as they have provided a good foundation for this work.

My profound gratitude is to my Supervisor Dr. Stephens Kambani for his invaluable support throughout the study, beginning with the company he provided deep into the forests of Ndola Rural Restricted Mining area for data collection and the indispensable guidance he tirelessly provided in the preparation of this dissertation. I also wish to humbly acknowledge the contributions of Dr. Chisengu Mdala the Co-supervisor for going through the manuscript. I salute both respectful Dons for having accepted my offer to be supervised at short notice when I changed the Research Proposal from the earlier one entitled: "Mine planning, Design and Ore body Modelling of the Chilembwe Phosphate Deposit in the Eastern Province of Zambia" to the current research which has been seen to its final completion and submission.

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DEDICATION

To my mother Jesinala Nawila Simwanza and late father Isaiah Ephraim Simwanza for their insistence in my early childhood that I continue going to school at the time it never made sense to me.

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NOMENCLATURE

1.	BOZ	Bank of Zambia
2.	CDC	Commonwealth Development Corporation
3.	CSO	Central Statistical Office
4.	ct	Carat
5.	EBD	Export Development Board
6.	EBZ	Export Board of Zambia
7.	ECU	European Community Monetary Unit
8.	ESMAZ	Emerald and semi-precious Minerals Association of Zambia
9.	FORMIN '94	Mining Investment Forum 1994
10.	g	gram
11.	GM	General Manager
12.	GSD	Geological Survey of Zambia
13.	ICA	International Coloured Gemstones Association
14.	kg	Kilogrammes
15.	km	Kilometre
16.	m	Metre
17.	MDD	Mines Development Department
18.	MEMACO	Mineral Marketing Corporation
19.	Mindeco	Mines Development Corporation
20.	MMMD	Ministry of Mines and Minerals Development
21.	MSD	Mines Safety Department
22.	MSM	Mindeco Small Mines
23.	NTE	Non-Traditional Exports
24.	Prod.	Production
25.	RMC	Reserved Minerals Corporation
26.	SITET	Special Investigations Team for Economy and Trade
27.	SSM	Small-scale Mining
28.	t	Tonne
29.	US$	United States of America Dollar
30.	ZAML	Zambia Amethyst Marketing Limited
31.	ZAR	South African Rand
32.	ZCCM	Zambia Consolidated Copper Mines Limited
33.	ZEA	Zambia Emerald Association
34.	ZEIL	Zambia Emerald Industries Limited
35.	ZEL	Zambia Emeralds Limited
36.	ZIC	Zambia Investment Centre
37.	Zimco	Zambia Industrial and Mining Corporation
38.	ZMK	Zambian Kwacha
39.	ZRA	Zambia Revenue Authority
40.	DCFROR	Discounted Cash Flow Rate of Return
41.	NPV	Net Present Value
42.	SWOT	Strengths, Weaknesses, Opportunities, Threats
43.	SYSMIN	Mining Investment Fund Forum

APPROVAL

The University approves this dissertation of Zion Ephraim Simwanza as fulfilling the requirements for the award of the Degree of the Master of Mineral Sciences in Small-scale Mining.

Examiners:

1. _____ Date: 27/06/2002
Dr. S. Kambani
Internal Examiner

2. _____ Date: 27th June, 2002
Dr. C. Mdala
Internal Examiner

3. _____ Date: _____
Dr. C. Kinabo
External Examiner

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External Examiner

CHAPTER ONE

INTRODUCTION

1.1 Statement of the Problem

Zambia is endowed with a variety of gemstones in considerable abundance. Significant mining of gemstones began in the 1970's. Between 1991 and 1999 the official figures for the country's total exports was at 8.3 million kilogrammes of rough gemstones valued at about US$ 80 million. The annual average estimated at about 926 thousand kilogrammes valued at about US$ 9 million. These figures however do not reflect the true nation's capacity because it is estimated that for rough emerald alone Zambia accounts for 20% of world's production valued at US$ 1 billion (Money and Simukanga, 1993). This translates into Zambia contributing about US$ 200 million annually. This discrepancy is a result of rampant illegal trading estimated at over 50% of total production (Kambani, 1995).

Despite the abundant presence of these resources as supported by the figures above and a long history of gemstone mining, there is still no established lapidary industry to match the growth in production of these precious minerals. Although it is clear in the national mining policy that downstream processing for all mineral products should be conducted within the country with incentives of waiving royalty, no attempt to enforce this measure on gemstones has ever been made. Contrary to penalties being imposed for exporting raw material, rough gemstone exports have actually been rewarded. Although they have been granted the Non Traditional Exports status, they still pay 25% corporate tax instead of 15% which beneficiaries of this category enjoy.

It is evident that the estimated US$200 million worth of rough exports may translate into substantial earnings if value is added through lapidary processing.

In a nutshell the problem to be addressed by this study is to identify the constraining factors affecting the successful evolution of the Lapidary industry in Zambia and identify appropriate interventions.

1.2 Objectives of the Study

There are three specific objectives of this study and these are as follows:

i. To investigate the constraints facing the lapidary industry

This is the principal objective of the study. It involves investigating why this industry has not thrived despite being founded in a major gemstone producing country. As part of achieving this objective the identification of weaknesses of the industry that have led to the problems in which it is currently embroiled are investigated.

ii. To evaluate the supply capacity for a sustainable lapidary industry

This objective focuses on identifying and analyzing the problems facing the gemstone-mining industry which constitute the supply side for the lapidary industry.

iii. To Suggest Policies and Strategies for developing a successful lapidary industry

To identify policies and strategies that need to be put in place to overcome constraints of the industry which would bolster the evolution of gemstone cutting and polishing in Zambia.

1.3 Significance of the Study

The study is a major attempt at investigating suitable conditions for establishing a dynamic lapidary industry in Zambia and will provide a basis for drawing-up a supportive policy framework encompassing the gemstone mining and processing sector. This will be of considerable importance to the Zambian economy in that the following benefits may be realized:

- The establishment of a sound local lapidary industry will result in backward integration with the gemstone producers as well as the creation of the supply industry for lapidary inputs and consumables. This will further establish the potential for the creation of the Jewellery industry.
- There will be an evolution of the local gemstone market.
- Downstream processing will result in adding value to rough stones that will in turn generate employment
- Once established, the lapidary industry would provide increased revenue for the government through taxes as well as increased foreign exchange earnings.
- It will increase the volume of cash inflows into the gemstone sector thereby creating the possibility of internal financing for re-investment.

- The report would provide an insight into the Zambian gemstone industry for people contemplating to venture into gemstone cutting and polishing. It discusses the mining and marketing aspects quite significantly to serve as a starting point for newcomers on the gemstone arena who would like to invest in any sector of the gemstone industry.

The adopted approach for achieving this task is by first identifying and documenting the constraints facing the lapidary industry in Zambia. It has been recognized that most of these constraints facing the industry now are passed on from the supply side of gemstones – mining. Since all the problems facing the various sectors of the gemstone industry (i.e. mining, processing and marketing) are interrelated, in this study, they have all been brought together into single focus. This holistic approach allows a formulation of policies that are comprehensive and coherent as the problems facing the entire industry are taken in corroboration.

Previous attempts by government since the 1980's to address the problems the gemstone industry was facing did not yield any tangible results. The Government tried to make compulsory cutting and polishing of all emeralds through Zambia Emeralds Industries Limited (ZEIL). This approach failed because interests of the producer were not addressed. ZEIL assumed a dual role of a processing and buying without independent valuation. This led to the collapse of ZEIL when economic controls were lifted. The gem cutting techniques were taught to small-scale miners, through various workshops, without providing the equipment or putting appropriate marketing measures in place. The Government used a compartmentalized approach. These earlier endeavours to solve the problems facing the industry lamentably failed because they tended to address them

independently of one another. In this study, the other two segments of the industry – mining and marketing, have been included and their impact on the lapidary sector has been identified and elaborated. When these problems are taken together it is easier to take appropriate interventions encompassing the entire cross section of the gemstone industry.

1.4 Research Methodology

The methods employed to collect relevant information for this study included the distribution of questionnaires. There were three types of questionnaires designed for the study. The first type was targeted for the gemstone miners and 13 of the sample of 30 distributed were answered and returned (see Appendix IX). There are more than 450 mining licence holders in the industry.

The second questionnaire was addressed to Lapidary and Jewellery owners (see Appendix X). The directory of Jewelleries and Lapidaries in Zambia published in 1995, which was used to trace the locations is outdated. Most of those still listed in it have since been closed. Tracking the few that still exist to date and others that have sprung up was difficult. In this category, only 10 were contacted and one from Ndola never responded on two occasions despite being left with a self-addressed envelope. This demonstrates how much people in the industry are fatigued with initiatives that are meant to help them because previous attempts yielded nothing. The second type was designed to assess the constraints of the lapidary and jewellery industries, and the role government is supposed to play.

Questionnaire type III was intended for the public and 70 copies were distributed (see Appendix XI). Only 62 were recovered. This was meant to assess how much Zambians

appreciate gemstone products for personal adornment. Interviews were also conducted with respondents in order to get points that could not be expressed in question form.

Further interviews were also conducted with other stake holders like officials at the Ministry of Mines, Export Board of Zambia, Ministry of Trade Commerce and Industry, the Bank of Zambia and Central Statistical Office. Others interviewed for the same exercise were officials from Ministry of Finance, Zambia Chamber of Commerce and Industry, Zambia Privatization Agency and numerous other individuals who were stumbled upon during the exercise. Data was also collected on hard copies from the same organizations stated above. The High Courts of Zambia in Kitwe and Ndola were visited to study some of the several cases involving miners that were brought before the law.

1.5 Scope of the Study

The focus of this study is mainly on the lapidary industry and how it can be strengthened from its current deplorable state. Since the lapidary industry relies on mining for the supply of raw material, an assessment of gemstone mining and its sustained capacity to deliver has been analysed. Zambia's mining policy with regards to gemstone activities has been included. Although Zambia is renowned in the world for its quality emeralds other types of gemstones are also abundant and have therefore been discussed.

The Zambian gemstone industry has been shaped by emerald mining. This study has therefore been extended to cover the legislation that was put in place to cater for emeralds and came to encompass the entire spectrum of gemstones that appeared later on the scene. The legacy of the marketing arrangements, which were intended for the emeralds and

have since undergone a lot of transformation, and their ramifications still affect the industry today. A history of gemstone mining in Zambia based on emeralds has been included.

International Gemstone Markets of Europe, America and Asia have been incorporated in order to demonstrate the availability of opportunities open to Zambia's cut stones. Most of the countries of the developed world import cut stones from India, Thailand and Israel. Meanwhile, these very countries are the major importers of Zambian rough gemstones that they cut, polish, and re-export to world gemstone markets. This topic has been deliberately included to bring attention to the export potential of cut and polished stones that has been usurped from Zambia by importers of rough gemstones. This allows a good assessment of how much potential exists for the Lapidary Industry if it were to be invigorated.

CHAPTER TWO

OCCURRENCE AND LOCALITIES OF GEMSTONES

2.1 Geology and Occurrence of Gemstones

Zambia is endowed with major geological settings that play host to gemstones. (see Fig. 2.1). Pegmatites country can be subdivided into five geological domains). The first is the Basement Complex, which is composed of granite, gneiss and schist. The Muva Super Group lies above Basement Complex and comprises pelitic and psammitic sediments and metasediments, which are intruded by acidic and basic rocks. The Muva is in turn overlain by the Katanga Super Group. The Katanga consists of pelitic and psammitic metasediments intruded by acidic and basic rocks. Above the Katanga lies the Karoo Super Group composed of pelitic and psammatic sediments and basalt flows. The fifth geological setting consists of Alluvium, Colluvium and Laterite which are the youngest sediments.

The gemstones are of a very wide distribution, they are found mainly in nine different types of environment, namely:

i. **Pegmatites**, with beryls, tourmalines, garnets, amethyst, citrine, cairngorm, moonstone, topaz, chrysoberyl, spodumene, zircon, rose quartz, beryls and chalcedony;

ii. **Veins**, with amethyst, fluorite, apatite, calcite, topaz, epidote, citrine, amazonite, tourmalines, rock crystal cairngorm, rose quartz, beryls and chalcedony.

iii. **Metamorphic** (mainly) sedimentary or volcanic, with garnets, diopside, corundum, epidote, sillimanite, kyanite, tourmalines, rutile, calcite, apatite, zircon, calcite and spinel;

iv. **Karoo basalts,** with amethyst, agates, opal, jasper, chalcedony, peridot, calcite, dumorterite and rock crystals;

v. **Contact zones,** with sillimanite, spinel, andradite, epidote, peridote, calcite, garnet, and amazonite;

vi. **Contact zones between pegmatites** and magnesium rich rocks, with emeralds, tourmalines, aquamarines, chrysoberyl and soapstones;

vii. **Kimberlites and lamproites,** with diamonds, spinels, zircons, garnets, peridot, kyanite and rutile;

viii. **Oxidised parts of sulphides**, with dioptase, malachite, chrysocolla, azurite and chalcanthite;

ix. **Detrital** (alluvial, elivial, colluvial, deluvial, rubble beds, boulder beds, etc) with diamonds, garnets, corundum, agates topaz, zircon, rutile, spinel, epidote, chrysoberyl, amethyst, tourmalines, beryls and peridote.

Gemstone mining is concentrated mainly in three mineral districts. The geological age of mineralization in these districts is quite different. Emerald in the Ndola Rural or Kafubu area was emplaced in pegmatites during Proterozoic time (approximately 1,400 million years ago) before the deposition of the Katanga Supergroup. Aquamarine in the Lundazi area is post-Katanga, pre-Karoo and probably synchronous with a granite which has been dated at 489 million years. Amethyst from Kalomo (Mwakambiko Hill) is post-Karoo and probably Jurassic in age (roughly 300 million years) (Brunnelli-1,1994)(a).

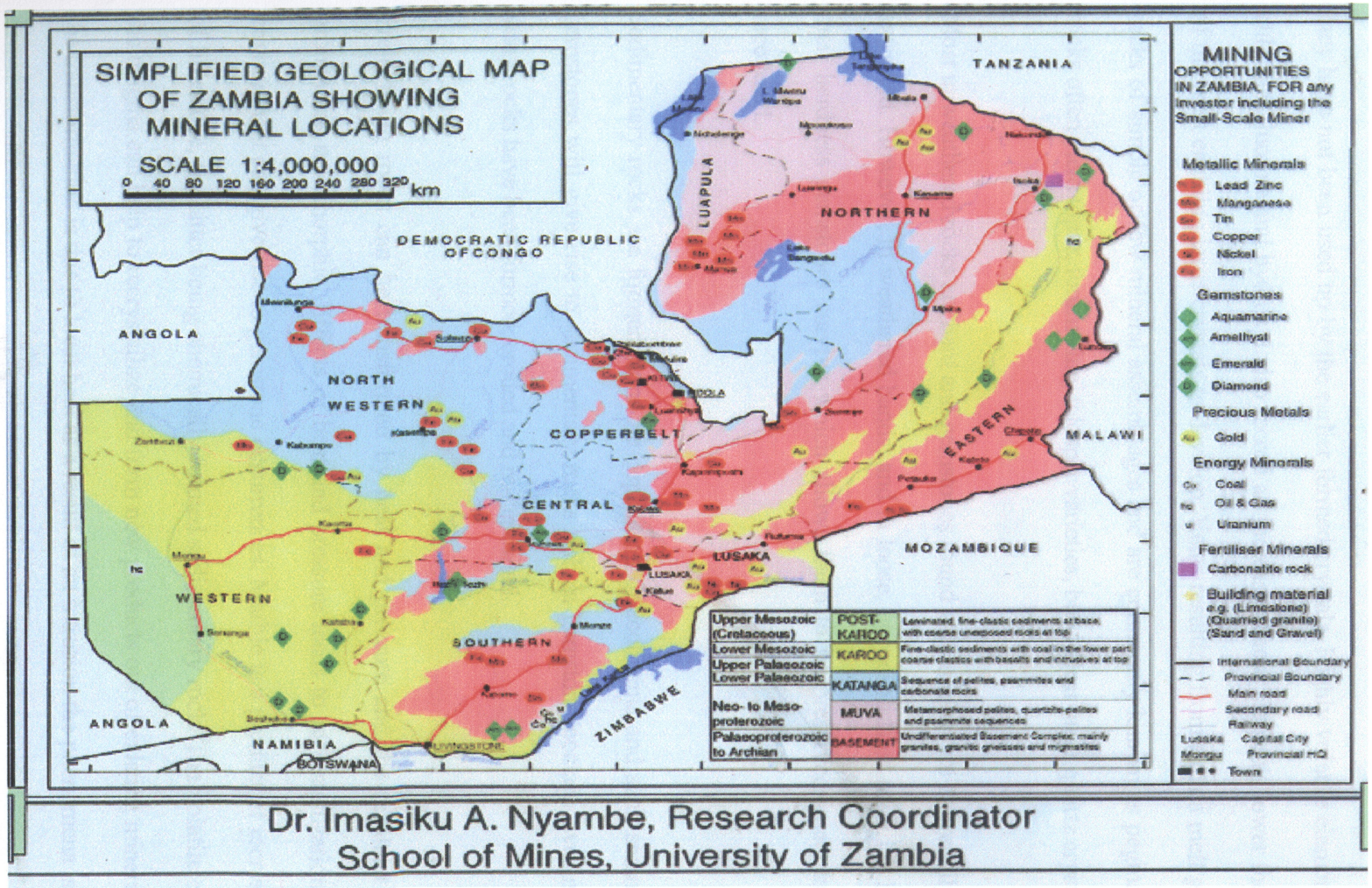
Most gemstones are minerals and minerals are the constituents of rocks, which make up the entire inorganic solid portion of the earth.

Gemstones are minerals that stand out from other minerals by their beauty, durability and comparative rarity. A gemstone is rare because of its unique characteristics - physical and optical.

There are several geological conditions necessary for a mineral to attain a gemstone status and such conditions are not common. For example, emeralds required a source of chromium, beryl minerals of which emerald is a special variety would be either colourless or tinted less attractively by other elements. In addition, for gem quality crystals to form, cooling from hot liquid phase must take place slowly. Fast cooling results in glassy products or minute crystals colloquially called 'sugar-sugar'.

Gemstones occur in all forms of rocks, igneous, sedimentary and metamorphic. Relatively large crystals are found in igneous rocks, which originate through crystallization of molten rock or magma. Deep-seated magma cools slowly and allows large crystals to form. Such rocks are plutonic and from such plutons ribbons of veins or dykes rise to fill the fissure in the surrounding rocks. Contact with cooler rocks above, leads to quick chilling along the margins and slow cooling towards the centre. The primary magma is largely basic in composition and is low in silica (around 50%) and relatively high in magnesium, lime, alumina and iron oxides. As the magma crystallizes, magnesium minerals are precipitated.

Figure 2.1 **Geological Map of Zambia Showing Gemstone Mineral Locations (After Nyambe, 1999)**



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With progressive crystallization and withdrawal of basic elements (magnesium calcium and iron) the magma becomes enriched in silica (quartz) and the composition of the magma and the resultant rocks become acidic. Granite is an acidic rock. Along with increasing silica, granite contains other elements such as lithium, beryllium and boron which also increase as they have not been used up by the earlier formed crystals. Highly volatile elements such as chlorine, fluorine and hydroxyl also record an increase. These elements lower the viscosity of the melt enabling large crystals to develop. Veins resulting from such a melt give rise to rocks of simple or few mineral assemblages and are commonly known as pegmatite. Such rocks often yield topaz, tourmaline, feldspar varieties, beryl clear large quartz crystals etc.

Most unweathered rocks are hard and gemstones found within them are not readily or easily extracted. However, in weathered bands, and in loose, unconsolidated material, because of their hardness gemstones survive which allows them to be preserved intact and readily recovered.

Sedimentary rocks are formed from the deposition of sediments and such sediments with gemstones will give rise to sedimentary rocks rich in gemstone pockets over millions of years rocks have been formed, eroded and re-deposited.

Pre-existing rocks can be transformed by heat and pressure and the resultant rocks are grouped as metamorphic. Effects of heat and pressure leads to recrystallization and such environment can give rise to gemstone occurrences. Marble is a product of recrystallization of limestone, the latter being chemically formed sedimentary rock. The volatile contents of the magma can help to recrystallize and form new products out of existing minerals. Where the transformation is due to local heat as a result of an intrusion the phenomena is known as

Contact Metamorphism as opposed to Regional Metamorphism, which is widespread and a function of both heat and pressure.

The finding of a gem crystal or pebble may provide a lead to the discovery of a rich new gem source. Such discoveries are rare for deposits occupy only a thin portion of the earth's crust. Basically, they are formed at depth or near the earth's surface and at varying temperature and pressure conditions. Gemstones can be formed when any of the following earth events take place:-

- During upwelling of magma
- Uplifting during mountain building
- During crystallization of granites
- During interaction of magma with limestone to form skarns
- During along quiet period when low temperature porous rock in a stable environment is precipitated.

The origins of gem minerals are therefore diverse. Their rarity stems from the unique combination of physical and chemical conditions necessary for gem formation and transportation to the surface. In Zambia, most of the gemstones are hosted in the veins and pegmatites within metamorphic or sedimentary rocks (see section 2.3.1).

Veins are mineral fillings of a fault or other fracture, in tabular or sheet like form. Veins vary in size from less than a millimeter to over a meter. The amethyst mineralization in the Kalomo area is found in such veins. The veins can be traced for long distances. The

emeralds of Ndola Rural also occur either within veins intruding metamorphic rocks (talc schists) or at the edge or margins.

A pegmatite is a very coarse-grained igneous rock with interlocking crystals usually found as irregular bodies (dykes), lenses or veins. The pegmatite is a special rock type, which usually hosts beryl, feldspar, tourmaline, garnet, spodumene, topaz etc.

2.2 Gemstone Localities of Zambia

Zambia is endowed with numerous pegmatities from which there are significant production of high quality gemstones. Among the gemstones, emeralds are the most important contributor to the country's economy while aquamarines, amethyst and tourmaline play lesser, but significant, roles.

The geological distribution would appear reasonably well defined. Four major areas have been recognized and these are: -

- Ndola Rural for emeralds,
- Kalomo for amethyst
- Lundazi for aquamarine
- Mkushi – Serenje for tourmaline and aquamarine

While these are the principal areas for the respective minerals, they are by no means confined to these territories. Amethyst is found west of Luanshya, tourmaline is also found at Nyimba and emerald has been reported from Changa in the Southern Province. A brief

review of the geological setting of the principal areas is presented in section 2.3.1 (refer Figure 2.1).

2.3.1 Description of Principal Gemstone Producing Areas

(a) Ndola Rural Area

The emeralds occur in pegmatites where they intersect talc-magnetite schist horizons in the Muva group, a thick sequence of metamorphosed clastic sediments deposited as sands, silts and shales. The talc-chlorite-magnetite schist horizons, which are found in the lower part of the Muva group, are considered to be the metamorphosed equivalent of very basic (high magnesium) lava flows or sills. There appears to be four main horizons or belts of talc schist in the kafubu area. The Chantete or the northeastern belt, dips 60° away from the Kafubu granite stock, the Miku or northern belt, dips 30° away from the stock; and the main belt, 5 km further south, dips 45° south. The southern belt 10 km farther south is not as continuous and has variable strikes and dips. For emerald exploration the footwall contact of the talc schist (of Muva group) with mica schist (in concordant pegmatites) is critical. It is along this contact that the emeralds are found. At a number of localities the contact (with emeralds) is a "slip plane" and also a zone for groundwater. Quartz-rich offshoots from the main pegmatite which cut the talc-schist may be 0.5 m wide and 5 to 50m long. These discordant pegmatites are zoned and have quartz-tourmaline cores and phlogopite-rich margins. Pockets of emeralds occur along these margins, often at the junction of "offshoots".

(b) Kalomo Area

The amethyst deposits occur in a northeast-trending belt, some 30 km long and 15 km wide. The main area of mining is concentrated in a narrower zone 15 km long and 2 km

wide. The bedrock geology is a metamorphic terrain intruded by granite and syenite. The country is rugged by Zambian standards. The veins formed along steeply dipping fractures in the older basement rocks are related to the major normal faulting which formed the Zambezi rift valley. The veins occur singly or in clusters.

(c) Lundazi Area

Lundazi pegmatites to be related to the Sinda batholith to the southwest or to a hypothetical, unexposed stock of similar age beneath the area (Brunnelli-1, 1994) (b). This means that the pegmatites are related to post-Katanga, pre-Karoo events considered to have occurred approximately 485 millions year ago. The pegmatites are emplaced into schists and gneisses of the basement complex and the overlying Muva supergroup. The Lundazi pegmatites are generally small, often occur in groups, are stock-like or lensoid and are haphazardly oriented. They generally contain radioactive minerals which helps in prospecting. They commonly show evidence of several stages of emplacement with inward cooling and crystallization. The outer zones of these zoned pegmatites include microcline, mica and coarse, cloudy, euhedral beryl. These beryls are commonly fractured. Within the microcline zone, there is often a well-defined quartz inner zone flanked on the outside by albite. Gem-quality aquamarine occurs in both in the albite zone and the cavities in the core.

(d) Mkushi-Serenje Area

The pegmatites occurring in the Mkushi and Serenje areas form part of a pegmatite field that extends along the entire length of the belt from Kapiri-Mposhi to Tunduma and into the Chipata – Lundazi – Chama areas. The general location is 50 km south of Mkushi,

200 km northeast of Lusaka and 180 km southeast of Kitwe. The pegmatite field lies between the north and the northeasterly trending, mid-Proterozoic fold belts. The fold belt extends over a width of about 120 km along the Great North road between the northern end of the Mchinga escarpment and the Mafinga-Hills in the eastern part of the country. It is bounded to the northeast by the Bangweulu block and to the southeast across the Luangwa valley and by the Mozambique belt to the northeast. The area is underlain by basement complex. It is in the pegmatites that coloured tourmalines, aquamarine, chrysoberyl and many other type of gemstones are found. The pegmatite bodies are of all sizes. They intrude gneisses and schists in the basement complex and occur in the form of dykes, veins, sills, stocks, pods, sheets, pipe-like bodies and irregular segregations. The majority of the pegmatites have steep to vertical dips. Some take the form of large elongated oval-shape bodies which may run to over 500 m in length where as others occur as narrow veins. These pegmatites are mineralogically and structurally complex in nature. Other gemstones present in the pegmatites include garnets, rock-crystal (quartz), citrine, amethyst, rose quartz, apatite, fluorite and epidote[1].

2.3.2 Geographical Locations of Main Gemstones in Zambia

(a) Amethyst

The area well known for good quality amethyst is the Mwakambiko of Kabanga Mission in the Kalomo District of the Southern Province.

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[1] The items (a) to (d) have been reproduced from the EBZ Report " *Overview of the Gemstone Industry in Zambia – Phase 1*' pp50, Lusaka , 1994

Gneisses adjoining the major rift like faults of the mid-Zambezi were penetrated by mineral bearing solutions during the Karoo times. The host rocks are granulates and gneisses. The rifting affected these rocks and the fractures that were developed as a result, amethystine solution was injected giving rise to series of veins lenses and stock works. The veins range from few centimetres in width to up to a metre. Colour varies from pale to deep purple and because of intermittent tectonic activity and shatter effects, multiple recrystallization appears to have taken place resulting in peculiar textural characteristics. There is a tendency for the amethysts to get darker towards north.

A number of licences have been issued and the region is a well-established producer of amethyst. Most workings are open cast with one underground mine which has since been abandoned.

(b) Aquamarine

Aquamarine has been found in many localities in the Basement rocks. In Serenje and Mkushi areas where they occur in pegmatites encompassed by gneisses and schists (Mapani, 1987). Aquamarine has been found in Itezhi-Tezhi in an area underlain by Hook granite. It is also found around the Luangwa River bridge area.

(c) Corundum

The occurrence of gem varieties of mineral corundum ruby and sapphire have not been found in Zambia. The mineral corundum is reported to occur east of Jessie north of Rufunsa, on the southern escarpment of Luano Valley (Mambwe, 1992). Some unconfirmed reports state the occurrence of corundum, ruby – variety east of Kafue, where it is associated with kynite pods and at Mugoto, 25 km east of Mazabuka.

(d) Diamonds

Recent reports of 2000, confirm existence of gem quality alluvial diamonds in Zambia from the exploration work led by Caledonia Mining Ltd in Shangómbo Western Province. The documents detailing this find are classified as they are considered a national security matter. Similar occurrences have been reported in Mwinilunga, North Western Province. In the past De Beers carried out extensive diamond prospecting from 1955 – 1983 during which they found 498 pieces of diamonds with a weight of 2.29 grams or an equivalent of 11.44 carats (Mambwe and Money, 1989) (a). The specific areas are found in the Provinces Eastern, Northern, Western and Northwestern as indicated in Figure 2.1.

(e) Emerald

Emerald so far is only found in Ndola Rural Area. Unconfirmed reports claim two other areas outside Ndola Rural (Mambwe and Money, 1993) (b). One such place is Changa area in Southern Province, which is 41 Km northwest of Siavonga District. The other place is the Kalomo Amethyst area.

The following are considered potential areas for emeralds occurrence due to similarities in geology to the Ndola Rural Emerald Area:-

- Mkushi – Kapiri Mposhi area
- Kasama – Mbala area
- Mpika Precincts

- Mutupa area which is 30 km south of Mufulira. The Talc schist and quartz-tourmaline float was reported in 1936 (Freeman, 1978).

(f) Garnet

Gem Quality garnet of the almandine variety is reported to occur at Nega-Nega in Southern Province and Nyimba precincts of Eastern Province. Mapani (1987) reported the presence of garnets 35 km south east of Serenje. Alluvial red rose garnets (Rhodolite) has been reported in Zhimu and Zongwe Rivers in Sinazongwe District, Southern Province.

(g) Malachite

Malachite of gem variety is associated with several copper mineralizations typical of mining areas. The most important being the Bwana-Mkubwa copper deposits near Ndola (see Fig. 2.1). Numerous isolated occurrences have been reported from Northwestern Province. Other important occurrences have been reported 32 km south of Nyimba, at Mumbwa (Sugar Loaf) and in the Mkushi area. One striking occurrence is at Ndomba Hills, about 15 km west of Sarare Mine in the Eastern Province.

(h) Quartz Gemstones

i. Rose, smoky, citrine, ...

Pegmatites hosting very good quality quartz-gemstones are found in Eastern, Central and Southern Provinces. The gemstone varieties of Quartz are rose quartz, smoky quartz, clear quartz, citrine, chalcedony, cat's eye quartz and conventurine quartz.

ii. Opal

Gem grade opal occurs near Sinazongwe as crypro-crystalline quartz (see Fig. 2.1). Chalcedonic siliceous stones resembling opal have been reported east of Lusaka.

(i) Tourmaline

Good grade tourmaline is mostly found in the Eastern Province. Well-known localities in the Province are Kamilulu, Kaombika, Chezi, Kapindo and Musakeni in Lundazi District. Outside Lundazi, green and pink tourmaline is found in Nyimba area, which covers Hofmeyer Mine. Significant quantities of gem tourmaline are also found in Mkushi and Serenje in the Chibale-Mukopa areas.

(j) Agates

The Karoo basalts near Livingstone contain surfaces which on weathering yield agates. Agate with similar mode of occurrence is reported at Dombwi Hill near Chileke along Chirundu Road. It is characterized by white and gray bands (Ngándu, 1991).

CHAPTER THREE

GEMSTONES SECTOR POLICIES

3.1 Mining Policy

The new Zambia's Mining policy is intended to promote private sector initiative in the development of new mines (MMMD, 1995). This has been addressed by providing a stable legal and fiscal regime to attract private investment in exploration and development of new mines. Since the enactment of the new mining policy, the Ministry of Mines and Minerals Development has recorded an increase in licence processing. As at February 2000 a total of 665 licences and permits had been issued, see Table 3.1 for a break down of details.

Table 3.1 Licences and Permits Issued

Type	Large-Scale PL and ML	Small-Scale ML	Gemstone GL	Prospecting Permits	Total	Gemstone Sales Certificate
No.	198	70	375	22	665	415

There has been remarkable increase and diversification of mineral and mineral-based production and exports, which has in turn increased the generation of foreign exchange and financial resources for the country. This increase is presented in Figure 4.2. The sudden surge in the production of gemstones for 1996-97 immediately after the new mining policy went into force can serve as an example. From a total production of about 217 thousand kilogrammes 1994 before the new policy to 2.3 million kilogrammes in 1996 after the policy was enacted.

The new legal and fiscal regimes have created a more conducive investment climate to develop new mines and provided the following guarantees;

- Security of title to mining rights
- Stability of legal and fiscal regimes
- Exemption from payment of import duty and Value Added Tax (VAT) on imported capital equipment
- Minimum tax return
- Minimum royalty rate on value added products (ref. Section 3.4.2 under Royalty)
- Classification of cut and polished gemstones and jewellery products as Non-Traditional Export (NTE) and therefore qualify for only 15% export tax
- Free usage of foreign exchange
- Right to market mine products
- Right to assign mining right (right to trade mining right)
- Stability in environmental legislation
- International arbitration
- Freedom of commercial operation
- Stable returns to both the government and mining company

The Government's policy is not to participate directly in exploration or other mining activities but to assume a monitoring, regulatory and promotional role.

3.2 *Classification of Gemstone Mines*

Under the new Mining Policy the mining operations pertaining to gemstones are divided into three categories depending on the scale of operation. These are discussed below:

3.2.1 Large Scale Mining Operations

(a) Prospecting Licence

No distinction is made between the prospecting and exploration licence. Only one licence renewable with relinquishments of 50% of the area at each stage. The initial grant will be for two years renewable for successive periods of two years each. The Minister may further renew the licence in order for the holder to complete the feasibility study.

The prospecting licence obliges the licencee to adhere to agreed programme of work: financial commitment, employment and training of Zambians. In carrying out these obligations the mineral rights holder has exclusive rights for mineral prospecting operations in the area. Quarterly and annual reports must be submitted in addition to geological reports at the end of the licence period.

The following Tables 3.2-3.4 summarise the prospecting licence fees for different mineral commodity categories.

Table 3.2 Licence fees for Precious Minerals (diamonds, emeralds and ruby)

Item	Cost
Basic licence fee	K20,000
Area Charges	K1000/ha/y
For each additional precious mineral	K800/ha/y
For each additional semi-precious mineral	K400/ha/y
For each additional mineral (other precious or Semi-precious)	K400/ha/y

Table 3.3 **Licence fees for Semi-precious Minerals (amethysts, aquamarine, tourmaline, etc.):**

Item	Cost
Basic licence fee	K10,000
Area Charges	K600/ha/y
For each additional	K600/ha/y

Table 3.4 **Licence fees for any Other Minerals**

Item	Cost
Basic licence fee	K4,000
Area Charges (other precious and semi-precious)	K400/ km^2/y
For each additional mineral (other than precious and semi-precious)	K400/ km^2/y

The holder of the prospecting licence has the right to apply for and be granted a Special Mining licence for mining within the prospecting area, upon fulfilling certain conditions. Monthly returns, quarterly and annual reports are required.

(b) Retention Licence

The holder of the prospecting licence may apply for a Retention licence if he identifies a deposit of potential commercial interest or when a deposit cannot meet adverse market conditions or other economic factors of a temporary character.

(c) Special Mining Licence

The holder of the prospecting licence is entitled to a Special Mining Licence. A person who is not a holder of the prospecting licence may apply for a Special Mining Licence over a vacant area. The duration of the Special Mining licence is 25 years. Monthly returns, quarterly and annual reports are required.

The application to be accompanied by:

- Proposed programme of mining operations
- Applicable environmental protection plan
- Proposal for the employment and training of citizens of Zambia
- Mining Development Agreement. A model of Mining Development Agreement has been proposed.

For different mineral commodity categories the Special Mining Licence fees are are given in Tables 3.5-3.7.

Table 3.5 Licence fees for Precious Minerals (diamonds, emeralds and ruby)

Item	Cost
Basic licence fee	K80,000
Area Charges	K2,000/ha/y
For each additional precious mineral	K2,000/ha/y
For each additional semi-precious mineral	K1,000/ha/y
For each additional mineral (other than precious or Semi-precious)	K400/ha/y

Table 3.6 Licence fees for Semi-precious Minerals (amethysts, aquamarine, tourmaline, etc.):

Item	Cost
Basic licence fee	K40,000
Area Charges	K1000/ha/y
For each additional	K1000/ha/y

Table 3.7 Licence fees for any Other Minerals

Item	Cost
Basic licence fee	K4,000
Area Charges	K800/ km^2/y
For each additional mineral (other than precious and semi-precious)	K800/ km^2/y

The special Mining Licence cannot be withdrawn once granted except on specified grounds clearly spelt out in the law and adequate accepted procedures followed. The holder of the

Mining lease has the exclusive right subject to the Act, regulations and conditions in the licence to carry on all operations in accordance with the programme of mining operations and environmental protection.

3.2.2 Small-scale Mining Operations

The applications for Mining Licence for gemstones can be made to the local office. An initial grant of 10 years is renewable once for a further 10 years. Maximum area is 400 ha. After five years, the holder may be required to apply for a Special Mining Licence.

3.2.3 Artisanal Mining Operations

Applications for the Mining Permit to be made to the local office. The maximum duration is two years. Artisanal Mining licences are limited to 5 ha.

All mining operations in all categories of licensing have to strictly abide by the Mines and Minerals Act of 1995. Before commencement of mining operations across all various Mining Licences, full compliance of the Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations of 1997 has to be enforced.

3.3 *Fiscal Regime*

There is no preferential treatment between foreign and local investment. Import and export restrictions do not exist except for a short negative list that requires government consent. The list includes explosives, drugs, ammunitions, pesticides, seeds, plants, minerals, etc.

The Zambia Investment Centre was set up under the Investment Act of 1993. Its role is to facilitate, provide and regulate domestic and foreign investment. The Investment Centre

was specifically set up to assist investors and to serve as a one-stop facility to co-ordinate the steps necessary to make an investment.

The Exchange Control Act was abolished and hence there are no restrictions on repatriation of funds. This allows opening and maintaining of foreign currency denominated accounts in local Commercial Banks. There are no restrictions on establishments and maintenance of offshore accounts. Any entity is free to borrow from external sources without Government interference and repay as revenues are generated. In the same vein commercial Banks may lend to any entity in foreign currency without government authority. They lend using the usual banking operating criteria depending on the individual ability of the bank.

In line with Government policy to bring down inflation, banks constrained by liquidity ratios are able to lend for short and medium terms which is equivalent to 12 months and three years respectively. Interest rates vary from bank to bank and from 40 % to 50 % dependent on weekly Treasury Bills tenders.

3.4 *Business Legislation*

Business activities, Lapidaries and Jewelleries included, may be carried out by individuals or companies. All business enterprises must be carried out under a name. Under the Companies Act, there are three types of Companies exist in Zambia, namely Public Companies, Private Companies and Foreigh Companies incorporated outside Zambia but operating in Zambia.

The Investment Act of 1993, revised 1996 and 2000, provides certain guarantees and incentives to investors in a business under the same Act. This applies to Lapidary, Jewellery, other manufacturing and commercial industries. Mining is provided for in the new Mines and Minerals act, 1995.

Disputes may be settled amicably or through arbitration. In the case of failure to settle disputes amicably, an investor has the right to refer the matter to an arbitration Board constituted under the Act or the High Court. In the event that the dispute still continues, the matter may be referred to:

- The Informational Centre for the Settlement of Investment Disputes (ICSID)
- The United Nations Commission in the International Trade Law (UNICITRAL)
- Any other international Machinery for the settlement of investment disputes agreed to by the parties.

Zambia is a member of the Multilateral Investment Guarantee Agency (MIGA) which subjects companies operating in the country to be eligible for international arbitration.

The employment of local workers in Zambia is regulated by collective bargaining under the Industrial Relations Act or Minimum Wages and Conditions of Employment Act, 1992. The Minimum Wages and Conditions of Employment (General) Order 1990 regulates the employment of specified workers such as General workers, watchmen, etc.

Expatriates wishing to work in Zambia must obtain work permits from the Department of Immigration. The requirements for employment permit are that the employee should have a valid contract from the prospective employer who should show that local expertise is not available. For self-employment, work permit (for investors) certificate of shares, investment licence and Bank of Zambia Statement showing importation of capital (for first-time investors in Zambia) must be produced.

3.5 *Taxation*

The new Mines and Minerals Act incorporates progressive financial provisions for the Mining Sector. These provisions have recognized the special and peculiar features of the mining industry i.e. huge capital investment requirements, highly sophisticated technology, risk, market conditions, etc.

3.5.1 Corporate Tax

Corporate tax is charged at the base rate of 35 %. For companies listed on the Lusaka Stock Exchange, the rate is 30 %. However, for mining companies the income tax rate is 25%. Mechanisms are incorporated into the tax regime to recognize the changing market conditions. The tax system provides for, on one hand relief to mining companies during hard times and on the other, the possibility of capturing windfall profits in times of buoyant mineral prices.

3.5.2 *Mineral Royalty Tax*

This replaced the old Mineral Export Tax. The royalty tax rates are as follows:

Mineral	Royalty Rate (%)
Base or industrial minerals	0.6
Precious metals	3
Gemstones	5

The royalty is calculated on the market value of the minerals f.o.b. less the cost of processing, insurance, handling and transportation from the mining area to the point of export or delivery within Zambia. In the case where the mineral is processed locally, the entire royalty is waived and only corporate tax will apply.

However, for processed gemstones, jewellery, they fall under the Non-Traditional products status where the corporate tax is reduced to 15 %. Until 1995, all gemstone exports, including rough, used to fall in this category of Non-Traditional Exports (NTEs).

3.5.3 Import Duty and Sales Tax

Mining rights holders are exempted from payment of import duty which is normally in the range between 20 – 40 % and sales tax normally at 23 % on all eligible machinery, equipment, and supplies for operations.

3.5.4 Other Taxes

Non-resident withholding taxes are charged at 10 %. These include: rents, contractors, dividends, interest, management fees and royalties.

3.5.5 Other Tax Benefits

In general, the Zambian tax regime also provides the following terms:

- 100 % deduction of pre-production expenses and other capital expenditure as defined in the Income Tax Act of 1999.
- Accelerated depreciation allowances for expenditure on machinery and equipment that does not qualify for hundred 100 % deduction.
- Unlimited carry forward losses.

Import duties are charged on specific items and the duty varies between 20 and 40 %. Usually items such as beers, wines, cigarettes, jewellery, cosmetics and luxury capital goods may be charged at higher rates. Certain essential goods such as crude oil, medical supplies, and fertilizers are exempt from duty.

Pay-as-you-earn system of tax collection applies to personal emoluments. Individuals ordinary resident in Zambia are liable to tax on income from sources in Zambia.

3.6 *Institutional Framework Support*

3.6.1 Ministry of Mines and Minerals Development

The Ministry of Mines and Minerals Development has the overall responsibility for geological surveys, minerals and mining. The three professional departments of the Ministry are Geological Survey, Mines Safety and Mines and Minerals Development that have specific responsibilities of implementing and enforcing the policies. In addition, the National Council for Industrial Research (NCIR) and Mount Makulu carryout some levels of research related to geoscience. The departments together with the Research centres provide facilities to carry out specific orientation studies and routine analysis.

Geological Survey Department

The Geological Survey Department collects and maintains geological, geophysical and geochemical data on a country-wide basis and acts as the national repository for all geological data on Zambia. It also provides support and advisory services to the public. Specialist units include the Chemistry Laboratory, Geophysics Section, Mineral Dressing and Metallurgical Laboratory, Gemmological Unit, Mineralogy and Petrology Laboratory and Cartographic Unit.

Mines Development Department

The Mines Development Department is responsible for drafting government mining policies and recommends which type of imported mining equipment qualifies for duty. It serves as liaison with other government ministries like the Ministry of Finance pertaining to the role of mining in national development. It is responsible for the issuing of all prospecting, retention and mining licences together with monitoring mining operations. Due to budgetary constraints the inspections to small-scale mines are seldom.

Mines Safety Department

The Mines Safety Department is responsible for all aspects of safety in mineral exploration, mining operations and explosives use. They carryout inspections for compliance and impose penalties for violations of regulations. The Department issues Blasting Licences for all mining operations in the Republic of Zambia and conducts escorts of incoming explosives from port of entry and the outgoing up to the port of exit.

In the National Budget of the Republic of Zambia for the year 2000, out of a gross of ZMK 2,957 billion budget for the country only ZMK 5.5 billion was allocated which is only 0.18%. Even this meagre amount the Government still failed to meet in full the pledged allocation requirements. The weakened resource base has made it extremely difficult for responsible Departments of the Ministry to undertake their regulatory and field support services. With the actual allocation falling far short of the budget, aggravates the situation as retention of professional staff in the Ministry becomes difficult.

3.6.2 Universities and Colleges

The University in Zambia and Copperbelt University offer programmes in earth sciences and engineering. The members of staff provide consultancy to the gemstone industry in matters relating to geology, mining, identification and valuation of gems. There are also several Colleges and Trade Schools scattered through out the country that supply skilled manpower in various fields other than lapidary and jewellery for the Zambian economy.

The trade schools can easily accommodate the gemstone cutting, polishing and jewellery training should the Government come up with the now long-over-due idea of seriously establishing a sound lapidary industry in Zambia.

3.6.3 Export Board of Zambia (EBZ)

EBZ was formed under the Export Development Act, 1985 and became fully operational in 1987. It was created in order to help find markets abroad for emergent industries like gemstone. This is achieved by advertising gemstones in brochures distributed abroad and

articles in foreign print media circulations. EBZ also develops and promotes non-traditional exports from Zambia into the global market by participating in trade fairs both local and foreign and linking Zambian exporters directly with the importers. Apart from conducting seminars and workshops for potential exporters about export procedures, the institution also maintains a website http//: www.ebz.co.zm that guides visitors to different products available in Zambia.

3.7 *Summary of the New Mining Policy*

The intended goal of the new mining policy as regards gemstone sector is discussed in subsequent sections.

3.7.1 Development of New Mines

The new legal and fiscal regimes are meant to create a more conducive investment atmosphere by providing appropriate guarantees to investors as explained in sections 3.1 and 3.3 respectively in order to develop new mines and allow reinvestment in existing mining operations.

3.7.2 Mining and Marketing

The aim and objective of the Mining Policy is to promote the development of gemstone mining and facilitate liberalized marketing arrangements in order to realize the industry's potential contribution to the economy.

3.7.3 Small-scale Mining

For the first time Small scale mining has been specifically addressed in Zambia's Mining Policy. This is meant to promote the development of small-scale mining industry which has the potential for a significant contribution to the economy by providing an appropriate legal and fiscal regime. The Government has recognized special characteristics of small-scale and artisanal gemstone mining. It has provided for the simplified licensing, reporting and appropriate taxation systems.

3.7.4 Mining and Environmental Protection

To reduce the danger of ecological damage arising from mining operations as well as damage on the health of workers and inhabitants of the neighbourhood through air, water and land an appropriate piece of legislation has been enacted. This is to safeguard against environmental damage and ensure safe and healthy working environments for both workers and neighbouring inhabitants. Recognizing the damaging nature of mining operations, any mining licencee issued will have to be accompanied by an approved Environmental Impact Assessment and Management Plan. In addition, the legislation provides for the establishment of an Environmental Protection Fund.

3.7.5 Down-Stream Processing

This aspect is intended to promote the local processing of mineral raw materials into finished products with added value by providing an appropriate legal and fiscal regime.

The Government has introduced royalties in the legislation to encourage mining right holders to process their minerals into finished products. Mineral products which will be exported or sold in their primary form will attract a higher royalty rate than those exported or sold as finished products which do not require further processing.

3.7.6 Infrastructure

Increased economic activity resulting from the new mining policy is envisaged to give rise to infrastructural growth in areas of potential mineral deposits to enhance their development. The Government has put in place a mechanism for development of the infrastructure in the areas of mineral exploration.

3.7.7 Labour

To encourage the creation of employment and training opportunities for Zambians in the mining industry. The Government has put in place legislation and ensures employment, training and utilization of locally available manpower in the mining industry. The legislation has provided for a requirement for the mining right holders to employ and train Zambians in their operations.

3.7.8 Marketing

To develop a liberalized and free marketing environment for mineral products, the Government has put in place mechanisms to promote the development of a liberalized and free market environment for minerals and mineral products.

To establish a Gemstone Exchange and the provision of the trading in gemstones through Gemstone Sales Certificate will facilitate the creation of a liberalized and free market environment.

3.7.9 Institutional Support

To provide efficient and effective support services to the mining industry, the Government has restructured the Ministry of Mines in order to make it more responsive to the needs of the mining industry. The efficient and effective services will be enhanced by:

- Decentralization of the services of the ministry;
- Establishment of an Investment promotion Unit;
- Removal of bureaucratic licensing procedures;
- Maximization of the utilization of national research and development institutions to enhance development in the minerals industry and
- Informational flow, which is computerized.

CHAPTER FOUR

MINING AND MARKETING

4.1 Introduction

Zambia has been producing and exporting gemstone for more than 25 years (see Appendix XVII). Given the long history of the gemstone industry, the Government decided in 1995, to strip the industry off its Non-Traditional Product status on its exports.

The mining of gemstones is largely dominated by small-scale mining entrepreneurs. Small-scale in the sense that large-scale mining in Zambia refers to copper mining companies

The absence of big mining corporations in this otherwise lucrative business of gemstones has given room to the industry to create its own big names to dominate the local scene. First, there was Kagem Mining and now its Kuber Mining Company that is the industry leader on the Zambian scene. Kuber Mining Ltd diversified its gemstone mining operations from emerald mining in Ndola Rural to amethyst in Kalomo in 1999. In 1996 official exports from Kuber Mining Ltd were valued at about US$ 4 million followed by Kagem Mining with about US $ 3 million and Kariba Minerals with about US$ 2 million (Exporter, 1997). The tide, however, turned in 1999. Kuber Mining disappeared from the Million-Dollar Club of the year. Kagem Mining dominated the industry with about US$ 4 million followed by Southern Stream, Southern Quarries, Grizzly Mining, and Sarunit Enterprises respectively in the US$ 3 – 5 million category.

The Million-Dollar Club is a list of Zambian exporters compiled by Export Board of Zambia for the companies whose value of exports exceed US$1 million. The reason that may explain Kuber Mining's poor performance in the year under review is perhaps the dividing of resources between the emerald operations in Ndola Rural and Southern Province amethyst operations. These official estimates do not however reflect the exact performance of the industry, as sector experts advise, because of the clandestine dealings that are very rampant.

The export statistics may serve as a guide to project the potential of the gemstone industry performance if all mining license holders were to be financed and brought their mines into production the current performance would immensely improve. From a list of more than 400 mining licenses as at December 31, 1999, only 30 companies recorded exports of gemstones.

4.2 Emeralds Mining

The actual extraction of emeralds begins with prospecting in order to know exactly were to locate the production pit. Currently all emerald mining operations are by open pit mining. Only illegal miners have ventured into underground mining often with disastrous consequences due to cave-ins. A number of them lost their lives due to the cave-ins. As expected, such accidents are never reported for fear of recriminations.

For most emerald mines of the Ndola Rural, prospecting was done by the illegal miners. With help of *experts*, usually former illegal miners the position of the pit is located after trenching and pitting work. Former illegal miners constitute a large part of the work force

in the Kafubu Emerald area because of their expertise in understanding the geology of the place.

During the early days of emerald mining in the mid 1970s, most stones were won from alluvial gravels. Currently, all emeralds recovered are from veins that have to be exposed by removing up to 20m or more of overburden. Large mines in the area are organized open cast workings, with benches for slope stability. Exposed veins are, however, still worked manually with hammers and chisels. Development work usually employs bulldozers, backhoe excavators, dump trucks, front end loaders and other ancillaries like tractors and graders. This inventory of machinery is usually found in big mines like Kagem, Kuber and Grizzly mines to quote a few examples. All of the above equipment is used for stripping the overburden in order to expose the emerald-bearing vein. Incidental drilling and blasting is employed where an intervening hard rock usually a pegmatite is encountered in the path of the vein.

For emergent miners without a strong capital base with limited finance hiring a bulldozer and a backhoe excavator is adequate. The backhoe excavator is a very versatile machine. For short distances of up to about 50m it can replace a dozer, a dump truck and a front-end loader in one operation. It is not disadvantaged by the high slopes resulting from poor mine planning which is very common.

Extraction of Emeralds from the Rock Matrix

When the gemstone bearing rock is identified through the indicators biotitic mica schists a wider area around the vein is then exposed leaving it clearly visible. A team of pick and shovel men is deployed. Some times a crow bar, gasoline or pneumatic driven picks are

used. Occasionally light and carefully controlled blasting is carried out in form of an implosion as opposed to explosion common in ordinary blasting. The vein is carefully worked along until the "pocket" of emeralds is reached when the skill of a "chisel man" is summoned to delicately separate the gems from the embedding rock formation using a chisel and a hammer. Highly skilled chisel men are employed to ensure that the stones are not fractured from hammer and chisel impact-shocks. Visible pieces are hand picked from the vein. These could be clean emeralds. For some mines like Kagem, the emerald - bearing ground may then be transported to the washing plant for further screening for figitive stones while other mines only extract what they can get during the mining operation.

4.2.1 Categories of Mines in Ndola Rural

According to this study the emerald mines in Ndola Rural can be divided in three categories based on the consistence of operation. This description can be extended to the rest of the mines in the other gemstone mining regions of the country. Based on this criterion the following classes have been identified.

(a) Perennial Mines

These are mines with continuous mining production operations throughout the year. In this category are Kagem, Kuber, Grizzly, Storcks mines and a few others. Most of the mines engaged in large-scale production are those owned by foreigners or non-indigenous Zambians except for Kagem that has government shareholding. These mines can comfortably be referred to as 'Big Mines' by gemstone industry standards as they are able to operate several production faces at a time. They started with their own equity or

financing. They are highly capital intensive with own fleets of bulldozers, dump trucks, backhoe excavators and other major equipment for gemstone surface mining operations.

(b) Intermittent Mines

The mines under this category operate as funds become available. A greater part of the year, the owners are busy looking for resources to support the operations at the mine. Examples under this class are Sachin and Misi Gems mines just to name two. These mines usually rely on hired equipment for mining activities. The workforce is maintained on food rations when mining operations are in abeyance (see Appendix XVIII).

Typically the hiring rates are summurised in Table 4.1.

Table 4.1 ***Heavy Duty Equipment Hire Rates***

Equipment	**Dry Rate /hour (US$)**	**Non-Dry Rate / hour (US$)**
D6 Bulldozer	60	80
D7 Bulldozer	116	155
D8 Bulldozer	120	160
D9 Bulldozer	240	320
Backhoe Excavator	70	160
Front End Loader (17t)	110	145
Front End Loader (10T)	55	75
Dump Truck (19t)	85	110
Dump Truck (9t)	55	70
Tractor + Trailer (45 + 2x2 t)	25	35

(c) Idle Mines

A majority of the owners of mines in this category got the licenses during the 'rush' when the restriction on emerald mining operations being limited to the state and Nkuralu was lifted. When the deposits where close to surface they used to manage with labour intensive methods using pick and shovel. Notwithstanding the revenues that were realized from early emerald sales, most of the miners never re-invested in capital equipment. In

part this may be due to the state controlled marketing system that worked against the miners because their production was subjected to gross under-valuation which led to reduced earnings (ref. Section 4.5.2 Marketing under RMC). Now many mines are idle having ceased operations some years ago.

Still under this category are 'virgin plots' that have never been developed before. Owners obtained licenses without enough capital with the idea of hoping to begin operations when their finances improved or when loans were made available.

The mines under this category are vulnerable as they are prone to fall prey to pre-financing, a vice which has cost some Zambians mineral rights as explained in the next section below.

4.2.2 Constraints Facing Emerald Miners

There are several problems affecting the emerald miners today. Although to a lesser extent these problems are only applicable to the mines described in the previous section above under Intermittent Mines, but largely to Idle Plots. Although the profundity of each of the problems may vary from mine to mine, chief among all the problems, which was quoted by all the respondents in the study, was 'lack of finance'. Other problems cited were:

- lack of equipment leasing facilities,
- lack of government commitment to help address their problems
- lack of proper marketing facilities, and,
- Lack of technical and business skills.

Although these problems were specifically cited by miners, there are others equally important constraints faced by the sector such as:-

- Poor sectoral organization
- Lack of skilled manpower

However, there is a horde of other problems that are self-inflicted by miners themselves. From this study, it was observed that the major problem affecting many miners is of intrinsic nature i.e. ignorance and lack of forthrightness even when dealing with the people who are supposed to help them. This problem cannot be solved by the Government but by the miners themselves. When applying for the Mineral Rights they produce or fake Bank Statements showing a sound financial standing demonstrating the ability to venture into the risky business of gemstone mining. Once the permit is granted, even when they start producing, they do not declare any production. Out of this compulsive demeanour of cheating and the insatiable quest to get money quickly, the following problems have led many miners that have indulged in them to self-destruction. These problems are discussed below.

i. Pre-Financing and Hostage Mines

This is common among the Idle Plots described earlier in this section. The vice of pre-financing has proved to be far more detrimental to the survival of the emerald miners than any other malpractice existing in the industry. This practice leads to taking the whole mine *Hostage*. It involves a, *Financier* usually a foreigner, who lends money to the mine owner on solicitation, as an 'incentive' or 'favour'. The lending is agreed on one term and repayment on another. It is structured on a *mafia-style* of agreement. The indicated

amount as borrowed is different from the principle that is actually transacted. The indicated amount on paper incorporates a 50 % interest, which the legal contract does not mention. On paper it is an interest free loan. For instance if the miner wants to borrow US$ 20,000 for the mine operations, s/he will be given the exact amount needed but made to sign for US$ 30,000. The lending agreement will be showing US$ 30,000 as debt and this is what is enforceable by law. The loan is disbursed on condition that the emeralds produced be sold only to the *Financier* in return for the favours rendered. Apart from the financial transaction, the mine owner is also treated to other emoluments like a house in a high residential area and a personal to holder car.

As the mine begins to produce all the emeralds are surrendered to the financier who discounts infinitesimal amounts of money against the loan, as equivalent to the quantity of emeralds due to undervaluing of the commodity while complaining of being cheated on the quality. The producer is held at ransom. This continues until the financier files an injunction for defaulting.

The mine owner is summoned to court for defaulting on debt settlement due to cheating on the quality of production. Meanwhile, the incentives in form of housing and car are withdrawn. Since the mine owner is bankrupt the court settlement is in form of re-partitioning the mining license area and commonly the 'plaintiff' takes that part which was in production as recompense. It is very common that the timing of such lawsuits is during the production phase of good quality stones. It begins with filing an injunction to cease all mining operations pending the court hearing on the "breach of contract on an unsettled loan".

The practice just described is very rampant. Some such cases of victims of pre-financing are Pirala Cooperative Society, Fibolele, Twampane, etc (ref. Appendix XII). The specimen of injunctions is given in Appendix XIV. In literally all cases it was held that the defendant surrender part of the mine to the plaintiff since they had defaulted on the loan. This is how many of the foreigner owned mines were founded. The same companies have continued to increase their mine plots through the same tactics of using litigations following pre-financing.

ii. Swindling Investor-Partner

The other self-destructive scourge that has contributed to the miner's tainted image in the eyes of potential investors is cheating by way of swindling the joint-venture partner out of gemstone production.

With the liberalization of the gemstone sector a lot of people obtained Mineral Rights for high potential areas where emeralds are least uncertain to be found going by prior knowledge of related geology from adjacent properties and illegal mining activities. As a result, most of the highly promising areas have already been claimed. With the conducive environment prevailing in the country for investment a good number of foreign investors have sought partnership with Zambian mining license holders requiring capital injection (ref. Chapter Three). Despite the partnership terms being somewhat unfair to the foreign partner, the high returns promised seem to offset them. The foreign partner is requested to provide, equipment, pay for fuel and labour. In addition, the partner should meet other demands like emoluments for the directors such as salaries, housing and child allowances. In return the investor takes a 50 % stake shareholding. This turns out to be the best deal on the market. Other offers are in the order of 35 % or less.

Despite all the investment the partner is still cheated upon. When the rich part of the vein is struck the local partners go to the pit at night with some workers to 'steal' from the mine without their counterpart knowing. This practice is done repeatedly until the financial resources of the foreign partner are exhausted or the investor is tipped off. Several innocent and unsuspecting investors have been swindled in this manner.

The lessons learnt from the early experiences of such joint-ventures with Zambians has scared the subsequent potential investors that are willing to go into the mining of gemstones on these terms. These practices have vilified and villanized the image of small-scale miners. The reputation of the miners looking for join-venture deals has been tainted, perhaps forever. The only offer the investors are ready to take now is outright purchase of the Mineral Rights.

iii. Mistrust Among Directors or Cooperative Members

When Ndola Rural Emerald Area was opened up to individuals and companies interested in mining, many who did not have a strong financial resource base joined together to form cooperatives. This was a deliberate government policy to empower Zambians with mineral rights as the country was recovering from the plunder of emerald wealth in the wake of "Sene-senes" as the Senegalese and others who were involved in the illegal trade in stones used to be called.

Now there are a lot of conflicts and mistrust among the cooperative members who prefer to be called Directors. This emanates from the varying disparities in the resources across the

various members of the cooperatives. Some members have a bit of capital while others are completely bankrupt. Those with some resources, feel that the financially impaired are delaying the commencement of operations. Meanwhile even the members with the finances cannot commit their resources because profit sharing in a cooperative is distributed equally including those who did not contribute. Such dilemma leads to some members to sell their shares without informing the other members. In a typical case one member of the Board had sold his shares in the cooperative to another person without informing other board members. The matter was committed to the Kitwe High Court. The case was later withdrawn as the transaction of shares was reversed. (ref. Case no. 20 Appendix XII).

iv. Go-Comes

Despite the high security deployed by the mine owners and the state, theft has proved to be difficult to eliminate in Ndola Rural Emerald area. Due to the high levels of thefts precipitated by the employees, another form of scourge has emerged to promote pilferage of stones. The perpetrators have come to be called Go-Comes. This term has evolved in the emerald area to describe the agents of buyers, who are permanently stationed in the mining area. These are equipped with vehicles for ease mobility. They are on stand-by for 24 hours a day waiting for 'sellers' of stones. These 'sellers' are usually mine employees pilfering stones from the pits as well as illegal miners.

Notwithstanding the complaints from mine owners lodged to the Police and Director of Mines, the presence of the Go-Comes in this Protected Area has remained unabated.

v. Lack of Skilled Manpower

Many mines that are run by indigenous Zambians do not have qualified personnel in the technical fields of Geology, Mining and Gemmology as well as business management. It consequently follows that during operations the experiences of slope failures are common due to poor planning. Very often lives have been lost due to slope failures. Waste handling and disposal is also a common avoidable problem. Poor mining technology resulting in high losses of gemstones in mining waste and poor preparation of stones prior to cutting. The services of a geologist have usually been substituted by the 'experts' who mainly comprise former illegal miners. They do not employ technical personnel on the grounds that they are expensive to hire. The absence of a gemmologist has contributed to the reduced earnings suffered by the miners because they are completely ignorant about the market value of the gemstones. Also from the business point of view, the mines are not run professionally. This has perpetuated the cycle of insolvency for many miners.

vi. Lack of Sector Organization

There are too many associations in the industry competing against each other and eroding each others trust before the donors who from time to time have shown willingness to provide assistance to the sector. The industry is unable to speak with one voice to promote its interests. The same industry has the following associations to represent their interests.

i. Emeralds and Semi-Precious Minerals Association (ESMAZ)

ii. Zambia Gemstones and Precious Metals Association (ZGPMA)

iii. Zambia Emeralds Association (ZEA)

iv. Zambia Gemstone Corporation

v. Zambia integrated Mine and Mineral Traders Association

vi. Association of Zambian Women in Mining

vii. Kalomo Miners Association

viii. Zambia Small-scale Miners Association Fund

ix. Masansa Gemstone Miners Association

x. Chibale Small-Scale Miners Association

4.2.3 Mining of Other Gemstones

'Other gemstones' in this context refer to all gemstones found in Zambia with an exception of emerald. There has been as no much enthusiasm of investment in other gemstones at a scale found in emerald mining. This is attributable to the fact emerald has a much higher unit value, i.e. more precious. Besides emerald, the only other mineral that has attracted large capital investment is amethyst in Kalomo. The examples of big mines in Kalomo are Kariba Minerals and Kuber Mining Limited. For amethyst, the occurrence is well defined in a vein and more systematic compared to other gemstones.

Amethyst

The bulk of Zambian amethyst is from mines with mechanical means of extraction. Although there are huge capital investments of specialized machinery injected by some big companies in this sector, in this text, only small-scale methods of extraction are described.

Extraction at small-scale mining level is carried out by highly labour intensive means using pick and shovel. The movement of ground is by way of using wheelbarrows on flat ground and buckets anchored to ropes for manual hoisting from pits. Mining is conducted in form of either pits or trenches trucking the veins. This may be either on flat ground or commonly on

hill sides. The small-scale miners may occasionally hire bulldozers to raze the ground for veins when finances allow. The mining of amethyst on small-scale can best be described by a typical case example as illustrated in the account by a miner (see Appendix XIX).

Mining of Aquamarine, tourmaline, Garnets, etc.

These gem minerals are occurring in the more central zones of a pegmatite where feldspar matrix is often decomposed or partially kaolinized. Mining is usually by artisanal pitting and quarrying operations typical of small-scale mining. This sector has not received any significant capital injection from serious investors like has been the case with emerald mining. Extraction of gem crystals partly or totally grown inwards into the core quartz and of gemstone in totally feldspar-mica matrix is quite difficult and results in excessive breaking of the gem crystals. The practice is usually the crystal bearing rock is isolated and subjected to pyro-treatment by heating it with wood fire and allowing it to cool thereby inducing cracks in the host rock and becomes easier to work with picks and chisels. Great care is exercised when finally recovering the crystals with chisels from the isolated host because it is as hard as gemstones embedded inside (about 7 on the mohr's scale). Most unweathered rocks are hard and gemstones found within them are not readily or easily extracted.

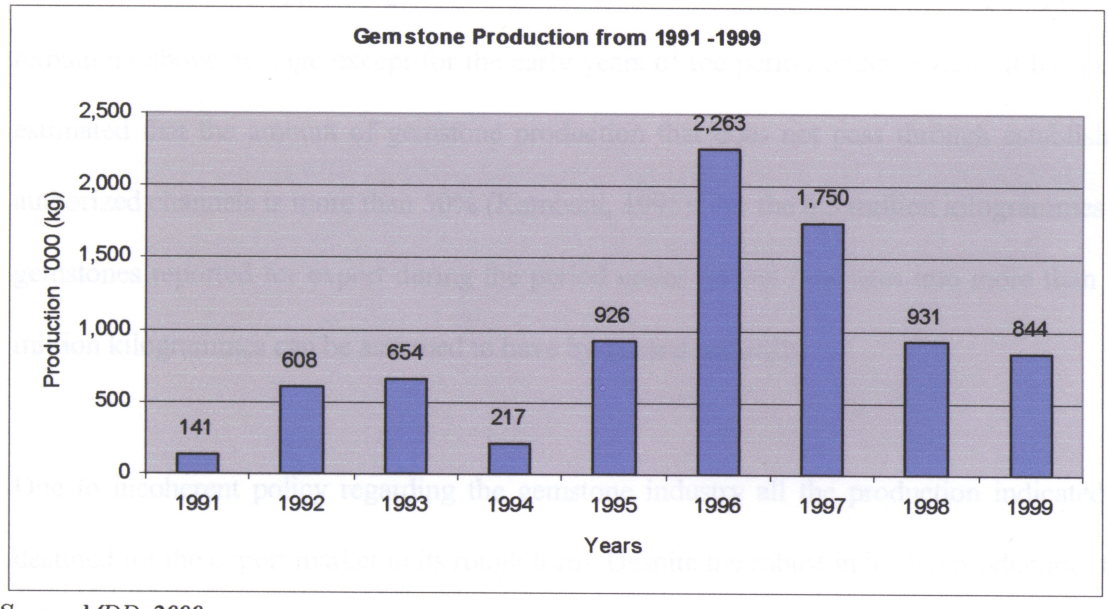
4.2.4 Problems Facing Other Gemstones Miners

The problems faced by other gemstone miners are generally similar to those already discussed. With an exception of a few, all problems described in section 4.2.2 are applicable though in varying degrees. For this sector, as explained earlier, because the stones do not command higher prices as compared to emeralds, investment has not been forth coming. The major problem facing the miners of other gemstones apart from

finance is market for their produce. Many of the producers take their gemstones to Chiparamba Road gemstone Market (ref. Section 4.6.0).

4.3 Gemstone Production In Zambia

Taking into account illegal gemstone production and exports together with official figures, Zambia is considered as one of the major overall producers in the world. The official production figures alone are very disappointing. This is because even the official figures are usually undervalued because the is no verification procedure in place to authenticate what is presented to the Valuation Officer at Geological Survey Department. The exporter usually takes a sample for valuation while the rest of the consignment is left at the port of exit. The exporter communicates the figure to the GSD official who grades the sample and extrapolates the value of the whole consignment based on the grade they find and the weight communicated. Table 4.2 shows the total production figures that have been reported over the period indicated.



Source: MDD, 2000

Figure 4.1 Volume of Gemstone Exports in Zambia 1991- 1999

4.3.1 An Assessment of Rough Supply

The production of rough material as evidenced from Table 4.2 and even more lucid from the graphical presentation of Figure 4.1 is strong enough to sustain the operations of a lapidary industry blissfully. These figures are those that are channeled through the official procedure and recorded by the Mines Development Department. The production across all the various gemstones recorded has remained steadily above average over the period 1991-1999 and has been on the increase (ref. Linear Total in Figure 4.2). There is a skew in the production figures of 1996 and 1997 due to high disproportionate production increase in amethyst and aquamarine. This has pushed the total average over the period to slightly over 926,000 kg from a normal average of about 487,000 kg excluding amethyst and aquamarine production for 1996-1997 period due to the impact of the new mining policy. The subsequent drop in export volume was due to the economic recession in the Far East the main market of Zambian gemstones.

Going by individual types of gemstones, their performance have been superbly improving remaining above average except for the early years of the period under review. It has been estimated that the amount of gemstone production that does not pass through established authorized channels is more than 50% (Kambani, 1995). For the 8.3 million kilogrammes of gemstones reported for export during the period under review translates into more than 16 million kilogrammes can be assumed to have by-passed authority.

Due to incoherent policy regarding the gemstone industry all the production indicated is destined for the export market in its rough form. Despite the robust indicated production, the

gemstones are not easy to find locally for a foreign buyer because there is no organized formal market in Zambia.

Figure 4.2 is indicating the performance of various gemstones produced in Zambia for export. The volumes of amethyst, aquamarine and emerald has been considerable over the period since 1995 although there has been a gradual drop in the production of aquamarine perhaps due to lack of finances.

The total production performance of all gemstones has shown some sinusoidal behaviour with the major amplitudes reached in 1996-97. The minor amplitude was attained in 1992-93 and 1998-99. The linear total has been steadily increasing over the period starting from about 500,000 kg 1991 to about 1200,000 kg in 1999. Due to lack of finances, beryl, garnet and tourmaline are still floundering to catch up with the rest of other gemstones.

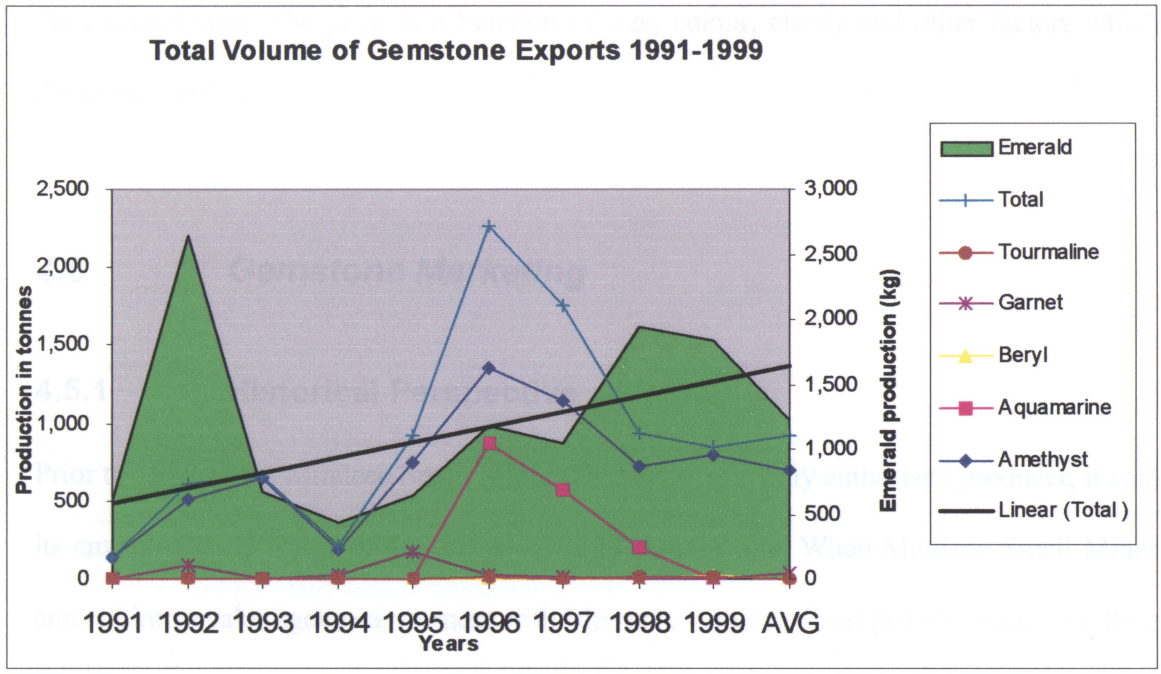
4.4 Quality of Zambian Gemstones

Zambian gemstones depending on genre are of good quality usually ranging from medium to high. Occasionally some gemstones that are new on the scene may show a lot of flaws this is a generally accepted concept in the industry. When subsurface mining of emeralds begun the initial production had a lot of imperfections with grade ranging only

Table 4.2 Official Gemstone Production and Sales 1991 – 1999

Year	Amethyst		Aquamarine		Beryl		Emerald		Garnet		Tourmaline		TOTALS	
	Quantity (kg)	Value (US $)	Quantity (kg)	Value (US $)	Quantity (kg)	Value (US $)	Quantity (kg)	Value (US $)	Quantity (kg)	Value (US $)	Quantity (kg)	Value (US $)	**Total Quantity (kg)**	**Total Sales (US $)**
1991	139,957	1,049,388	0	0	110	40,130	618	10,687,779	4	652	46	21,911	**140,735**	**11,799,860**
1992	512,274	1,868,112	65	37,197	1,466	242,946	2,647	2,838,883	91,827	1,943	34	23,665	**608,313**	**5,012,745**
1993	650,258	2,377,135	113	40,737	202	66,547	666	1,556,168	1,685	32,771	994	59,023	**653,919**	**4,132,382**
1994	188,611	1,501,430	188	105,030	911	200,142	438	1,821,524	26,192	54,624	537	146,848	**216,877**	**3,829,597**
1995	746,411	2,401,140	365	298,151	510	380,793	639	2,874,823	177,043	665,990	1,454	59,869	**926,422**	**6,680,766**
1996	1,359,792	3,200,830	866,243	213,712	2,106	722,739	1,181	6,477,167	26,624	169,465	7,175	293,671	**2,263,120**	**11,077,584**
1997	1,149,040	2,139,459	574,540	465,383	3,261	760,758	1,047	9,201,207	16,100	33,775	5,764	606,502	**1,749,752**	**13,207,084**
1998	717,064	1,439,943	199,844	782,854	4,055	281,233	1,933	7,263,096	2,212	76,270	6,253	481,695	**931,362**	**10,325,090**
1999	794,947	2,071,858	5,766	835,146	20,285	464,703	1,831	9,567,500	4,016	32,011	17,299	488,412	**844,144**	**13,459,629**
Total	**6,258,353**	**18,049,296**	**1,647,124**	**2,778,209**	**32,906**	**3,159,992**	**11,002**	**52,288,147**	**345,703**	**1,067,499**	**39,555**	**2,181,595**	**8,334,645**	**79,524,738**
AVG	**695,373**	**2,005,477**	**183,014**	**308,690**	**3,656**	**351,110**	**1,222**	**5,809,794**	**38,411**	**118,611**	**4,395**	**242,399**	**926,072**	**8,836,082**

Source: MDD, 2000



Source: MDD, 2000

Figure 4.2 Total Volume of Various Gemstones Exported

from low to medium. Today Zambia is renowned of producing some of the best emeralds in the world commercially called 'Zambian Green'.

Table 4.3 illustrates an assessment of the quality of selected Zambian raw gemstones and the corresponding value when cut.

Table 4.3 An Assessment of the Value of Zambia Gemstones

Gemstone	Price of raw gem per gram (US$)	Price of value added gem per carat US$)
Emerald	10 – 300	300 – 600
Aquamarine	2 – 30	10 – 300
Amethyst	0.01 – 0.30	1 – 60
Amandine	5 – 40	0.50 – 6.00
Rhodolite	2 – 4	15 – 20
Tourmaline	2 - 30	10 - 100

Source: Overview of the Gemstone Industry - 1994

Comments:

These values are estimated for the average minimum price and average maximum price of the material sold. The price is a function of size, colour, clarity and other factors which determine quality.

4.5 Gemstone Marketing

4.5.1 Historical Perspective

Prior to 1976, when Mindeco Small Mines (MSM) was the only authorized producer, it sold its emeralds on the basis of the prices determined by buyers. When Mindeco Small Mines entered into a sales agency agreement with Memaco, it was realized that the mode of selling emeralds as practiced by MSM was unsatisfactory on account that some of the prices offered by the buyers were ridiculously low.

4.5.2 Memaco Marketing

Memaco adopted a Closed Auction System. In this type of auction participation of bidders is strictly by invitation. Each customer views separately the emerald parcels and makes a sealed bid which is only opened after all other bids have been made. By 1979, Memaco had organized eight such auctions at Zimco House in London. London was selected as venue because of its commercial value in Europe and the fact that Memaco had a subsidiary company in London which could supervise the auctions. It was felt at the time that the auctions held in Zambia would probably not attract as many buyers.

The auctions were normally held over a period of three days. Before any auction was held the producer advised Memaco that it had stones to sell. Memaco, in conjunction with the

producer, then fixed the dates for the auction. When this was done, Memaco sent out invitations by way of notices as shown in Appendix II to all buyers on its official list which included 65 dealers. Appendix III shows the names of the dealers. Each buyer was given information on the weights and source of emeralds to be auctioned and was requested to indicate whether they would attend the auction. The name of the person to attend the auction was also requested. The buyers were normally given two weeks notice in order to ensure good attendance at the auctions. On receipt of a positive response, Memaco fixed a date and time each buyer was expected at the auction. Emeralds were sorted, parcelled and displayed separately in trays for viewing in showrooms. The appointments were spaced in a manner that gave each buyer sufficient time to determine the value of each parcel they were interested in. The buyers' bids were then sealed. After all the participants had completed the viewing of parcels, the sealed envelopes were opened by a Memaco official usually in the presence of the producer's representative. Memaco had the authority from the producers to accept any bid or combination of bids provided that the price was not less than the producer's reserve price. In cases where the bid price was lower than the reserve price, the bid was referred to the producer for fresh instructions. The successful bidders were promptly informed after which an invoice was prepared. The parcel was not released to the buyer until payment had been received in full.

Some stones that remained unsold at the end of the auction with approval of the producers, Memaco approached buyers who might have an interest in these "reject" stones to make bids for them. These stones were only disposed of if the price offered was acceptable to the producers.

From the auctions, Memaco's experience was that the price or value of an emerald varied from buyer to buyer according to the use to which it was to be put. No two buyers gave the same value for the same parcel and the range between the highest and the lowest bids was usually very wide as much as US$ 217,000 in some cases (see Appendix IV).

It was also observed that the auctions attracted mainly cutters and polishers who, in contrast to jewellers in the retail business, offered higher prices. Most of those that were unsuccessful at the auctions continued to come to Zambia to enquire about emeralds.

Marketing under Reserved Minerals Corporation

As a result of the recommendations of the 1979 Commission of Inquiry, a new Company called Reserved Minerals Corporation (RMC) under the Zimco Group was formed in 1980 in view of the envisaged growth in the gemstone sector. It was formed to oversee the mining of minerals which restricted especially those that fell outside the ZCCM mining interests. These minerals included gemstones and industrial minerals. RMC was formed to perform the following functions:

Constitute the investment arm of the Government in all joint ventures connected with gemstones.

To be the sole marketing agent for all gemstones, either directly or through devolution to relevant agencies.

To be the major buying agency of gemstones as well as lending agent to SSM

To act as guarantor in all aspects relating to the gemstones industry in Zambia.

The auctioning system described in the previous section continued until a dramatic policy shift in the marketing of Zambian gemstones when the government banned the export of

rough emeralds in November 1988. For other gemstones i.e. aquamarine, tourmaline garnet and malachite, producers surrendered the material to RMC and continued to be exported as rough while arrangements were under way to establish a facility like ZEIL to cater for these other gemstones.

Apart from the normal Sales Agency function, RMC administered a revolving fund from which they could purchase rough stones from miners and would advance interest-free loans to miners recoverable upon sale of gemstones.

Local lapidaries wanting to cut and polish any gemstones except emeralds were able to procure the material from the respective marketing organizations in Kwacha as long as the Ministry of Mines authorized such purchase.

ZEIL came about due to the recommendations of the Commission of Inquiry. It was a Joint Venture between the Zambian Government and a Brazilian firm. As was the case with all other big companies, the Government had 51% in this company. It was charged with the responsibilities of buying all rough emeralds from miners, which it cut and polished before and export. Unfortunately, this arrangement disadvantaged producers because ZEIL offered very low prices. It contributed to the collapse of many mines, which are still not in production today. At the time the mines had an opportunity to produce, when reserves were at shallow depths, the prices were ridiculously low and did not generate enough revenue to support re-capitalization.

4.5.3 Current Marketing Arrangements and its Shortcomings

Currently, gemstone marketing in Zambia is in disarray because there is no established Gemstone Exchange facility. When the gemstone marketing was liberalized in 1992, the government allowed *laissez-affaire* in the trade without setting up a regulatory body to monitor the sales. The big gemstone mining companies like Kagem, Kuber, Kariba Minerals, etc. have established their own marketing arrangements abroad. This has left small-scale miners who cannot afford making market contacts abroad, neglected by the system. This has created an opportunity for middlemen to take advantage of the situation and move in and take the place of an established marketing structure.

The current export arrangements are through the steps described below.

Step 1. - Get the letter of Authority from Mines Development Department (MDD)

Step 2. - Get the Government Valuation Certificate from Geological Survey Department (GSD)

Step 3. - Get the Customs and Excise Declaration Form from Zambia Revenue Authority (ZRA)

At GSD, only a sample is exhibited. Based on that sample a valuation of the whole quantity of export material is extrapolated and endorsed on the Valuation Certificate. The Government Valuer need not see the actual consignment meant for export. The quantity indicated on the certificate is communicated by the exporter. No verification procedures or requirements are in place. The valuation certificate and letter of authority are then taken to ZRA for tax purposes. No independent valuation or scrutiny is applied. After ZRA procedure, the gemstones are ready for export.

4.5.4 Liberalised Marketing

With the Liberalization of the economy in the early nineties, the mining sector in general and the gemstone industry in particular was not spared. Gemstone marketing was liberalized. Producers were no longer compelled to sell the stones to ZEIL. When ZEIL was formed the government started selling its share of production from Kagem to this lapidary while the other shareholders were free to sell elsewhere. Export Board of Zambia (EBZ) in conjunction with Kagem Mining occasionally would organize Closed Auctions System.

These new marketing arrangements, led to the loss of monopoly and business by ZEIL. Producers stopped selling stones to this parastatal. With time the company collapsed and declared bankruptcy. All the equipment belonging to ZEIL has since been auctioned.

EBZ has not held any of such auctions in a long time. The sale of gemstones is now an individual responsibility of a producer in a manner elaborated later in the chapter.

At the moment, there is no organized structure in the marketing of gemstones. It is up to the individual producers to make their own marketing arrangements. There are five legal channels open to private miners in Zambia. These are:-

- Visits by buyers from overseas for whom there is an export procedure in place. Since there is no formal gemstone exchange, such visits whose date may be unknown to many small-scale miners whose operations are in remote areas and isolated in terms of telecommunication are chanced by few.
- Local lapidaries: these are very few in number, small in scale and insufficiently funded to buy in serious quantity at good price.

- Miners personal exports: the procedure for this arrangement is described in section 4.5.3.
- Auctions organized by EBZ: these at present are too seldom to be relied upon.
- The biggest producer Kagem holds quarterly auctions here in Zambia and participation is strictly by invitation.

Due to the absence of any formal marketing structure like a Gemstone Exchange, an illegal gemstone market along Chiparamba Road in Lusaka has sprout up. Different kinds of stones are traded at this market from amethyst to diamonds. The grading and sorting is done in an adjacent building called Chiparamba Gemstones that used to house the now defunct Kayaya Lapidary Enterprises.

4.5.5 Local Consumer Market

Almost all of the gemstones produced in Zambia find markets abroad. All the Jewelleries that were contacted in the study confirmed that their major clients are overseas. The local market is still insignificant despite the long history of gemstone production in Zambia. The little market that is available for gemstones is mainly dominated by tourists, foreign visitors, residents and non-indigenous Zambians.

According to the results of the survey, which was conducted as part of this study, 10% of Zambians showed very good knowledge about gemstones. Over a choice between a 10ct piece of best diamond and a Toyota Camry, there was an even split of 40% while 19% were not sure. Only 2% had any knowledge about cubic Zirconia. Diamond and emerald were found to be the most popular because 90% and 92% of respondents knew them respectively.

It is not strange to find a Zambian who has never had a glimpse of an emerald or heard of an aquamarine or a garnet which is produced in their backyard. This lack of gemstone awareness and appreciation has contributed greatly to lack of a sound lapidary and jewellery industry because there is no immediate and strong need for them to be established.

Gemstones are typical examples of luxury products. For such products discretionary income is the dominant factor influencing demand. From Table 4.3 the national average for people living in abject poverty was 55%. The recent statistics have pegged the average population living below the Poverty Datum line to be more than 80%[1].

Table 4.4 Zambia Household Welfare Indicators

		Expenditure quintile												
abour Market	**Unit of**	**Natl.**	**Rural**						**Urban**					
Population aged 15-64)	**measu**	**Total**	**All**	**1**	**2**	**3**	**4**	**5**	**All**	**1**	**2**	**3**	**4**	**5**
lo. of People Employed	No.													
n sample		18684	9463	1668	1757	1816	1957	2265	9221	1620	1512	1673	1958	2458
roportion of employed	%	56	69	70	70	70	69	67	47	45	43	45	48	54
Branch of activity	%	65	87	95	91	91	85	76	11	29	14	10	6	3
griculture /Fishing	%	8	3	2	2	2	5	5	21	15	22	22	24	20
Mfg, Mining, construction	%	15	5	2	4	3	5	10	39	36	39	41	39	38
ommerce	%	7	3	1	2	3	3	6	16	8	13	14	17	21
ivil servant/army	%	5	1	1	1	1	2	3	14	12	12	13	14	17
Other sector	%	72	73	71	68	73	72	77	71	68	66	70	73	78
abour force participation														
Male	%	74	77	76	73	78	77	79	71	69	66	70	72	78
emale	%	70	69	67	64	69	68	75	72	67	67	70	74	81
Household expenditure														
Mean per capita expenditure (K)	'000	24	16	4	7	11	16	44	37	9	17	24	36	97
opn. below relative poverty line	%	55	70	100	100	100	52	0	28	100	38	0	0	0
hare of food in total expenditure	%	64	69	81	76	70	65	53	56	64	60	58	54	45

Source: African Development Indicators 1998/99, World Bank Publication

[1] Poverty in this context is defined using the World Bank convention as persons living on less than US$1 per day

The gloomy picture provided by the national statistics on the state of the welfare of many Zambians explains in part why the lapidary-jewellery industry is in such derelict state. To determine the profile of consumers for ornamental products some factors are very important such as income levels as well as traditions and culture

4.5.6 Illegal Trade

For ordinary goods and services, illegal trading is usually practiced to avoid paying tax while for restricted goods it is intended to elude both taxes and prosecution. In Zambia gemstones have proved to be an intriguing commodity. Despite being legalized, a greater part of their trade is still carried out illicitly on the black market. The legacy of illicit trade created by illegal dealers, during the period the emeralds were a restricted commodity, has been difficult to eliminate long after the restriction on gemstone mining and trade were lifted. The scale and volume of trade being carried out illegally has been increasing as exemplified by the increased number of gemstone operating mines and licences issued but there has not been a corresponding increase in declared official sales.

Lack of formal sources of financing for gemstone mining has been one of the main contributors of the perpetuation of illicit trade in this commodity. The sector relies on the parallel economy for financing which takes the form of prefinancing arrangement by illegal dealers against future production (Kambani, 1995).

In the 1970's, illegal mining activities were the main source and automatic supply for illegal markets. Now with easy mining licensing procedures, the suppliers are no longer

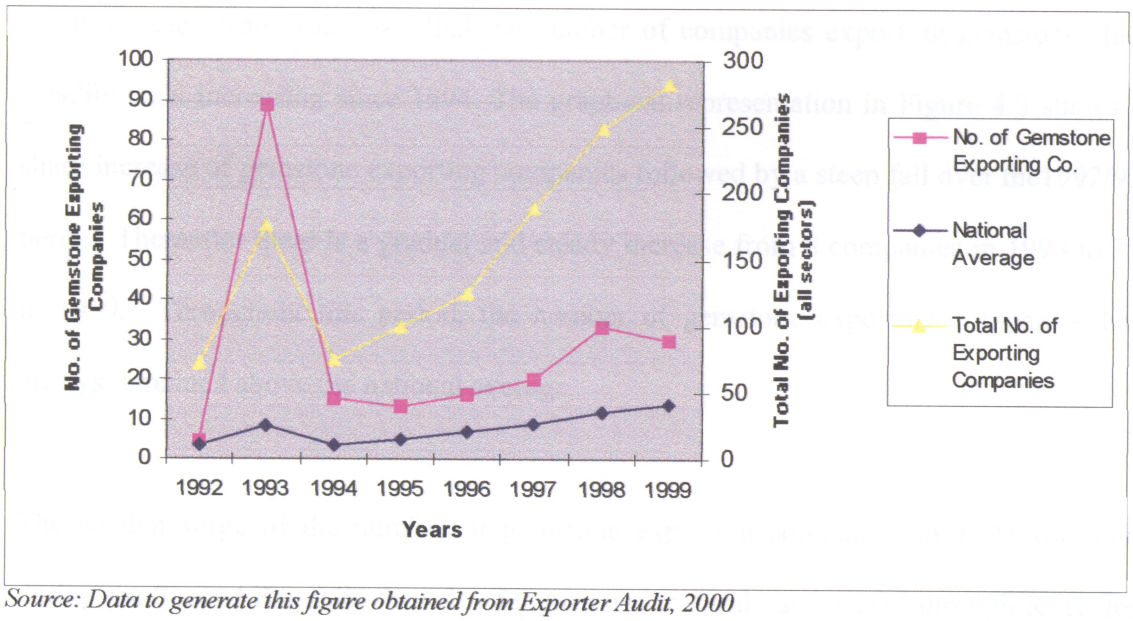
illegal miners but registered and licensed mineral rights holders who deliberately do not declare production to government.

According to Kambani (1995), illegal trading activities have serious economic implications in any given country. The practice denies affected countries data on production output and its corresponding value. This makes effective planning of the sector difficult. For instance, strategies to invest in local processing may be frustrated without data on output and quality of production. The most direct losses from illegal trading are from taxes.

The inability to add value to illegally exported unprocessed minerals also results in a loss of potential employment and taxes that may be generated by forward integration into lapidary processing and jewellery making and backward integration from establishment of industries to supply the sector with various inputs. Although the country may earn some invisible income from illicit trading, this type of trade is often characterized by a large involvement of aliens which implies that substantial incomes accruing to these foreigners are repatriated abroad resulting in weakened final demand linkages locally. In general illegal exports diminish the sector's economic contribution to national economy.

4.6 *Performance of the Gemstone Sector*

Declared gemstone export for 1999 were about 63,000 kg with revenue amounting to US$ 13.8 million. This represented an increase in earnings of about 19.4 % against the 1998 revenue of about US$ 11. 6 million



Source: Data to generate this figure obtained from Exporter Audit, 2000

Figure 4.3 Number of Gemstone Exporting Companies

(Exporter, 2000). The increase may partly be attributed to the increase in the number of exporting companies from 33 in 1998 to 35 in 1999 (see Table 4.5)

Table 4.5 Number of Exporting companies by Sector

SUB-SECTOR	1992	1993	1994	1995	1996	1997	1998	1999
1. ANIMAL PRODUCTS	2	3	3	2	13	13	16	30
2. BUILDING MATERIALS	4	5	3	6	3	4	4	3
3. CHEMICAL PRODUCTS	7	3	4	8	8	14	25	22
4. ELECTRICITY	0	1	1	1	1	1	1	1
5. ENGINEERING PRODUCTS	7	3	6	6	5	7	6	6
6. FLORICULTURAL PRODUCTS	6	9	6	13	21	23	29	33
7. GARMENTS	2	2	2	2	2	3	4	3
8. GEMSTONES	5	89	15	13	16	20	33	35
9. HANDICRAFTS	2	2	2	4	5	13	15	9
10. HORTICULTURAL PRODUCTS	3	5	2	4	8	9	8	12
11. LEATHER PRODUCTS	1	5	5	6	7	10	8	10
12. MINING	0	0	0	0	0	0	6	3
13. MINING EQUIPMENT	2	1	1	0	0	0	1	0
14. NON METALLIC MINERALS	2	2	1	2	3	4	4	5
15. OTHER MANUFACTURERS	1	5	1	2	3	8	13	20
16. PETROLEUM OILS	1	1	1	1	1	5	6	5
17. PRIMARY AGRIC. PRODUCTS	13	20	8	7	10	16	14	28
18. PROCESSED FOODS	2	3	3	4	6	5	18	30
19. SCRAP METAL	0	0	0	0	0	0	15	11
20. TEXTILES	9	10	9	10	8	10	10	9
21. WOOD PRODUCTS	7	6	6	9	5	21	13	13
TOTAL	**72**	**175**	**74**	**100**	**125**	**189**	**249**	**283**
AVERAGE	**3.4**	**8.3**	**3.5**	**4.8**	**6.6**	**9**	**11.9**	**13.5**

Source: EBZ Exporter Audit Report 1997and 2000

It can be seen from Table 4.5 that the number of companies exporting gemstones has steadily been increasing since 1994. The graphical representation in Figure 4.3 shows a sharp increase of gemstone exporting companies followed by a steep fall over the1992/93 period. Thereafter there is a gradual and steady increase from 8 companies in 1994 to 35 in 1999. Throughout this period, the number of gemstone exporting companies has always remained above the national average.

The sudden surge of the number of gemstone exporting companies in 1993 was that during the Second Republic the sale of gemstones was only authorized through RMC for other coloured stones or through appointed agents ZEIL for emeralds and Kariba Amethyst Marketing Limited for amethyst. With the coming of the new government in power in 1991, on a free-market-economy ticket, many producers of gemstones hoarded their produce in the banks with the hope of selling freely once the marketing was liberalized.

When the law governing the marketing of gemstones was abrogated in 1993, with the passing of the first Investment Act, all the producers who had held up their stones in the banks released them on the free export market. This explains the sudden surge of the number of gemstone exporting companies in 1993 (see Figure 4.3). Prior to 1993, only five gemstone exporters were authorized. These included RMC, ZEIL, KAML, Mindeco Cutting and Polishing and Zambia Emeralds Limited.

The Far East continues to be the biggest market of Zambian gemstones. Export to the region totalled US$ 9.8 million amounting to 65 % of total sectoral export. India, which accounts for over 80 % of the global supply of cut and polished gemstones, imported gemstones

worth US$ 7.8 from Zambia. China continued being a big market for low grade amethyst. The European Union and other markets imported US$ 1.3 and US$ 2.3 million respectively.

4.6.1 Non-Traditional Export (NTE) Status

The gemstone sector suffered a set back in 1995 when the government removed gemstones from the non-traditional export product list. This led to gemstone miners being subjected to 25 % corporate tax instead of the 15% which is normally applicable to NTEs. Nevertheless cut, polished and gemset jewellery still enjoy the 15% corporate tax under this category.

The contribution of the 1999 gemstone exports out of the total visible NTE's earnings for the country amounts to 4.6 % which is an improvement from the previous year's 3.8 %. The total visible NTE's earnings for 1999 recorded more than US$ 298 million. This represented a slight decrease from the previous year's US$ 308 million.

The NTE earnings as seen and portrayed in Table 4.6 and Figure 4.2, gemstones sub sector inclusive, have since 1990 have shown an steady annual growth of 14 % while their contribution have also increased from under 10% to 39% in 1999 (Exporter, 2000). This sector recorded stagnation in 1998 and 1999. This period is viewed as the worst performance of the NTE sector. The reasons for the stagnation in the growth of the gemstone sector in the last two years of the period under review can be attributed to the economic recession of the far eastern countries and the political turmoil in Indonesia. These effects had a negative impact on the demand of rough gemstones.

Table 4.6 Non-Traditional Export Earnings by Sub-Sector, 1994 – 1999

SUB-SECTOR	1994	1995	1996	1997	1998	1999
	US$ '1000	US$ '1000	US$ '1000	US$ '1000	US$ '1000	US$ '1000
ANIMAL PRODUCTS	355.18	1403.73	1719.03	3412.64	4149.71	4374.08
BUILDING MATERIALS	3048.25	5220.45	7941.42	12000.96	8582.73	10184.70
CHEMICAL PRODUCTS	2249.31	2441.14	3057.95	7816.07	6895.49	5942.17
ENGINEERING PRODUCTS	34545.92	39402.93	36536.75	42420.04	31672.12	23211.98
FLORICULTURAL PRODUCTS	9110.35	13533.97	18299.84	21242.15	32855.48	42677.14
GARMENTS	500.60	145.63	138.16	258.19	417.41	449.33
GEMSTONES	9437.07	7539.51	10894.35	14543.79	11584.54	13835.94
HANDICRAFTS	85.00	82.99	217.72	95.52	162.70	208.15
HORTICULTURAL PRODUCTS	2420.86	4023.39	8858.74	15859.27	20557.35	23871.12
LEATHER PRODUCTS	1234.94	1944.23	2093.93	2221.49	3133.94	2000.00
NON METALLIC MINERALS	820.94	703.67	672.85	541.11	532.08	981.97
OTHER MANUFACTURERS	27.50	530.00	1475.20	3021.85	3090.12	6500.00
PETROLEUM OILS	3917.33	11360.75	5694.83	1807.83	6813.27	6411.84
PRIMARY AGRIC. PRODUCTS	10007.51	24079.94	37853.19	90918.65	62244.74	72501.11
PROCESSED & REFINED FOOD	22192.82	25207.53	33834.93	30851.52	49407.11	33034.75
TEXTILES	28461.00	39146.02	40450.21	50639.14	42369.89	36997.48
WOOD PRODUCTS	893.00	1417.77	1843.02	3375.75	3192.44	3044.30
SUB-TOTAL	129307.99	178183.77	211582.18	304773.12	287661.12	286226.06
RE – EXPORTS	0.00	0.00	4091.27	3882.30	3656.00	2685.13
SCRAP METAL	0.00	0.00	10729.64	6019.26	4210.20	6120.06
MINING	0.00	0.00	0.00	3747.15	12232.77	3337.07
TOTAL VISIBLE NTES	**129307.99**	**178183.77**	**226403.03**	**314674.68**	**307760.09**	**298368.32**
ELECTRICITY	19551.64	21100.00	16152.00	14813.00	5627.48	6127.49
TOTAL NTES	**148859.64**	**199283.77**	**242555.02**	**329487.68**	**313387.57**	**304495.81**
METAL EXPORTS	965200.00	1038700.00	754200.00	808595.13	629740.00	467563.20
TOTAL EXPORTS	**1114059.64**	**1237983.77**	**996755.02**	**1138082.81**	**943127.57**	**772059.31**

Source: EBZ Exporter Audit Report 2000

Million-Dollar Club

Within the NTEs there is another classification of companies that export goods worth one million dollars and above. This group is called Million-Dollar Club. Many gemstone producing companies have joined this club and consistently maintained their membership. The names of companies that are members of this club are Kagem Mining, Southern Quarries, Grizzly Mining, etc. There are five sub-divisions in this class of NTEs, namely:

Class 1. *Above US$ 20 million*

Class 2. Between US$ 10 and 20 million

Class 3. Between US$ 5 and 10 million

Class 4. Between US$ 3 and 5 million

Class 5. Between US$ 1 and 3 million

Table 4.7 1999 Gemstone Million Dollar Club

Company	Value in	Main Exports
ABOVE US$20 m	Nil	
Sub-Total	**0**	
BETWEEN US10 – 20 m	Nil	
Sub-Total	**0**	
BETWEEN US5 – 10 m	Nil	
Sub-Total	**0**	
BETWEEN US3 – 5 m		
Kagem Mining Ltd	*	Rough emerald
Sub-Total	*	
BETWEEN US1 – 3 m		
South Stream Enterprises	*	Rough gemstones
Southern Quarries Ltd	*	Rough gemstones crushed
Grizzly Mining Ltd	*	Rough Gemstones
Sarunit Enterprises	*	Rough gemstones
SUB-TOTAL	*	
Total by Gemstone Million Dollar Club	**8.7**	

Source: EBZ[3].

* The figures are available but could not be released for this research because of confidentiality

Mainly the gemstone companies start featuring in fourth and last classes of the Million Dollar Club (see Table 4.7). There is great potential for these companies if they started cutting and polishing their products for export they can elevate to first and second classes as cutting adds value by more than 10 times.

The full list of club members including those from other sectors is included in Appendix V. These appear in Appendix VII Classified List of Gemstone Exporters.

[3] Figures for individual company sales are highly confidential as demanded by the exporters. Secrecy of the value of sales is the condition upon which they are divulged to EBZ and never to be communicated to any third party without written permission of the exporter.

4.7 International Gemstone Marketing

4.7.1 Introduction

There is no official figure for the size of the world gemstone market, only hints and clues of just how big it might be (Kremkow, 1996). Different sources give different figures for the value of total world trade in emeralds and coloured gemstones in general. One source estimates the world coloured gemstone trade to be valued at US$ 3 billion with Zambia estimated to contribute about 54% (Bowa, 2000). Another source quote the total value of rough emerald globally to be at US$ 1 billion with Zambia contributing about 20% (Money, 1993). However, ICA estimates the annual world gemstone - jewellery sales to be US$10 billion. This translates to about US$ 1.8 billion market value of loose coloured gemstones, which is usually about 6 times less than the total value of gemstone-jewellery. These estimates are based on the 1990 – 1991 gemstone trade value. Over the years, the statistics have not varied much. The size and scope of the world market for ruby, sapphire, emerald and other coloured gemstones is difficult to estimate. This is so, because there is very limited data available and the industry is very private, with most companies being traditional family owned and operated businesses. There are various statistics for coloured gemstone exports and imports around the world but because these are for loose stones only, they do not include the many gemstones that are exported and imported already set in jewellery.

According to ICA the estimate of the world gemstone market share and distribution as extrapolated from the diamond jewellery market data as given in Table 4.8.

Table 4.8 World Gemstone Sales

Country	World Gemstone Sales by		World Value of Gemstone-Jewellery (millions US$)
	Value (%)	Carat Weight (%)	
USA	35	37	3.400
Japan	33	28	3.175
Europe	17	15	1.600
SE Asia	03	07	300
Others	12	13	1.150
Total	100 %	100 %	**9,625**

Source: ICA, 1996

From the above market distribution statistics using gemstone trade values of each of the major gemstone trading nations named, the estimate of the gemstone market worldwide is calculated as in the last column of the table. This is taken as a very conservative and modest figure by ICA and hence the use of a round number of annual retail sales of coloured gemstone jewellery as US$ 10 billion.

The US Department of Commerce estimates the annual retail sales of fine jewellery (including diamonds) in the United States to be $15 billion. The Department of Commerce has also estimated that the U.S. represents 28 percent of the world market for fine jewellery.

The estimated size of the world jewellery market is between $50 and $60 billion. The United States Bureau of Mines (USBM) estimated that the coloured gemstone jewellery has about a 20 percent market share worldwide. The USBM was scraped in 1998 and all its functions transferred to the US Bureau of Land Management (USBLM) which estimates the annual world retail sales of coloured gemstone jewellery at $10 to 12 billion.

Under the international import and export classification system, the Harmonized System (see Appendix VI), coloured gemstone jewellery should be included in either the gold jewellery category or the gemset jewellery category, depending on whether the gold is the most important value factor or the gem is the most important value factor. Gemset jewellery is not divided by type of stone so it does not separate diamonds and coloured stones. Since labour is a very important cost consideration for jewellery set with many small gemstones, this is the type of jewellery most likely to be imported. Most of this type of gemstone jewellery will be categorized in import and export statistics as gold jewellery.

4.7.2 The International Market Potential for Zambian Stones

Zambia's rough gemstone exports have traditionally been to India, Israel, Thailand, China and Taiwan. These markets are among the gemstone processing centres of the world. Once the rough gemstones, including stones of Zambian origin, are cut and polished, they are then exported to major gemstone markets of the world like New York, Antwerp, Ider Oberstein, etc. The European Union, the United States, Canada and Japan have to a lesser extent been the destination of Zambian rough gemstones mainly through illegal channels. These countries provide the biggest potential for cut and polished stones because of the high labour costs incurred in the processing of gemstones. With the cheap labour so abundant in Zambia, it is the market worth exploiting.

Thailand has used the abundant cheap labour in the country to its advantage. For all the coloured gemstone jewellery imported by the US it is only in emerald that Thailand is not the leading supplier. For the rest of major coloured stones like ruby and sapphire

Thailand has been leading all other exporters on the US market. Thailand has mobilized its cheap manpower resources to excel in gemstone manufacturing. The industry imports rough gemstones from all over the world and processes them before exporting to the developed world. Its Jewellery manufacturing has recorded rapid growth since 1985. The vast majority of the jewellery manufactured in Thailand features coloured gemstones, primarily ruby and sapphire, either alone or accented with diamonds. Thailand's jewellery exports reached US$496 million in 1990. Coloured gemstone exports in 1990 were US$539 million. The value of total Thai gemstone and jewellery industry exports in 1990 was US$1.5 billion. This represents amazing growth: the value of total industry exports was only US$350 million in 1985, primarily composed of exports of loose ruby and sapphire. During the same period loose gemstone exports to Thailand's major markets also continued to increase, indicating that the Thai jewellery exports were increasing the overall market for coloured gemstone – jewellery.

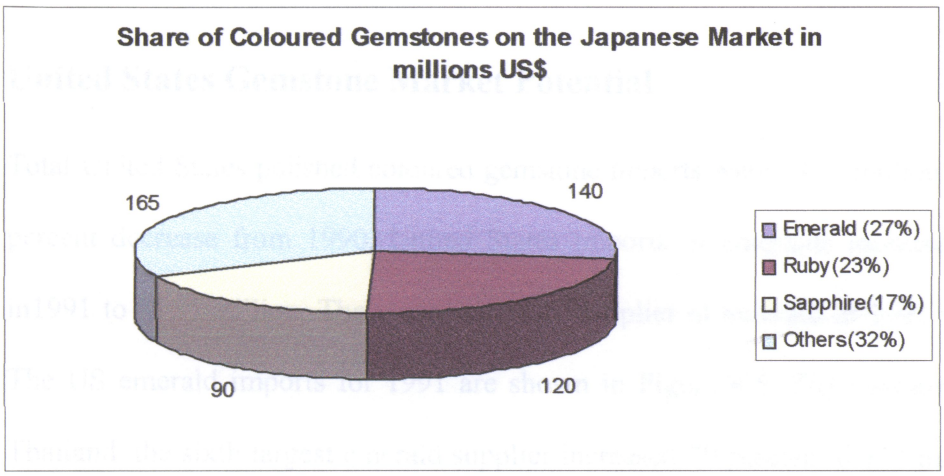
Thailand can be used as a model by the Zambian gemstone industry. If all the processing of gemstones were done locally, the industry would easily penetrate the international gemstone markets of the world. There has been a tendency in the economics of gemstone trade on the international scene to prefer gemset jewellery because of the high labour costs in the developed world.

The opportunities offered by some specific countries for gemstones are discussed below. The discussion is based on the 1990 – 1991 trade statistics. This is to provide an insight of the potential market provided by the selected countries.

Japanese Gemstone Market Potential

The value of Japan's imports of loose polished coloured gemstones decreased by 15 percent in 1991 to US$512 million. However, by volume, Japan's 1991 gemstone imports increased 70 percent to 888 million carats. Japanese polished gemstone import statistics are broken into only two categories: ruby, emerald and sapphire together in one category and all other gemstones in the other.

Japan imported US$347 million in ruby, sapphire, and emerald in 1991 (Figure 4.4). By volume, imports in this category increased 3 percent to 3.7 million carats. Japan's most important supplier in the ruby, sapphire, and emerald category is Thailand. Japan imported US$173 million from Thailand in this category in 1991, presumably ruby and sapphire. The second largest supplier in the ruby, sapphire, and emerald category in 1991 was Colombia. Japan imported US$85 million in this category from Colombia, presumably emerald.



Source: Data to generate this graph is obtained from ICA, 1996

Figure 4.4 Market Share of Coloured Gemstones on the Japanese Market

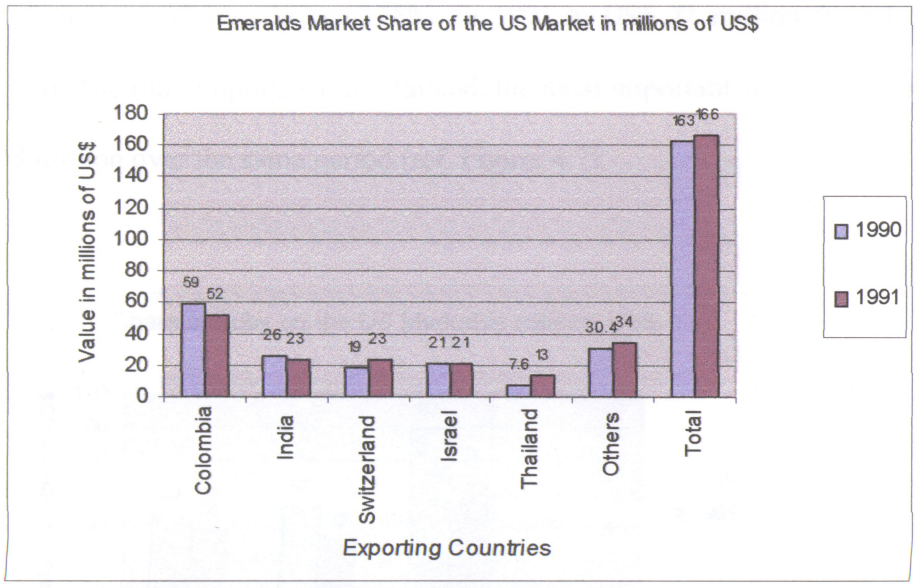
Japan's imports of ruby, emerald, and sapphire break down approximately are shown in Figure 4.5 Japan was the world's largest market for loose coloured gemstones in 1991, with imports 12 percent more than the second largest market, the United States. It is encouraging to note that emerald of which Zambia is also a major producer commands a larger market share on the Japanese coloured gemstone market.

The coloured gemstone market in Japan is only now opening for gemstones other than the traditional stones. Sales are now increasing for fashion jewellery set with tourmaline, tanzanite, aquamarine and other more unusual stones. More retailers, including large pearl retailers, are carrying gemstone jewellery. For example, Japan is the most important world market for the new Paraiba tourmaline from Brazil (Kremkow, 1996).

Research conducted on the consumer market in Japan by the Platinum Guild International shows that sales of coloured gemstone jewellery in Japan are growing faster than sales of any other jewellery category. This presents a good opportunity for Zambia.

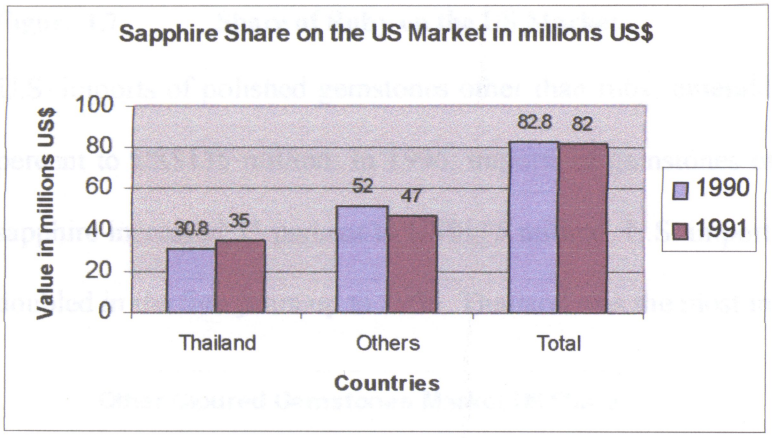
United States Gemstone Market Potential

Total United States polished coloured gemstone imports were $455 million in 1991, a one percent decrease from 1990. United States imports of emeralds increased two percent in1991 to $166 million. The most important supplier of emerald in 1991 was Colombia. The US emerald imports for 1991 are shown in Figure 4.5. The emerald imports from Thailand, the sixth largest emerald supplier increased 70 percent to $13 million. Emerald is the only U.S. gemstone import category that Thailand does not currently lead.



Source: Data to generate this graph is obtained from ICA, 1996

Figure 4.5 Emeralds Market Share on the US Market

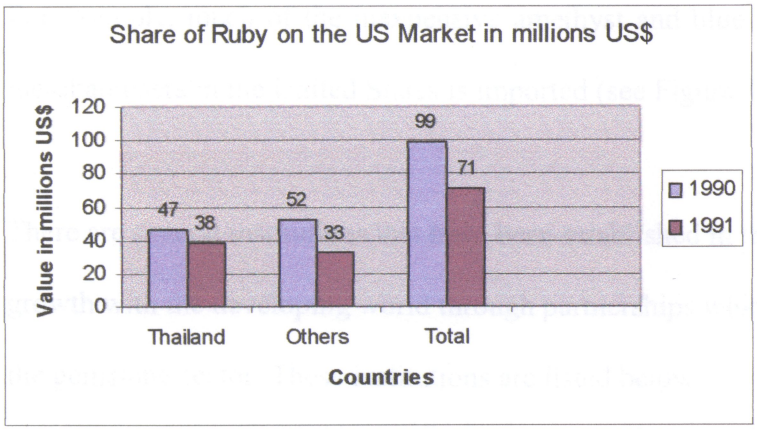


Source: Data to generate this graph is obtained from ICA, 1996

Figure 4.6 Sapphire Market Share on the US Market

United States imports of sapphire were $82 million in 1991, a slight one percent decline from 1990 (ref. Figure 4.6). The most important sapphire supplier was Thailand, with imports of 47 million in 1991.

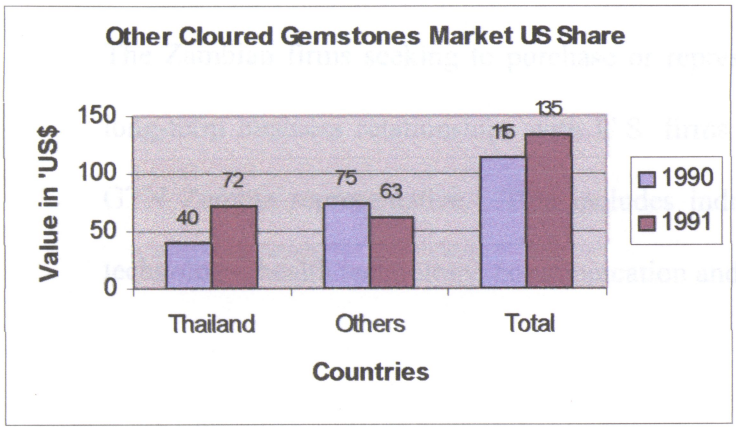
U.S. imports of ruby dropped 28% in 1991 to US$ 71 million from US$ 99 million in 1990. The ruby imports from Thailand, the most important supplier, dropped 19% to US$ 38 million over the same period (ref. Figure 4.7).



Source: Data to generate this graph is obtained from ICA, 1996

Figure 4.7 Share of Ruby on the US Market

U.S. imports of polished gemstones other than ruby, emerald, and sapphire increased 17 percent to US$135 million. In 1996, imports of gemstones other than ruby, emerald and sapphire increased 35 percent to US$115 million. U.S. imports of unusual gemstones had doubled in the five years up to 1996. Thailand was the most important U.S. supplier of



Source: Data to generate this graph is obtained from ICA, 1996

Figure 4.8 Other Gemstones Market Share on the US Market

other gemstones in 1991. The United States imported $72 million in other coloured gemstones from Thailand in 1991, an increase of 78 percent over 1990. The United States is still conspicuously the largest consuming market for gemstone jewellery. This is because the market includes a very large percentage of inexpensive gemstone jewellery. For example, much of the inexpensive amethyst and blue topaz jewellery sold by mass merchandisers in the United States is imported (see Figure 4.8).

There are several institutions that have been established in the U.S. to foster economic growth with the developing world through partnerships which can tremendously benefit the gemstone sector. These institutions are listed below.

- ***Africa Growth Opportunity Act AGOA)***

  The US market under the Africa Growth opportunity Act (AGOA), 2000 has allowed free entry of gemstones from Africa exempt of all import taxes.

- ***Global Technology Network (GTN) - Zambia.***

  The Zambian firms seeking to purchase or represent U.S. technology to initiate long-term business relationships with U.S. firms can register their request with GTN Zambia representative. This includes industries like mining, agriculture technology, health technology, communication and information technology, etc.

- ***Africa Trade Investment Policy Program (ATRIP)***

  This program focuses on promoting exports from Zambia to the U.S.A. The program also aims at increasing International competitiveness of the selected host countries in doing business within the region and with the U.S.A

The European Union Gemstone Market Potential

The European Union (EU) comprises 15 member states. The market size for the EU is 370 million consumers compared to the North American Free Trade Association (NAFTA) which covers 365 million. According to ICA the EU market for coloured gemstones is the third in the world after the US and Japan. The European sources argue that the European market is second only to the US (Masin, 1998).

For customs and statistical purposes for all EU member states, a coding system called Harmonized Commodity Description and Coding System (HS) was introduced in 1988. This was to allow uniformity in the description of various gemstones and their products across the different custom management in the EU countries. Under this system, the breakdown of statistics is possible into:

- Value of imports and exports (in ECU)
- Quantity of imports and exports (in grams, carat, kilogrammes or tonne)
- Country of origin (each continent, developing country)

Table 4.9 Extract of HS Codes

HS code	Product group
17.01	Pearls
71.02	Diamond
71.03	Natural coloured gemstones
71.04	Synthetic and reconstructed gemstones
71.16	Articles of pearls, natural and synthetic

An extract from the full list is shown in Table 4.8. The Full list of HS codes for Gemstones and articles of gemstones is given in Appendix VI which gives the exact description of the HS codes with all their subdivisions whereas appendix IX shows a table of total imports into the EU for every product group and its share of suppliers from the developing countries.

Gemstone Imports into the EU

The total imports into the EU of all gemstone categories in 1996 amounted to ECU 9,454 million and can roughly be divided as shown in Table 4.9. The total imports into the EU of coloured gemstones alone in 1996 amounted to 242 million ECU.

The gemstones and articles of gemstones consumption had relatively remained steady in the period 1989-1996 (ref. Figure 4.9). This shows the invariable demand that exists on

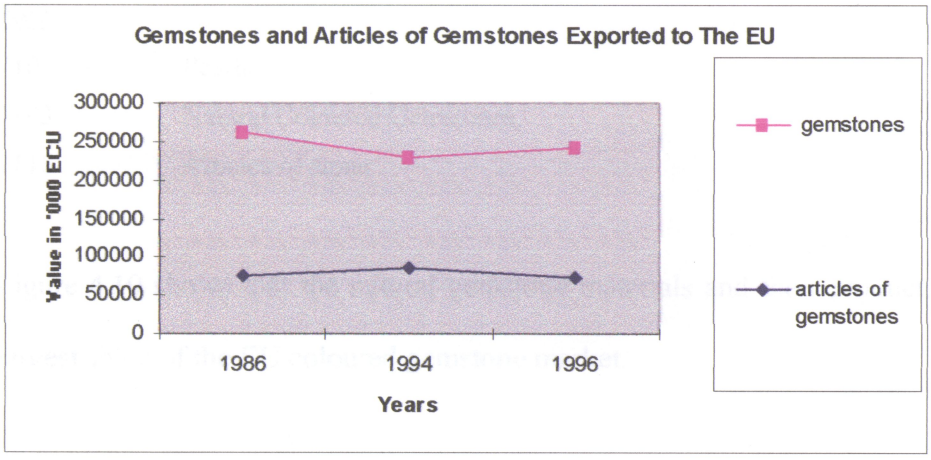
able 4.10 Values (in 1000 ECU) and shares of imports into the EU (1989 – 1996)

roduct group	**1989**	**Share (%)**	**1992**	**Share (%)**	**1996**	**Share (%)**	**% change '89 – 96**
Unworked diamonds	1,760,347	37.1	1,406,245	35.2	5,402,778	57.2	207
Worked diamonds*	257,1367	54.2	2,178,009	54.5	3,595,126	38	40
All other product groups	411,803	8.7	413,474	10.3	453,459	4.8	10
Pearls	74,968	1.6	98,680	2.5	137,884	1.5	84
Coloured Gemstones	261,373	5.5	228,832	5.7	242,402	2.6	-7
Products of coloured gemstones	75,462	1.6	85,962	2.2	73,173	0.8	-3
Total	**4,743,517**	**100**	**3,997,728**	**100**	**9,451,363**	**100**	**99**

*1996: without UK (unknown)

Source: Precious and Semi-Precious Stones, 1998

the EU market. The imports of gemstones on the EU market have consistently been three times more than the consumption of articles of gemstones. The difference between the two has been averaging about 166000 ECU. The main suppliers for this group to the EU are shown in Figure 4.12. Table 4.10 shows the major European markets and their share in the EU.



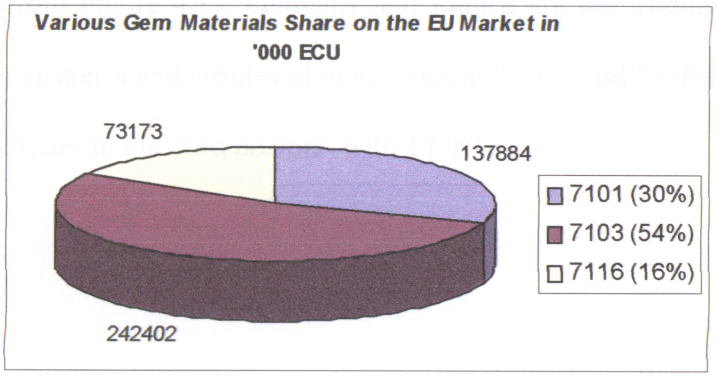
Source: Data to generate the figure obtained from Precious and Semi-Precious Stones, 1998

Figure 4.9 Gemstone and Products of Gemstones Exported to the EU

ble 4.11 Imports of gemstones and gem materials into EU(value in '000 ECU)

S-code group ountry	7101 ECU	Share (%)	7103 ECU	Share (%)	7116 ECU	Share (%)	Total Ecu	Share (%)
elgium/Lux	6501	4.7	25625	10.6	3401	4.6	35527	7.8
nited Kingdom	16763	12.2	43310	17.9	7072	9.7	67145	14.8
ermany	53266	38.6	68068	28.1	18737	25.6	140071	30.9
ance	12940	9.4	61489	25.4	16633	22.7	91062	20.1
ie Netherlands	634	0.5	964	0.4	640	0.9	2238	0.5
ly	28623	20.8	22827	9.4	9334	12.8	60784	13.4
ain	10508	7.6	5202	2.1	9691	13.2	25401	5.6
her EU-Members	8649	6.3	14917	6.2	7665	10.5	31231	6.9
otal	**137884**	**100**	**242402**	**100**	**73173**	**100**	**453459**	**100**

Source: Precious and Semi-Precious Stones, 1998



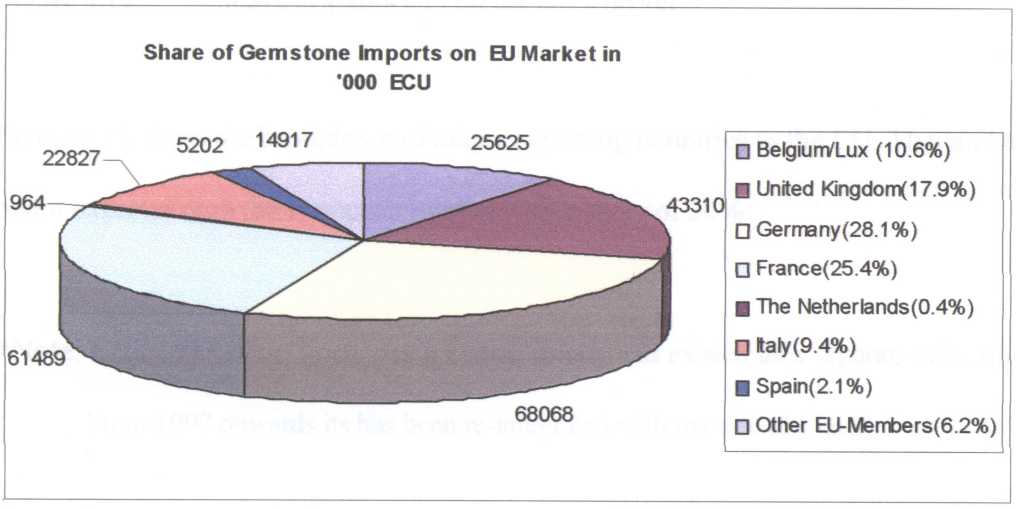
Source: Data to generate the figure obtained from Precious and Semi-Precious Stones, 1998

Figure 4.10 The Share of Various Gem Materials on the EU Market

Key

7101	Pearls
7103	Natural Coloured Gemstones,
7116	Articles of stone

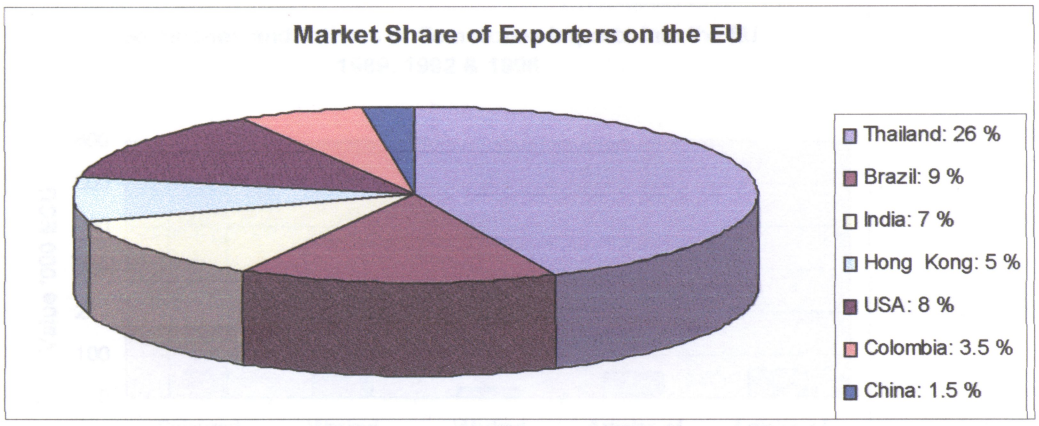
Figure 4.10 shows that the natural gemstone materials and their products command the largest share of the EU coloured gemstone market.



Source: Data to generate the figure obtained from Precious and Semi-Precious Stones, 1998

Figure 4.11 Share of the Gemstone Imports on the EU Market

From Figure 4.11, Germany and France are the leading consumers of natural coloured gemstones and articles of gemstones at 28.1% and 25.4% respectively while pitting Great Britain in the third position with 17.9%.



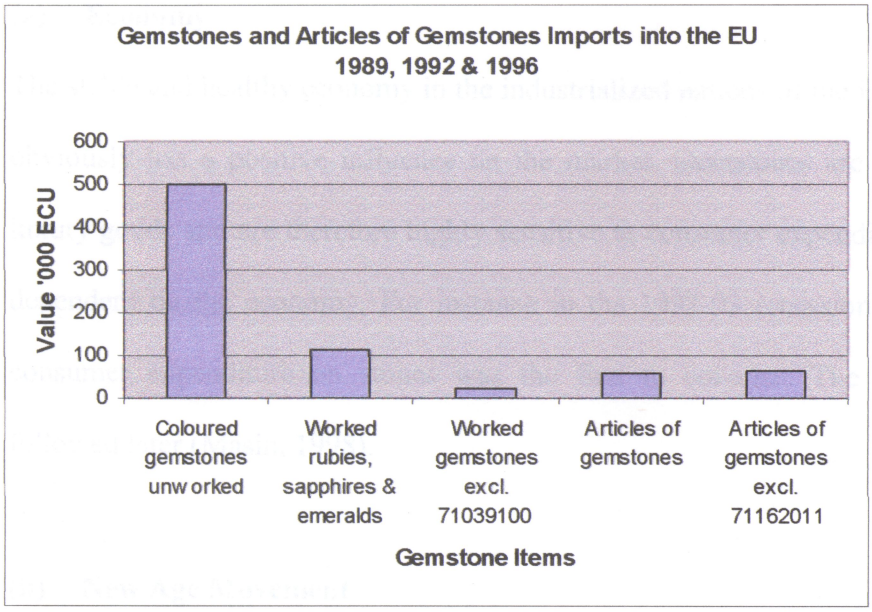
Source: Data to generate the figure obtained from Precious and Semi-Precious Stones, 1998

Figure 4.12 Share of Exporters on the EU Market

Figure 4.12 show the breakdown of major exporting countries to the EU. Thailand is still the major exporter onto the European market with a share of 26%.

***Note**: Until 1997 Hong Kong was a British colony and existed as a separate state from China. From 1997 onwards its has been re-integrated with main land China.

Asian countries are traditionally very strong in cheap manufacturing. China has a fast growing industry. Wages in china are low and craftsmanship is of high standard. The Zambian gemstone dealers stand to benefit from EU market following the drop of import tariffs on gemstones.



Source: Data to generate the figure obtained from Precious and Semi-Precious Stones, 1998

Figure 4.13 Volume of Coloured Gemstone Materials onto the EU Market

One striking observation, which can serve as inspiration to Third world countries, is Thailand that has conspicuously stood out in all leading gemstone markets. It dominates virtually all major gemstone markets of the world in natural coloured gemstones. Figure 4.13 summarises the consumption of all gemstones and articles of gemstone on the EU market.

4.10 Factors Affecting Demand and Consumption of Gemstones

Generally, the demand for gemstones is a function of economic growth. In the recent years of economic prosperity, the market has been growing steadily. Especially in the past 15 years an increased interest in these products has been shown (Masin, 1998). The key factors to explain the increase are in order of importance:

(a) Economy

The stable and healthy economy in the industrialized nations of the EU, Japan and the US obviously has a positive influence on the market. Gemstones are typical examples of luxury goods and are therefore highly sensitive to consumer expenditure which in turn is dependent on the economy. For instance in the 1992-93 recession in the Netherlands, consumer expenditure on stones was the first to collapse. The other luxury goods followed later (Masin, 1998).

(b) New Age Movement

A very important stimulation for the demand of gemstones is caused by the New Age fashion. Due to their supposed therapeutic properties, many stones are sought by therapist and Medical Doctors. The consumer is increasingly becoming interested in the metaphysical aspects of the stones. The Movement has led to the demand for certain special cutting forms such as:

- Pyramids
- Spheres
- Pendants
- Tumbled crystals (mostly re-polished rock crystals; one side pointed the other rounded for massage purpose)
- "Touch stones" (various rounded shapes that are pleasant to touch and small to carry in a pocket)

A few important examples for the purpose outlined above are:

- Rock Crystal
- Rose quartz

latter stabilized mainly because not only the bottom prices were reached but also the supply of higher quality products was on the increase.

The low prices can be explained by:

i. **Maturity of Market**

In earlier years the products were knew which gave them an additional 'rarity'. Nowadays stones are gradually becoming more common and therefore losing their additional value.

ii. **More And Better Production Facilities**

The proliferation of new technology to cut, polish, drill, etc. in many cases has driven the prices down. More often, the price is determined by production costs because the rough material is cheap. Products made of cheap rough materials have become a lot cheaper lately. On the other hand, more people in the market are being reached who previously were not really interested due to the "expensive" image of the gemstones.

Although the foregoing account was an analysis based on the EU market, the points and attributes raised can generally be applicable to any major gemstone market of the world.

CHAPTER FIVE

THE LAPIDARY INDUSTRY

5.1 *The History of the Lapidary Industry in Zambia*

As part of the recommendations of the Commission of Inquiry on adding value to emeralds in order to increase revenue for the Government, RMC negotiated for an agreement with a Brazilian Company to establish a cutting and faceting operation on a Joint-Venture terms. The new lapidary company called Zambia Emerald Industries Limited (ZEIL) was 51% owned by government through RMC while the remaining 49% shares were held by a Brazilian firm. The company's operation was initially confined to emeralds and RMC was to make available the required raw material from Kagem and other private producers.

Several offers by foreign companies to establish lapidaries in Zambia were made following the RMC deal with a Brazilian Company, only known by its Portuguese acronym as ERB. All the offers were turned down by the government for fear of inadequate raw material to cater for all. This was the first devastating blow to the rise of the lapidary industry in Zambia. Mindeco Small Mines (MSM) a fully government owned company engaged in mining of gemstones other than emeralds was allowed to operate a lapidary so that it could cut a greater volume of gemstones outside emeralds. Beside MSM there were also a number of other lapidaries ranging from small to commercial scale producing only a small fraction as cut gems of the total production of gemstones in Zambia.

5.1.1 The Current Status of the Lapidary Industry

The Zambian lapidary industry is currently in a deplorable state. The absence of policies to protect and foster growth in this sector has led to attrition of this industry. The Government *laissez - affaire* attitude has abrogated the state's role of steering economic growth and promotion of downstream processing industries in the mineral sector. By 1992 there were about 160 lapidary and jewelleries in Zambia and Lusaka alone boasted of 55 (see Appendix XV). As at December 2000 less than 15 were still operating countrywide while the rest had gone under due to a number of factors.

The major problems cited, by many respondents during this study, for the collapse of many lapidaries, was poor supply of raw stones and lack of market for cut stones. Contrary to conventional wisdom, there has never been a situation where the stones have ever been in short supply in Zambia; it is only that the lapidary operators have been offering very low prices for purchases and as a result the miners have shunned them in preference to the middlemen and foreign markets.

Although the reasons quoted above as responsible for the demise of the lapidary industry may be the immediate causes, the long-term insidious effect has stemmed from policy negligence on the part of government to protect the industry. When gemstone marketing was liberalized only sweeping indiscriminate policies across the entire gemstone industry were put in place without consideration to address the specific needs of the local lapidaries. The industry's fate was left to the dictates and ravages of callous market forces.

When the marketing of gemstones was state controlled, miners had reservations selling their produce to the authorized state monopoly RMC and its subsidiary ZEIL because a 10 % levy, in addition to the usual taxes, was imposed for every sale. To avoid the levy and low prices, miners used to clandestinely avail their produce to the local lapidary industry where the prices were relatively better than those offered by government appointed buyers. Even then, such flow of stones to lapidaries was remnant of what illegal buyers could not buy resulting at least a few percolating down to the industry. Illegal buyers were only buying very good quality stones which apart from guaranteeing a market and high return minimized the size of parcels for smuggling.

With discouraging policies in place, like levies and low prices administered by government appointed agencies, the lapidary industry thrived on purchases of gemstones through illegal channels. Over this period lapidaries, had three ways of purchasing stones open to them:

(a) buying legally from the authorized parastatal company;

(b) buying illegally from employees parastatal company through pilferage ; and

(c) buying illegally from small-scale miners and illegal dealers.

It is important to note here that the last two options were a norm rather than an exception. When the marketing of gemstones was liberalized and middlemen with government issued licences appeared on the scene, miners who could not afford to find markets abroad were intercepted by the middlemen right at the mine site. Since the middlemen now possess gemstone-trading licences, they are able to purchase any amount of stones freely as in the past smuggling, which was the cause of restricted purchases for easy concealment, is no longer the mode of exit for export trade. As a result, the supply to the

local lapidary industry has been stifled as middlemen and foreign markets offer better prices than the lapidary operators. Due to lack of financial capacity to compete, many lapidaries have been grounded. More than 95% of lapidaries still operating are owned by gemstone miners as they are able to feed the lapidary with mine production.

5.1.2 Constraints in the Lapidary Industry

The present structure of policy as it stands is an epitome of catastrophe for the lapidary industry in Zambia. Comprehensive surgical measures need to be taken in order to resuscitate the sector. Although the new Zambia's Mining Policy emphasizes on downstream processing of all minerals before export, the paradigm implementation has heavily weighed on industrial and metallic minerals. The policy imposes royalty on export of raw materials as determined by MDD. The royalty is completely waived if the product is processed locally to its final stage ready for use (ref. Section 3.4.1). Unfortunately for gemstones, the policy has never been strictly enforced in this era of liberalized economy. Paradoxically, the rough gemstones where even granted the NTE status until 1995 where they used to pay only 15 % of income tax on profits. Despite that gemstones no longer enjoy this tax waiver and are now subjected to 25% corporate tax , they still remain under the NTE categorization and pressure is mounting on the Government to restore to the pre-1995 status quo. The calls for reinstatement of the export of rough to pre-1995 status is an impending threat to the promotion of cutting and polishing of gemstones as rough exports would equally enjoy the tax waiver which only processed gemstones in the gemstone category are privileged.

A broader perspective of the situation in Zambia with regards to the gemstone industry reveals that the current source of problems facing the lapidary industry can be identified as discussed below.

i. Lack of Local Market for Gemstones

Most industries begin expanding into international trade after saturating the local market with their line of merchandise. After mobilizing resources and gathering momentum from the local markets they venture into foreign markets. This has never been the case for the Zambian lapidary industry. The industry has always operated for foreign markets ever since the number of expatriates started diminishing. The industry insiders have complained about lack of a formidable local market for gemstone products. Gemstone products are in economics classified as luxury goods whose demand is associated with the presence of discretionary incomes that are virtually non-existent to a vast majority of Zambians. This as previously discussed can be attributed to poverty. This explains why the few surviving lapidaries are owned by foreigners who can afford to find markets abroad where they have contacts.

ii. Over-liberalization of the licensing system

Under the new liberalized economy there is no screening as to who must apply for a Gemstone Dealers' licence. In the old centralist economy one had to own a mine, lapidary or Jewellery shop to be granted authorization to trade in gemstones. This unrestricted access to gemstone dealing has created "authorized" middlemen. These middlemen going round the mine sites buying selected good quality stones leaving out low grade, which even the lapidaries cannot buy. This has contributed to the shortage of stones some lapidaries complain about. The stones usually purchased in this manner are later illegally smuggled out of the country.

iii. Lack of Capital in Lapidary Industry

The lapidary industry usually lacks financial capacity to offer competitive prices to miners for rough gemstone purchases. This partly explains why big mines have established export markets while the small-scale miners sell to middlemen where the prices are relatively better.

iv. Lack of an Established Gemstone Exchange

The absence of a Gemstone Exchange has hampered the growth of the gemstone sector in general and the lapidary industry in particular. International buyers prefer a one-stop centre where they can carry out all the transactions which is not the case at present in Zambia. Individual miners and lapidary operators travel abroad to make their own market arrangements. The small-scale miners, who cannot afford to travel, sell their produce to middlemen. If there was a Gemstone Exchange facility miners who do not have any idea of the value added when a rough gemstone is cut will have a feel of the price disparities that exist between the two and will be attracted to cut and polish their produce. A gemstone exchange therefore would contribute to the successful evolution of a lapidary industry as producers will be motivated to cut stones to increase profits and improve cash flows.

vi. Import Taxes on Rough Gemstones

Independent operating Lapidaries do not have easy access to good quality stones locally. Independent in the sense that they do not share ownership with a gemstone mine (Ref. Chapter Six). They cannot import rough gemstones for processing locally because of the 25% customs duty levied on rough gemstone imports. The import tax renders the idea of processing imported rough material inconceivable. As previously discussed, the

successful lapidaries are only those owned by gemstone mine owners and are therefore able to supply their own lapidaries with rough stones.

vii. Inadequate Government Policy on Downstream Processing

Although in the current mining policy there is mention to encourage downstream processing of minerals, there is no deliberate policy to make it compulsory to only export cut and polish stones (ref. Mining Policy, 1995). Since the bulk of Zambian gemstones are produced by foreigner-owned companies, exporting rough material favours their strong offshore business interests. It is evident that an appropriate legislative intervention will be required to reverse this situation.

viii. Lack of Financial Resources

Many lapidary operators lack working capital to buy rough stones in quantity and quality required for economically sustainable operations.

ix. In adequate Valuation Skills

Many gemstone miners lack valuation skills. They usually depend on the middlemen who set the prices and obviously exploit their ignorance. This is a result of a combination of factors namely:-

- Lack of gemological skills and
- Inadequate access to marketing information on trends in pricing on the international markets.

x. Inadequate Lapidary Skills

For the Zambian lapidary industry to assert itself and penetrate international gemstone markets and compete favourably with more than a century-old experienced gem cutters of India, China, Thailand and Israel, highly specialized training is required. Cutting stones of high quality is done manually by experts, many of whom take many years to perfect the skills.

There has been double standard on the part of the government regarding national manpower development requirements. In response to the vast skilled manpower the copper mining industry was going to demand, the government set up the School of Mines at the University of Zambia in 1973 and Mining and Mineral Processing at Zambia Institute of Technology (ZIT) along side other trades that would meet the ever growing needs of all industries. Similar institutions were built to cater for agriculture. No parallel training was provided for the gemstone processing industry despite Zambia being a major gemstone producer. To date there is no manpower development plan for the sector despite gemstones having been mined in Zambia for more than 30 years.

5.2 Gemstone Cutting and Polishing

5.2.1 Introduction

The final stage of gemstone processing is cutting and polishing. The aim of cutting is to retain as much weight as possible whilst ensuring that the most attractive colour is visible through the table facet. It is also critical that certain angles and proportions are maintained in order to maximize overall brilliance in a gemstone.

Coloured gemstone cutting is one of the oldest forms of art with records dating back to the period before the birth of Christ (Geogem, 2000). The origins of gemstone cutting can be found in India. Up until 1400 AD, there was very limited polishing done. This was mainly to improve lustre and remove unsightly blemishes. Idar-Oberstein became the centre of agate and coloured stone cutting in the 15th Century. The major cutting centres today are Sri-Lanka, Thailand, India, Brazil and Idar-Oberstein.

The processing of gemstones can be divided into four distinct areas:

(a) Engraved gemstones (i.e. cameos)

(b) Agates

(c) Coloured gemstones

(d) Diamonds

5.2 Cutting and Polishing of Gemstones

Cutting gemstones is called Lapidary Work or Gem Cutting. The cutter is known as a Lapidary, Lapidarist or Gem Cutter. Gem cutting involves the steps as shown in the flowchart Figure 5.1 on page 100.

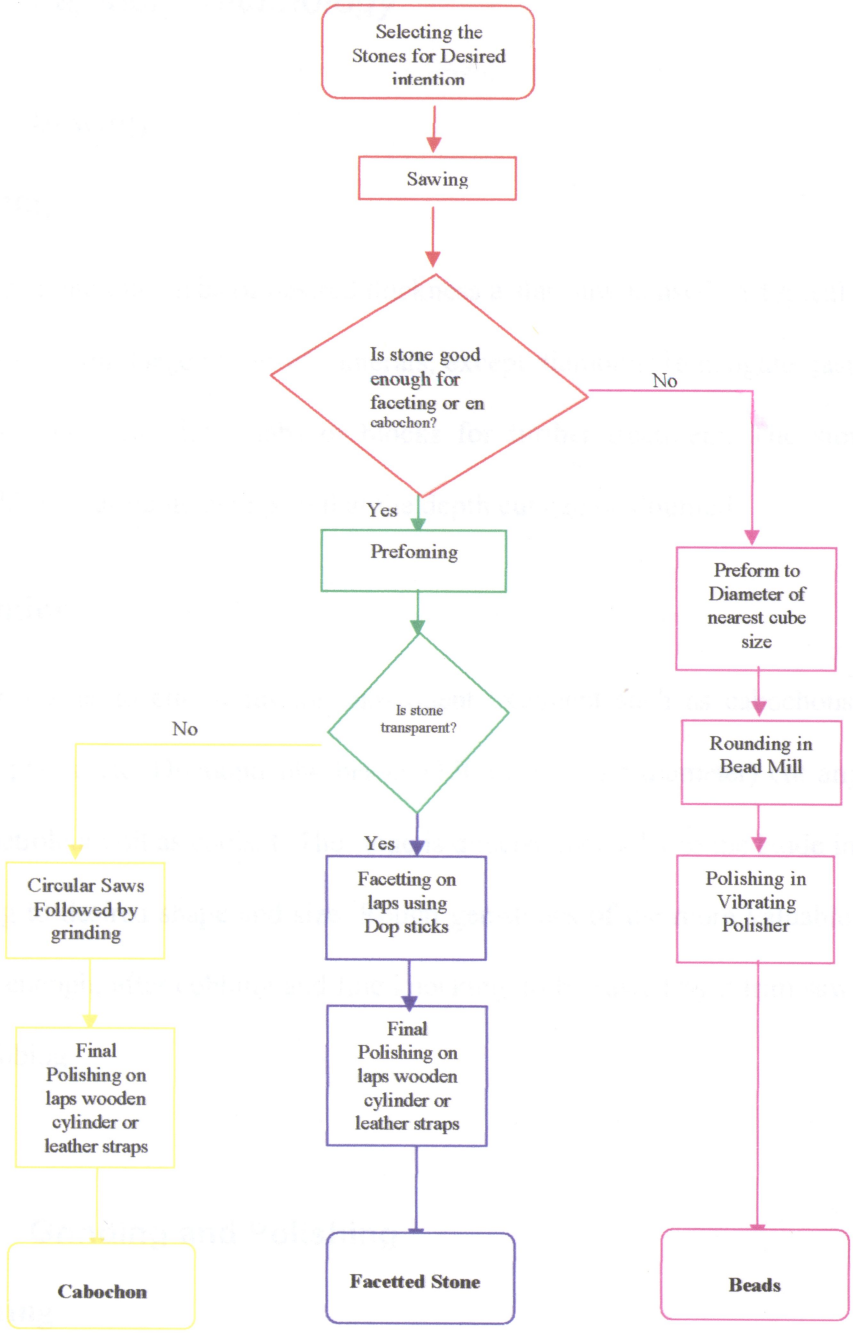


Figure 5.1 **Gemstone Cutting and Polishing Flowchart**

5.3 *Lapidary Technology*

5.3.1 Sawing

(a) Slabbing

To cut a rough stone into slabs of desired thickness a slab saw is used. A typical slab saw is designed for sawing large pieces of minerals, except diamonds (e.g. agate, jasper, lapis lazuli, sodalite, jade etc) into slabs or blocks for further treatment. The stone to be worked is held in a turntable clamp so that the depth cut can be doubled.

(b) Trimming

The trim saw serves to cut stones for subsequent treatment such as cabochons, faceted stones, small plates, etc. Diamond saw blades (150 or 250 mm diameter) cut any type of stones with petroleum oil as coolant. The stone is directed manually to the blade in order to saw according to desired shape and size. Rough gemstones of the more valuable type are mostly small enough, after cobbing and fine knocking, to be sawed by a trim saw, without preceding slabbing.

5.3.2 Grinding and Polishing

(a) Grinding

Grinding is the abrasive process used to give rough shapes to gemstones. In lapidary work, the term refers to the use of abrasive wheels. The most common are made from silicon carborundum in many sizes and shapes and employ abrasive grains of different sizes, depending on the purpose of the wheel. In modern practice, many grinding wheels use diamond grains bonded by a metal or plastic matrix.

Coarse grits are used to make wheels that rapidly remove material, while fine grits are used whenever the abrasive action must be slower and smoother. A gem cutter uses grinding wheels to shape cabochons and to preform rough for faceted gems, as well as to grind bevels on flats, shape carvings, profile pieces for inlay work, and many other tasks. Grit sizes for loose grains and abrasive wheels in grinding tools, are numbered: the finer the particles, the larger the grit number i.e. 100 grit is coarse while 1200 grit is very fine. The grits used in lapidary work, either as loose grain or coated, are shown in Table 5.1.

Table 5.1 Grit Size

Grit Size	Micron Size	Purpose
60	400	Rough grinding and Tumbling
100	150	Rough grinding and Tumbling
220	60	Fine grinding, lapping and sanding
325	45	Very fine grinding, lapping tumbling fine sanding
600	30	Very fine lapping, fine sanding
1200	15	Very fine lapping, prepolishing.

i. Grinding Wheels

Carborandum wheels for gem cutting come in a variety of sizes, depending on the type of equipment used. Common sizes range from 20 - 50 mm thick and from 150 - 250 mm diameter. Shaft holes are available in sizes ranging in diameter from 20 - 30 mm to accommodate various makes of equipment.

For rough shaping, a medium soft grade of 120 grit is most popular. In fine grinding, where the object is to smoothen surfaces and not remove much material, a 220 grit wheel in medium - hard grade is best.

Vertical diamond grinding wheels are available, but more common are horizontal diamond grinding wheels or laps. Diamond plated laps have diameters of 150 - 200 mm and consist of a metal surface over which the diamond grains are evenly spread and held in position by nickel galvanizing. Normally used grains are listed in Table 5.2.

Table 5.2 Grit Size and Usage

Grit Size	Usage
180	roughing (mostly done by vertical wheels)
400 0r 600	quick cutting
1500	smoothing facets prior to polishing

ii. Grinding Powder

Grinding Powder is used in tumbling mills, vibrators and surface grinding machines, as well as for cutting of facetted stones when not using diamond laps. Carborundum is used in grit sizes 80 - 320 for coarse and medium, and 400 - 1200 for fine and very fine work.

(b) Sanding

The most commonly used material for sanding is stout cloth covered with a layer of silicon carbide grit. The grit varies from very coarse to very fine, but only two or three sizes are usually needed. For coarse sanding, 220 grit is popular, followed by 400 or 600 grit for finer sanding.

Ordinary sanding cloth is made with water-soluble glue. Another type is impregnated with plastic resin glue and is impervious to the effects of water. Sanding cloth is available in disk, strip and belt form, depending on the type of equipment. Almost all grinding, sanding and polish processes of gemstones involve application of water.

(c) Polishing

The final step in the preparation of gemstones is polishing. The brilliant and radiant smooth surfaces typical of polished gems and are produced by pressing the shaped stone with considerable force against yielding materials such as felt, leather, cloth, or wood that have been charged with polishing agent. With the exception of diamond, most polishing agents are oxides of metals:

- aluminium oxide, 0 - 1 micron or finer
- ceric oxide
- chromic oxide
- ferric oxide
- chalk or finest marble dust
- tin oxider
- tripoli = finest diatomite
- zirconium oxide
- diamond (powder or paste), 0-2 micron

There are two types of general polishers: those for polishing cabochons, flats, spheres, and other work demanding little accuracy; and those for polishing geometrically flat surfaces such as on faceted gems. The first type embraces buffs constructed from yielding materials, such as fabric and leather, but also harder materials such as wood, less yielding

5.4 Production Steps in a Multipurpose Lapidary

The flowchart shows the various processes a rough stone undergoes before living the lapidary as a polished gem.

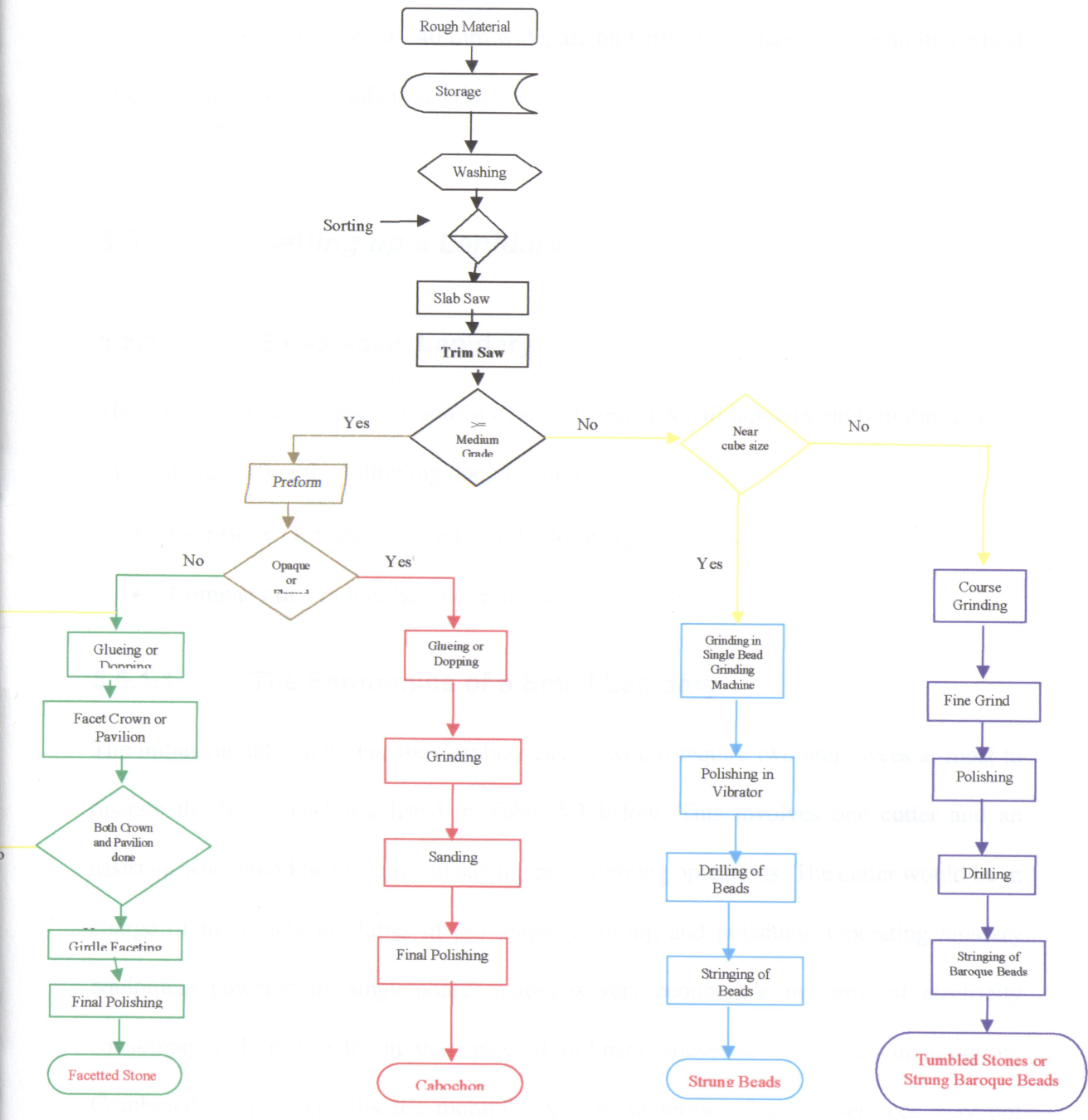


Figure 5.2 Production Steps in a Multi-Purpose Lapidary Workshop

under pressure and more capable of providing the accurate surfaces desired. The polishers used in facet work are called laps and those used in cabochon work are called buffs. The most popular polisher is a solid felt wheel made of top-quality compressed wool. The best is called rock-hard because other kinds are soft and wear too quickly. Felt wheels have 100 - 200 mm diameter and are 10 - 40 mm wide, are on vertical grinders, like a grinding wheel. There are also wheels in other materials.

5.5 Setting up a Lapidary

5.5.1 Small-scale Lapidary

There is no red tape in the procedures of establishing a small lapidary shop in Zambia. One only has to get the following documentation and licensing:

- Gemstone Dealers' licence from the Ministry of Mines.
- Company or Trading licence from the Civic Centre.

5.5.1.1 The Economics of a Small Lapidary

The initial capital is low. For the Zambian case it would require two employees at most to operate the basic machines listed in Table 5.3 below. This involves one cutter and an assistant who would be in charge of sawing and tumbling operations. The cutter would be in charge of more delicate duties of pre-shaping, cutting and polishing. Operating lapidary equipment powered by single-phase motors is very economical in terms of electricity consumption. It is usually in the range of ordinary household domestic consumption. Combined with water bills the monthly expense in terms of utility services may not exceed US$ 100.

Table 5.3 Cost Estimates of Lapidary Equipment

Equipment	Unit Price (US$)	Weight (kg)	Accessories		Total	
			Weight (kg)	Price (US$)	Weight (kg)	Price (US$)
Sawing	200.00	5.00	0.99	18.95	5.99	218.50
Preforming, Cutting and Polishing Machine as one assembly	2000.00	17.00	N/A	N/A	17.00	2000.00
Tumbler	350.00	9.00	4.68	98.90		448.90
Vibrator	200.00	7.00	1.98	6.95	8.98	206.95
Table and Stand	150.00	To be Sourced locally				150.00
Total	**2900.00**	**38.00**	**7.65**	**124.35**	**45.27**	**3024.35**

Total Equipment Cost = US$ 3,024.35

Insurance = US$ 1.60/per US$ 100 insured[4] = $\frac{3024.35}{100}$ x 1.60 = US$ 48.39

Freight = US$ 93.00 for the first kg and US$ 16 for each additional kg[5]

= 93 + (45.27 – 1) x 16 = 93 + 708.32 = US$ 801.32

VAT and Customs Duty @17% and 14 % respectively

3024.32 x (0.17 + 0.14) = US$ 937.54

Total Landed cost = US$ 3024.35 + US$ 48.39 + US$ 801.32 + 937.54

= US$ 4811.60 rounding up.

≈ US$ 4,812

Calculations in this section are based on the assumptions made in the next section.

[4] Gemstone Cutting Equipment Corporation, Inc. insurance is US$1.60 per every US$100worth of equipment purchased.

[5] United States Postal Services, charges freight to this part of Africa is US$93.00 for 1st kg and US$16.00 for each additional kg.

The production would be expected to be about 6 stones per day at about 0.7 ct per stone. Compare with the calculation for the multi-purpose lapidary in the next section. Here the production is taken to be 6 stones per day because of that is the average production in single-employee lapidaries.

Assuming the average selling price of a cut and polished stone to be US$6.5,

Revenue per year = 6 stones x 0.7ct/stone US$6.5/ct x 322 days = **US$8,791**

Total quantity of rough required per day is 7g

Total quantity of rough required per year is 7 x 322 working days per year = 2254 g

The cost of rough per day is 7g x US$ 2,000/ kg = US$ 14.00

Table 5.4 Calculating the After-Tax Net Present Value (NPV) for Small Lapidary

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Revenue		**8,791**	**8,791**	**8,791**	**8,791**	**8,791**	**8,791**	**8,791**	**8,791**	**8,791**	**8,791**
- Utilities Bill		-1,200	-1,200	-1,200	-1,200	-1,200	-1,200	-1,200	-1,200	-1,200	-1,200
- Labour		-1,200	-1,200	-1,200	-1,200	-1,200	-1,200	-1,200	-1,200	-1,200	-1,200
-Rough		-4,408	-4,408	-4,408	-4,408	-4,408	-4,408	-4,408	-4,408	-4,408	-4,408
- Consumables		-600	-600	-600	-600	-600	-600	-600	-600	-600	-600
Total Operating cost		-7,508	-7,508	-7,508	-7,508	-7,508	-7,508	-7,508	-7,508	-7,508	-7,508
- Amortization		-40	-40	-40	-40	-40	-40	-40	-40	-40	-40
- Depreciation		-815	-815	-815	-815	-815	-815	-815	-815	-815	-815
Net Taxable Income		428	428	428	428	428	428	428	428	428	428
-Tax @ 15%		64	64	64	64	64	64	64	64	64	64
Net Income		**364**	**364**	**364**	**364**	**364**	**364**	**364**	**364**	**364**	**364**
+ Amortization		40	40	40	40	40	40	40	40	40	40
+ Depreciation		815	815	815	815	815	815	815	815	815	815
- Installation	-200										
-Equipment Cost	-4812										
Total Capital Cost	-5012										
Cash flow	**-5012**	**1,219**	**1,219**	**1,219**	**1,219**	**1,219**	**1,219**	**1,219**	**1,219**	**1,219**	**1,219**

Cost of Rough per year = 14 x 322 = **US$ 4,508**

Cost of Consumables per year = 50x12 = ***US$ 600***

From Table 5.4 the following calculations are done:

NPV : $-5012 + 1{,}219(P/A_{8,10})$

1,219 x 6.71 - 5012

US$ 3,166

Salvage value is assumed to be 0.

The DCFROR @ NPV = 0 is 21 %. Since this is greater than the assumed bank interest rate of 8% the project is considered viable.

5.5.2 Large Lapidary Complex

Setting up a multi-purpose lapidary takes the same steps as establishing a company as discussed in Section 3.3.0.

The following text discusses the financial and economic analysis of setting up a multi-purpose lapidary. *It has been adapted and slightly modified from the Socilap Lapidary* Project of Mozambique (FORMIN 94).

The purpose is to start a lapidary with personnel of 54 cutters and 6 overheads. The production personnel of 54 have been arrived at from the assumption that single-employee lapidaries have a production rate per day of 6 stones. With economies of scale at play, the annual consumption of 140 kg rough material can be handled by 54 people at an average of about 8 stones per person. 140 kg is assumed to be the average annual production of gemstone for Zambia mines (Taupitz, 1996). At first stage the intention is

to cut and polish all Zambian production. Perhaps at a later stage to expand into cutting and polishing of imported roughed material.

5.5.2.1 Project Assumptions

- The current gemstone production levels would be sustained for several years to come.
- 90 - 95% of the total stones to be cut in standard size and shape while the rest will be cut free or special size and shape.
- The quality of cutting will be as good as competitors'.
- The cutting cost per carat will be lower than US$ 2 so as to be able to compete with other Third World traditional cutting centres like India, Thailand, Sri Lanka, China, etc.
- In the event of overwhelming demand, production can be increased by introducing extra work-shifts.
- The rough will yield about 32% in the preshaped stones.
    - The preshaped stones will yield an average of about 40% in the polished stones.
    - The final yield (polished stone) of the rough will therefore be 12.8 % for this report a conservative figure of 12.5% will be adopted for ease division in 100%.
    - Expected annual production: 85,000 ct of polished stones.
    - Monthly production (22 working days): 7,084 ct, average weight 0.7 ct, i.e 10,120 polished stones per month.
- If extra shifts still do not cop with demand then the plant will have to be extended according to demand forecasts.

5.5.2.2 Lapidary Requisites

Basic Details

140 kg rough emerald, aquamarine, tourmaline, garnet and amethyst to be cut into facets and cabochons. The capacity was arrived at based on the official figures of an average production of emeralds from an ordinary mine in Ndola Rural Restricted Area based on the 1990's statistics.

Approximate weight of the average polished stone: 0.70 ct.

5.5.2.3 Personnel required for expected production

1. The daily production per lapidary worker is a minimum 8.5 stones.
   - Total cutting staff: 54 cutters
   - The daily production: 460 stones
   - Monthly production: 10, 120 stones
   - Yearly production: 121, 440 stones
   - Yearly production in carats 85,000 ct
2. In view of the above it will be possible to cut and sort the needed quantity of stones with a staff of 60 workers as follows:
   - 3 - Sorting department for rough, preshaped and polished stones;
   - 3 - Preshaping;
   - 3 - Girdle and shaping;
   - 3 - Glueing;
   - 12 - Cutters
   - 2 - Cabochon cutters and polishers;

- 26 - Polishing;
- 5 - Laboratory, office and maintenance;
- 3 - G.M. + Production Manager + supervisor.

Total 60

5.5.2.4 Equipment and department functions

Sorting department 3 workers

The department will sort and keep record of the goods in 3 stages:

- Rough.
- Preshaped.
- Polished – sorting and pricing.

Stock supervision and registration will be done by a computer in a second stage.

Personal training: Eye tests should be performed for detecting problems in colour differentiation and general sight. Training period: from 9 to 12 months.

Preshaping department 3 workers

This department should be located in a maximum daylight facility.

Equipment:

- 3 work positions and lighting facilities.
- 1 work position for large stones with additional lighting.
- Electricity, water and drainage installations for each work position.

Spares:

- 10 grinding wheels for preshaping.

- 100 saws and auxiliary equipment.

Personnel training:

Suitability tests should be performed for detecting problems in colour differentiation, three dimensional sight, etc.

Training period for 1 preshaper: from 6 to 12 months.

Girdle and shaping department 3 workers

This department will be responsible for giving the stone its shape before cutting. The stone will be cut manually or by a semi-automatic girdle machine depending on its size and quality.

Equipment:

- 1 centering machine.
- 1 semi automatic girdle shaping machine with cams.
- 1 square-shaping machine.
- Auxiliary equipment: glue and dops.
- Electricity and water installation for each working position.

Personnel training: 2-4 months.

Glueing department 3 workers

This department is responsible for glueing all the stones on dops, before and after shaping and turning them over during the cutting process, using hot glue system and the cold glue system.

Equipment:

- Dops with plastic dividing heads.
- Kit and glue for sticking the stones to the dops.

- Auxiliary equipment for handling dops.
- Auxiliary equipment for 3 gluers such as; lighting, gas for bunsens, tools for glueing. Gadgets for transferring stones zeroing etc.

Personnel training: about 3 months

Cutting department 12 workers

This department is responsible for cutting all the stones after shaping.

Equipment

- 10 standard working positions with tools for cutting facets and tables.
- 2 standard working positions with tools for cutting emerald cuts.
- Each working position should include additional auxiliary equipment such as: working tables, electrical motors, appropriate lighting, water and drainage.
- 150 standard cutting discs, all types.

Personnel training: 4-6 months.

Cabochon department 2 workers

This department is responsible for cutting and polishing of cabochons. The shapes will be formed partly by hand and partly by the semi-automatic girdle-shaping machine (with cams).

Equipment:

- Standard American equipment.
- Installation for water, gas bunsens, electricity, and drainage.
- Sticks for glueing cabochons.
- Work tables, cutting wheels and various materials for polishing.

Personnel training period: about 4 months.

Polishing department 26 worker

This largest department is responsible for the polishing of all stones, including tables and girdles.

Equipment:

- 20 working positions with standard tools for polishing;
- 2 working positions for polishing girdle of emerald cut and squares.
- 6 working position for polishing tables.
- 100 green polishing wheels.
- Working tables, water, electricity and drainage installations, electric motors, lighting.

Personnel training period: 2 to 4 months.

Laboratory, office and maintenance 5 workers

The office is responsible for keeping track of all the stones and recording their progress trough the different departments.

The laboratory is responsible for cleaning, oiling, weighing and registering of all the stones at the end of the entire cutting process.

Equipment:

- 1 oiling system.
- Various oils and auxiliary tools.
- Safe room, work tables, office equipment, gas bunsens.

1 maintenance man responsible for taking care of:

- Electricity systems for: lighting, motors, air conditioning.
- High and low pressure water systems and drainage.
- Gas pipes and bunsens.

- Mechanical systems of all the working positions.
- Inter alignment of all the stands.
- Internal and outside communication systems, security and alarms.
- Servicing of polishing laps, dressing and scouring.

2 cleaning workers responsible for cleaning the lapidary and halls.

Personnel training period: about 1 month.

General Manager, Production Manager and Supervisor 3 workers

1 Supervisor

The quality of every stone must be inspected by the supervisor in each stage of the cutting and polishing processes.

1 Production manager

Responsible for the running of the lapidary.

1 General Manager

In charge of overall responsibility of running the administrative and production operations.

Training period 1 expert for 6 months

A foreign expert in cutting, polishing preshaping, doping and production control will be responsible for training all workers in the various departments including the quality supervisor and sorters.

Note: The preshaping and sorting are the only departments that need the period of training longer then 6 months. The intention is that they will study the first 6 months

under the expert's supervision and another 6 months under the General Manager's supervision.

5.5.2.5 Budget and List of Equipment

A. Assumptions

- The numbers of preshaping stands, cutting stands, polishing stands and the cabochon equipment are done on the basis of the experience of some local small-scale lapidaries considering the number of stones and type of stones required, quality and high productivity.
- Personnel Distribution
    - 40 stands for cutting and polishing – 40 workers
    - 3 regular preshaping stands + 1 special stand for big stones – 3 workers
    - 3 glueing stands – 3 workers
    - 2 cabochon stands – 2 workers
    - Laboratory – 1 worker
    - Sorting – 3 workers
    - Office + maintenance – 5 workers
    - Management – 3 staff

    Total: 60 workers.

- The costs of the lapidary infrastructure (building, drainage, water, electricity, gas supply and security) have been omitted as they fall under civil engineering a subject beyond the scope of this thesis. However, accommodation for the lapidary will be by

way of renting an already existing building with local rentals averaging about US$1000.

- One supplier has to be taken in consideration for the 20 + 20 cutting and polishing stands in order to get an inter alignment of the equipment.

B. Cost of equipment and consumables

The following tables summarise the cost of equipment and consumables for different departments.

Table 5.5 **Preshaping department** – 3 workers

Equipment	Estimated Cost in US$
3 preshaping stands + illumination	21,750.00**
1 stand for big stones	1,000.00*
10 diamond laps different kinds	2,500.00
100 sawing discs of different sizes	1,500.00
Working tools and spare parts	1,250.00
A tool for cleavage	250.00
TOTAL	**28,250.00**

Table 5.6 **Cutting and shaping department** – 12 workers

Equipment	Estimated Cost in US$
8 new stands for cutting + table device including tables	41,000.00*
4 new stands for cutting + shaping of emerald cuts including tables	19,750.00*
1 new manual stand for cutting and polishing shapes	2,800.00*
New semi automatic shaping machine with cams and accessories	17,750.00
Different cams for different shapes	1,000.00
Illumination for the above mentioned equipment	1,200.00
150 cutting laps of different types	8,000.00
2 cabochon stands + different laps	5,000.00
Girdling machine and squares	1,500.00
TOTAL	**98,000.00**

Table 5.7 **Polishing department** – 28 workers

Equipment	Estimated Cost in US$
20 stands for polishing including new quandrants with adaptors	75,450.00*
2 new stands for polishing girdles for square and emerald cuts including table	8,800.00*
6 new stands for polishing + table, polishing device (including table)	32,700.00
4. 100 polishing laps of different kinds	18,000.00
5. Illumination	800.00
TOTAL	**11,450.00**

Table 5.8 **Glueing Department** – 3 workers

Equipment	Estimated Cost in US$
3 stands of hot glueing	3000.00*
80 cut dops with attachment heads +40 dops for cabochons	300.00
Gas Bunsens	250.00
100 kgs of hot glue and cold glue	3,000.00
Illumination	300.00
650 stone shelves	4,000.00
3 electrical hot plates	600.00
TOTAL	**11,450.00**

Table 5.9 **Laboratory + Office** – 3 workers

Equipment	Estimated Cost in US$
Metal wardrobe for storing stones during working hours	600.00*
A small "Zvika" oiling machine + ultrasonic machine	3,800.00
Gas bunsens	400.00
Chemicals and different types of oils	2,000.00
Tweezers, scoops, loops and office equipment (fax machine, internal telephone system, security, photocopy machine, etc.)	30,000.00
Stove for heat treatment	3,000.00
TOTAL	**39,800.00**

Table 5.10 Sorting – 3 workers

Equipment	Estimated Cost in US$
Illumination	900.00
3 x Sorting table and stand	8,400.00*
Lathe machine	3,000.00
TOTAL	**12,300.00**

Table 5.11 Miscellaneous

Equipment	Estimated Cost in US$
Mounting and running of the equipment	17,000.00
Miscellaneous	25,000.00
Shipment + insurance	8,000.00
TOTAL	**50,000.00**

Table 5.12 Summary

Equipment	Estimated Cost in US$
Preshaping department	28,250.00
Cutting and shaping department	98,000.00
Polishing department	79,750.00
Glueing department	11,450.00
Laboratory + office	39,800.00
Sorting	12,300.00
Mounting and running of the equipment	17,000.00
Miscellaneous	25,000.00
Shipment + insurance	8,000.00
TOTAL	**319,550.00**

5.5.2.6 Budget Calculations

54 production workers in the lapidary (excluding office personnel) will cut and polish 460 stones per day at a total weight of 460 x 0.7 = 322 ct.

Then the monthly production will be (at 22 working days) 322 x 22 = 7,084 ct.

If we consider that the 7,084 ct cut stones will be the 12.5% result of the rough, then the monthly rough consumption will be –

$$7{,}084 \times 8 = 56{,}672 \text{ ct}$$

In grams - $\frac{56{,}672}{5} = 11{,}334$ g

Yearly rough consumption: 11,334 x 12 = 140 kg

If the average price per kg of the rough is US$ 2,000/ kg, then the monthly cost of rough will be: 11,334 x 2000 =US$ 22,668.00.

Calculating the cutting cost per ct and the cost of the cut products including all expenses and orders of rough.

With a qualified production manager

Total salaries	=	US$ 9,000.00		
General expenses	=	US$ 3,000.00		
Monthly Rentals & Security	=	US$ 1000.00		
Miscellaneous	=	US$ 500.00		
Total monthly salaries	=	**US$ 13,500.00**		
Average cutting cost per ct	=	US$ 13,500.00	=	US$1.90/ct.
Monthly production in ct	=	7,084		
Monthly rough purchasing	=	US$ 22,668.00		
		+		
Monthly total salaries	=	US$ 13,500.00		
Total monthly expenses	=	**US$ 36,168.00**		
Cost of cut products including				
Cutting expenses	=	US$ 36,168.00	=	US$5.11/ct
		US$ 7,084.00		

The total monthly sales taking into consideration that the selling price of cut stone will be an average minimum of US$6.5/ct.

Sales per month	=	7,084 x 6.5	=	US$ 46,046
Sales per year	=	46,046 x 12	=	US$ 552,552
Expected before tax profit/month	=	46,046 – 36,168	=	US$ 9,878
% Gross profit	=	9,878	=	27.3 %
		36,168		

The capital investment will be carried out during the first year. Working capital should cover consumables for a period of four months.

Working capital for first 4 months: 36,168 x 4 = US$ 144,672.00

Trainer for 6 months (including travelling expenses)= US$ 30,000.00

TOTAL **US$ 174,672.00**

Table 5.13 First year expected investments:

Item	Estimated Cost (US$)
Equipment	302,550.00
Installation	17,000.00
Sub-Total	**319,550.00**
Working capital for first 6 months	174,672.00
GRAND TOTAL	**494,222.00**

5.5.2.7 Investment Analysis of a Lapidary Project

Capital Investment = US$ -494,222.00

Operating Cost per year = US$ -36,168 x 12 = US$ - 434,016.00

Revenue per year = US$ +46,046 x 12 = US$ 552,552.00

Apparent Profit per year = US$ + 9,878 x 12 = US$ 118,536.00

Salvage Value after 10 years = US$ 196,650.00

Corporate Tax = 15 % (Cut gemstones are considered NTE)

Royalties = 5 %

Interest = 8 %[6]

*Salvage Value is calculated at 90% of Salvageable material marked with * in the inventory of lapidary equipment.

** US$1,750 for illumination is excluded in the Salvage value calculation.

[6] International average lending rate has been adopted for calculation. Local banks contacted for Forex base rates had no information since all their lending transactions are in Kwacha.

The total of asterisked assets is US$ 218,500. These assets are rigid frames without any moving parts and therefore have a very long life span. At the end of year 10 they are assumed to have been depreciated by only 10%.

5.5.2.8 Estimating the Projects Internal Rate of Return

The calculation considers two cases : Case A deals with development from own equity; Case B is developed with a debt equity ratio of 70:30. Since most financial institutions require a client have 30% minimum equity toward capital required or 70:30.

After-tax Net Present Value (NPV)

The equipment cost (US$ 302,550) is specified as depreciable assets while the cost of installation of equipment and expenses for the trainer (US$17,000 and US$30,000 respectively) are amortizable. Both depreciation and amortization are straight-line over 10 years.

Case A: Debt Free

This is a project undertaking that is developed from an investor's own financial resources without involving debt. The following parameters are applied as:

- Base rate i* = minimum rate of return = 8 %
- Working Capital is only recovered in the terminal year of the project
- Savage value = US$ 196,650

Refer to Table 5.15 for computational details. The project has equal positive cash flows from year 1 through year 9. Year 10 has an increased cash flow because of the salvage value and working capital return expensed in the final year. Year 0 records a negative cash flow due to expenditure on capital. The NPV calculation is as follows:

NPV: $0 = -494{,}222 + 85{,}203\ (P/A_{8,9}) + 397{,}028\ (P/F_{8,10})$

= + 85,203 (6.2469) + 393,028 (0.4632) 0.4632 - 494,222

NPV: = **US$221,932**

The NPV is positive: Project is therefore accepted.

The DCFROR for the project is calculated as **15%** from Microsoft Excel. Since the DCFROR is **15%** which is above the bank-lending rate of 8% the project is acceptable.

Case B: 70:30 Debt Equity Ratio

For case B the interest of the mortgage has to be separated out from the principal for tax purposes. Refer to Table 5. 14. An error amounting to -US$7 (as indicated in cell (6,10) has occurred due to floating decimals carried over during the computer spreadsheet calculations. As before, at - 0.0007% is too small to influence the accuracy of the results.

Table 5.14 Calculation of Annual Interest and Principal for Case C

Year	Principal Owed During the Year	Mortgage Payment	Interest =8% of Principal	Amount Applied to Reduce Principal	New Principal
1	345,955	51,558	27,676	23,882	322,073
2	322,073	51,558	25,766	25,792	296,281
3	296,281	51,558	23,703	27,855	268,426
4	268,426	51,558	21,474	30,084	238,342
5	238,342	51,558	19,067	32,491	205,851
6	205,851	51,558	16,468	35,090	170,761
7	170,761	51,558	13,661	37,897	132,864
8	132,864	51,558	10,629	40,929	91,935
9	91,935	51,558	7,355	44,203	47,732
10	47,732	51,558	3,819	47,739	-7
	Totals	**515,580**	**169,618**	**345,962**	

The NPV for the project is calculated as:

NPV: $0 = -345,955 + 35,963\ (P/F_{8,1}) + 35,070\ (P/F_{8,2}) + 34,768\ (P/F_{8,3}) + 34,433(P/F_{8,4}) + 34,072\ (P/F_{8,5}) + 33,682\ (P/F_{8,6}) + 33,261\ (P/F_{8,7}) + 34,261\ (F8,8) + 32,806(P/F_{8,9}) + 343,609\ (P/F_{8,10})$

NPV: **US $26,639**

Table 5.15 **After-Tax Cash Flows – Wholly Own Equity**

Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Revenue		552,552	552,552	552,552	552,552	552,552	552,552	552,552	552,552	552,552	552,552
- Royalties @ 5%		-27,628	-27,628	-27,628	-27,628	-27,628	-27,628	-27,628	-27,628	-27,628	-27,628
Net Revenue		**524,924**	**524,924**	**524,924**	**524,924**	**524,924**	**524,924**	**524,924**	**524,924**	**524,924**	**524,924**
- Salvage Value											196,650
- Operating Costs		-434,016	-434,016	-434,016	-434,016	-434,016	-434,016	-434,016	-434,016	-434,016	-434,016
- Amortization		-4,700	-4,700	-4,700	-4,700	-4,700	-4,700	-4,700	-4,700	-4,700	-4,700
- Depreciation		-48,175	-48,175	-48,175	-48,175	-48,175	-48,175	-48,175	-48,175	-48,175	-48,175
- Training Costs	-30,000										
- Installation Costs	-17,000										
- Interest on loan											
Taxable	0	38,033	38,033	38,033	38,033	38,033	38,033	38,033	38,033	38,033	234,683
-Tax @ 15%	0	-5,705	-5,705	-5,705	-5,705	-5,705	-5,705	-5,705	-5,705	-5,705	-35,202
Net Income		32,328	32,328	32,328	32,328	32,328	32,328	32,328	32,328	32,328	199,481
+ Amortization		4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700
+Depreciation		48,175	48,175	48,175	48,175	48,175	48,175	48,175	48,175	48,175	48,175
+ Principal											
Working Capital Return											144,672
-Equipment Cost	-302,550										
-Working Capital	-144,672										
Total Capital Cost	–494,222*										
+Loan	0										
Cash Flow	**-494,222**	**85,203**	**85,203**	**85,203**	**85,203**	**85,203**	**85,203**	**85,203**	**85,203**	**85,203**	**397,028**

*Total capital cost already includes: Equipment, working capital, installation and training costs.

Table 5.16 **After-Tax Cash Flows – 70 % Borrowed Money**

Revenue		552,552	552,552	552,552	552,552	552,552	552,552	552,552	552,552	552,552	552,552
- Royalties @ 5%		-27,628	-27,628	-27,628	-27,628	-27,628	-27,628	-27,628	-27,628	-27,628	-27,628
Net Revenue		524,924	524,924	524,924	524,924	524,924	524,924	524,924	524,924	524,924	524,924
Salvage Value											196,650
- Operating Costs		-434,016	-434,016	-434,016	-434,016	-434,016	-434,016	-434,016	-434,016	-434,016	-434,016
-Amortization		-4,700	-4,700	-4,700	-4,700	-4,700	-4,700	-4,700	-4,700	-4,700	-4,700
- Depreciation		-31,955	-31,955	-31,955	-31,955	-31,955	-31,955	-31,955	-31,955	-31,955	-31,955
- Training Costs	-30,000										
- Installation Costs	-17,000										
- Interest on loan		-27,676	-25,766	-23,703	-21,474	-19,067	-16,468	-13,661	-10,629	-7,355	-3,819
Taxable	0	26,577	28,487	30,550	32,779	35,186	37,785	40,592	43,624	46,898	247,084
-Tax 15%	0	3,987	4,273	4,583	4,917	5,278	5,668	6,089	6,544	7,035	37,063
Net Income		22,590	24,214	25,968	27,862	29,908	32,117	34,503	37,080	39,863	210,021
+ Amortization		4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700	4,700
+Depreciation		31,955	31,955	31,955	31,955	31,955	31,955	31,955	31,955	31,955	31,955
+ Principal		-23,882	-25,792	-27855	-30,084	-32,491	-35,090	-37,897	-40,929	-44,203	-47,739
Working Capital Return											144,672
-Equipment Cost	-302,550										
-Working Capital	-140,672										
Total Capital Cost	-494,222*										
+Loan	345,955										
Cash Flow	**-345,955**	**35,363**	**35,077**	**34,768**	**34,433**	**34,072**	**33,682**	**33,261**	**32,806**	**32,315**	**343,609**

* Total capital cost already includes: Equipment, working capital, installation and training costs.

The DCFROR for the project is calculated as **9%** from Microsoft Excel.

Since the DCFROR is **9%** which is above the bank-lending rate of 8% the project is acceptable.

5.5.2.9 Project's SWOT Analysis

The Strengths, weaknesses, Opportunities and Threats (or SWOT) Analysis of the project indicates the following:

Strengths

The strength of the project lies in the following reasons:

- Zambia produces gemstones in considerable quantities accounting for significant proportion of global production.
- Low cost production considering that average labour cost is very low.
- Added value for cut and polished stones providing increased revenue.
- Positive NPV and cash flows for both assumed cases.

Weaknesses

- Difficulties in selling due to lack of local gemstone exchange market.
- Foreign buyers are usually reluctant to take on new comers on the market because of the rampant scams. It takes sometime to establish trust among the buyers until authenticity and consistence guarantees are proven beyond reasonable doubt for one to be confirmed as a reliable supplier.
- It will take sometime before employees perfect their cutting skills for effective competition of their products on the international market.

- Lack of Basic Business Training facilities for semi-illiterates.

Opportunities

- Liberalised Economy
- No foreign exchange controls
- There is no lapidary of any industrial significance to compete with
- There is a lot of low grade gemstone material which currently has no buyer
- SYSMIN funds available from the European Union to Lend money to small-scale miners

Threats

- Lack of local cutters and experts in lapidary.
- Lack of legislation to protect the lapidary industry
- Cheap synthetic products on the international market
- High import duty on imported rough gemstones
- Illegal sales of gemstones may undermine the supply to the lapidaries
- Lack of local suppliers of lapidary equipment
- Difficulties in accessing finance
- Lack of Lapidary Schools

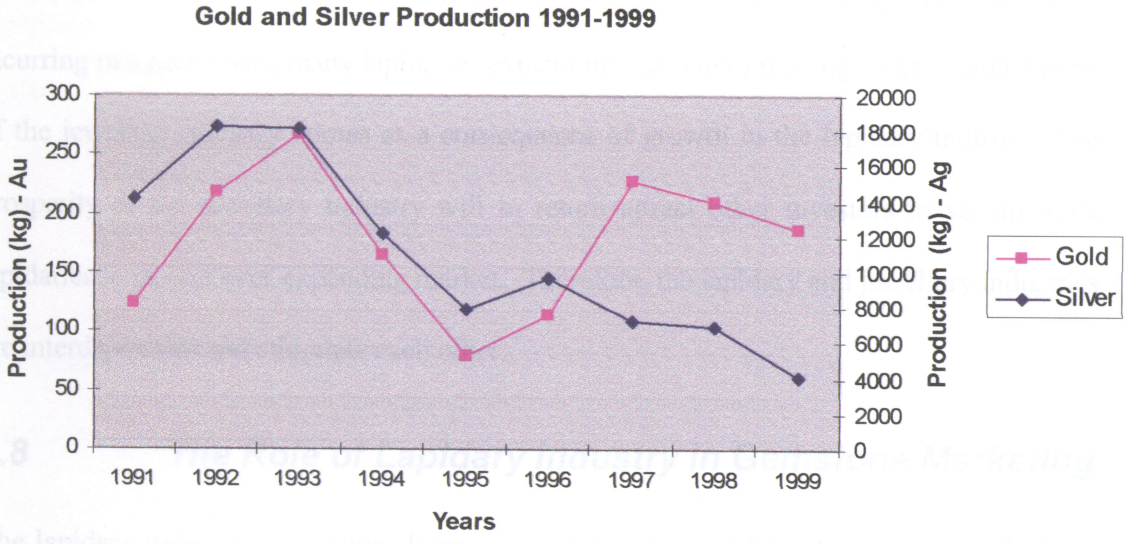
5.6 *The Lapidary Industry and Gemstone Mining*

In countries where the lapidary industry is well established, it provides a ready market for the local gemstone-mining sector. The industry can process low-grade rough material

which may be difficult to export. Successful lapidaries also administer loans to small-scale miners whose produce is promising. A stable lapidary industry eliminates the need for middlemen who have been exploiting the small-scale miners for a long time now.

5.7 The Lapidary Industry and Jewellery Making

The jewellery industry is the final destination of cut and polished gemstones before ultimately reaching the consumer. The lapidary industry is supposed to be the major source of raw materials for the jewellery industry. Since this industry is virtually non-existent in Zambia the local jewellery industry has been compelled into cutting and polishing of their own stones for setting in gold or silver articles. This industry is supported by the local production of the precious metals used in the industry i.e. Gold and Silver. Figure 5.3 shows Zambia's production of silver and gold between 1991 and 1999. There



Source: Data to generate this graph obtained from MDD, 2000

Figure 5.3 Gold and Siver Production

was a gradual drop in silver production from 1993 onwards, as Kabwe Mine was grinding down to a halt until its final closure in 1994. Kabwe Zinc and Lead Mine was Zambia's major producer of Silver. This explains the sudden reduction from five to four digit production figures. After 1994, production has been sustained from by-product processing of copper on the Copperbelt at Ndola Precious Metals Plant. However there are other sources of gold and silver apart from being recovered as by-products of copper and cobalt processing. There is a gold mine in Mumbwa district run by Caledonia Mining while operations at the silver copper mine in Mkushi are in abeyance.

As mentioned earlier, it is very common in Zambia to find that apart from operating lapidaries, the jewellery owners also have gemstone mines. If the lapidary industry is vibrant, it serves as stimulus for jewellery manufacturing as it provides the ready raw material required in expensive jewellery that involves gemstones. Attracted by the relatively wide revenue margins between a loose cut and polished stone and a gemset jewellery only incurring marginal costs, many lapidaries expand into jewellery making. The establishment of the jewellery industry comes as a consequence of growth in the lapidary industry. The prosperity of the jewellery industry will in return attract other investors to set up more lapidaries to tap the ever-expanding market. Therefore, the lapidary and jewellery industries are interdependent and stimulate each other.

5.8 *The Role of Lapidary Industry in Gemstone Marketing*

The lapidary industry is a major player in supplying commodities to Gemstone Markets. Since approximately only 12% of the original rough material is recovered as cut and polished stones it saves the foreign buyers enormous labour costs and the burden of disposing waste material both of which are expensive in the developed world. The other

advantage of cut and polished stones is that the price range for negotiation is limited since there are international standard price referral charts that guide the pricing unlike rough where it is boundless particularly if the seller has little knowledge on the attributes that govern the cutting of stones. A successful gemstone exchange cannot be established without the backing of a strong lapidary industry. This may explain why the concept of the Zambia Gemstone Exchange is yet to be realised.

Over the years, the gemstone industry has developed international standard sizes and shapes as is the case in all other manufacturing industries. Stones cut in these sizes can easily fit in the gold, platinum or silver casings that are moulded to the same standard dimensions for compatibility. However, there are free sizes and shapes available to accommodate consumers who have tastes for uniqueness. There is a provision also to cut stones to client specifications. Wherever lapidary industry exists side by side with jewellery manufacturers a close intimate relationship develops that best satisfy customer needs.

5.9 *The Lapidary industry in the economy*

The gemstone sector if organized and allowed to achieve its fullest potential can become the major foreign exchange earner for the country. This expectation can only be realized through the establishment of the lapidary industry and banning the export of rough gemstones.

From 1991 – 1999 the total official exports of rough gemstones was 8.3 million kilogrammes valued at US$ 79 million (see Table 4.2). If these gemstones were cut and

polished, based on the pessimistic view, assuming selling at the least price in the low grade category for all the gemstone types, the revenue would have been USS$ 16.3 billion giving an annual average of about US$ 2 billion. This implies that the country had lost about US$ 15 billion over the same period by not adding value through cutting and polishing the stones translating into about 99.5% revenue losses excluding interests.

The lapidary industry also plays a pivotal role by providing the market or impetus for direct suppliers of mining equipment, custom mills, fuel, transport services; and Community service-oriented business (social amenities).

5.9.1 Revenue Loss Estimation

Using the least-grade gemstone price for all the categories the weighted average selling price of the total gemstones produced is calculated as shown in Table 5.18.

Table 5.17 Estimation of Lost Revenue through Export of Rough Stones 1991-99

Gemstone	Conversion from kg to ct	Least Price/ct (US $)	Value in billion ct.US$	Price for Different Grade Categories in US$		
				95 %	50%	15%
Amethyst	6,258,353 kg x 1000g x 12% x 5 x	3.00	11.26505	32.00	4.00	3.00
Aquamarine	1,647,124 kg x 1000g x 12% x 5 x	4.00	3.95310	225.0	22.00	4.00
Beryl	32,906 kg x 1000g x 12% x 5 x	4.00	0.078974	90.00	6.00	3.00
Emerald	11, 002 kg x 1000g x 12% x 5 x	200.00	1.320240	5700.	400.00	20.00
Garnet	345,703 kg x 1000g x 12% x 5 x	4.00	0.829687	9.00	5.00	4.00
Tourmaline	39,555 kg x 1000g x 12% x 5 x	3.00	0.071199	240.0	25.00	3.00
Total	5,000,787,000 ct		**17,518,250 ct.US$**			

(Total prod. 1991-99 in kg) x (1000g x 12% x 5 carat/gram) x (least price/carat for given gem)
Where:

1000g is conversion of kilogrammes to grams

12% is amount recovered of cut and polished from rough

5 carat/gram is conversion factor of grams to carat

Weighted Average Price = 17,518,250,000 ÷ 5,000,787,000

= **US$ 3.50**

Total Revenue from 1991-1999 = 8,334,645 x 1000 x 12% x 5 x 3.50

= US$ 17,502,754,500

≈ **US$17.5 billion**

Annual Average Revenue = 17.5 ÷ 9 = US$ 1.9 billion

≈ **US$ 2 billion**

The total reported earnings over the same period are only about US$ 80 million (see Table 4.2). This amounts to a staggering total loss of about US$16 billion. Although the reported figures are far lower than the actual production, due to illegal trade, they still serve as a guide to estimate the lower extreme of the probable range where the true quantities lie.

The range in the last three columns of Table 5.12 represents the available prices of excellent-, medium- and low-grades prices spread on a 100% scale from which the least grade-price was adopted. Similarly, extending the calculation to the other two grade categories yields the average prices and total value of the gemstones exported as indicated in Table 5.18.

Table 5.18 Average Price/ct and Estimates Total Gemstone Sales 1991-99

Grade Estimate as a % Quality	Weighted Average Price/ct	Value (US$)	Average Value/Year (US$)
Excellent - 95	77.90	389,488,597,800	43,276,510,870
Medium -50	8.20	41,151,459,600	4,572,384,400
Low - 5	3.30	16,310,274,000	1,812,252,667

Earnings

The selling price arrived at is far below the market price because the extreme low side of the value of the different gemstones exported from Zambia was assumed and highly exaggerated because even by the calculation in the Lapidary Project in section 5.5.2 indicates the average minimum of US$6.5/ct in order to make a profit. The prices used for the calculation are adopted from 2000 Price Tables by the International Coloured Gemstones Association of South Africa (see Appendix XVI).

The medium grade and excellent yield weighted average selling prices of US$8.30/ct and US$77.90/ct respectively achieving about US$41 billion and US$390 billion respectively. The average price resulting from using the top grade selling prices is ignored because not all gemstones exported can be excellent quality. This shows that the mid-point (medium grade) prices yield weighted average close to the assumed selling price of US$6.50/ct for the Lapidary Project is a good conservative estimate and realistic. If the selling price of US$ 6.5 per carat adopted in the Lapidary Business Plan earlier in the Chapter is applied, the total value of gemstones exported between 1991-1999 would be over **US$ 32 billion** yielding an annual average of **US$ 3.6 billion.** These figures may still be very conservative as an estimated over 50% of gemstones is assumed smuggled out of the country illegally (ref. Section 4.6.1).

Employment

From the Budget Plan for a lapidary it has been calculated that 142 kg annual capacity employs about 60 people. With Zambia's exports of gemstones averaging about 926,000 kg a total of about 6,250 lapidaries would be required to absorb the production. This amounts to creation of about 375,000 jobs directly related to gemstone cutting and polishing.

The image of revenues and jobs created by this industry from the above account is very promising for the nation. This would have a further multiplier effect by the eventual establishment of the engineering-support industry supplying equipment and consumables. The mining sector would subsequently flourish, as there would be a ready steady market for their produce. Small-scale miners who would not be willing to sell their rough to lapidaries would alternatively be allowed to have their stones cut and polished on toll basis or commission. This would in turn eliminate any suspicion that might arise of the seller being exploited. Small-scale miners, the main suppliers of illegal dealers, would for the first time have an opportunity to turn their produce over to the local open legal market.

Balance of Payments

If all gemstones produced in Zambia are cut and polished the gemstone industry would be the major foreign exchange earner relegating combined copper and agriculture to a distant second place.

The increased earnings estimated at more than US$ 2 billion annually from gemstones due to cutting and polishing would significantly improve the balance of payment position for Zambia which stood at a deficit of US$ 189 million for 1999.

Resource Mobilization

For a country to develop, it has to mobilize all available resources at its disposal and utilise them to their fullest potential without leaving any sector behind. In Zambia only large-scale base metal mining has been given undue attention while neglecting other sectors like gemstone and agriculture which are capable of turning the economy around.

A role model for Zambia can be Sri Lanka. From a country dependent on an economy based entirely on agriculture, it has managed to reorganize and mobilize the gemstone sector by conducting all gem-processing locally. This has now transformed the sector from its insignificance to one of the leading foreign exchange earners as discussed below.

Sri Lanka as a Model

In 1993 Sri Lanka exported US$220 million worth of jewellery and related products. Over the ten years between 1984-1993 the jewellery industry showed a growth rate of 17.5% and from 1992-3 the rate was 19%, while the value of gems exported grew by 27.5%. For gems, the chief markets are Japan, China, Thailand, USA, Singapore and Indonesia. This remarkable growth is due to participation by operators in international trade fairs, mainly Germany, Italy, Japan and the US. Foreign buyers are attracted to Sri Lanka by gemstone trade fairs (Brunnelli-1, 1994) (c).

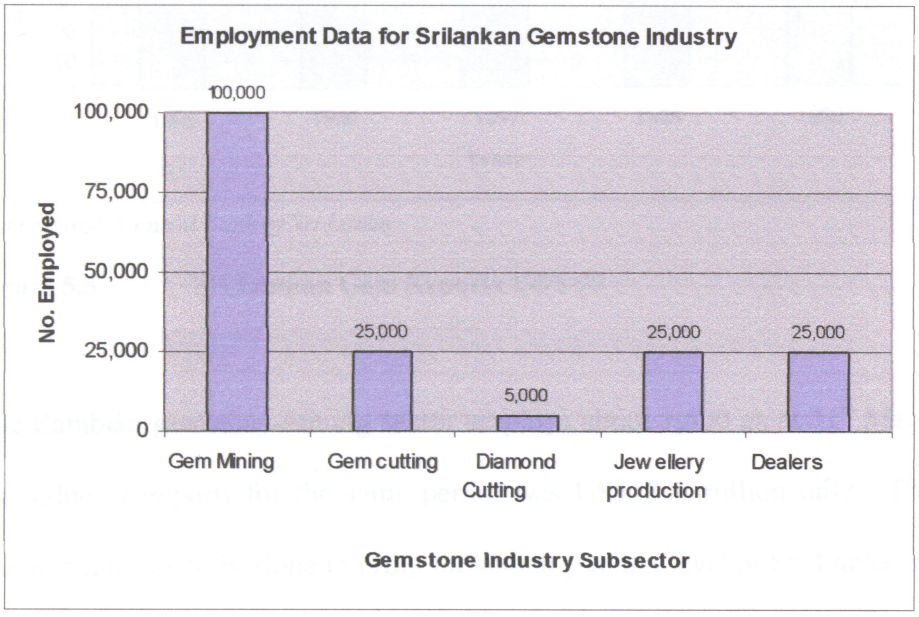
To solve the industry problems the Sri Lankan government put it on priority promotion in order to address the pertinent issues chiefly fiscal obligations and a general lack of understanding of the requirements and quality standards of overseas markets. The measures taken to remedy the situation and help the industry were the setting up of:

- Gem Testing and Certification Centre (GTCC).
- Gem and Jewellery Exchange.
- Sri Lanka Jewellery Manufacturers' and Exporters' Association under the auspices of the Export Development Board (EDB)

Jewellery school was founded in 1981with the assistance of EDB and the State Gem Corporation.

Other measures taken were:

- Tax exempt on imports of any rough stone.
- Tax exempt on Imports of tools, machinery and other equipment used solely by the jewellery and gem industry.
- Exempt from customs duty of import of rough gemstones and duty on other items specified being limited to 10%.

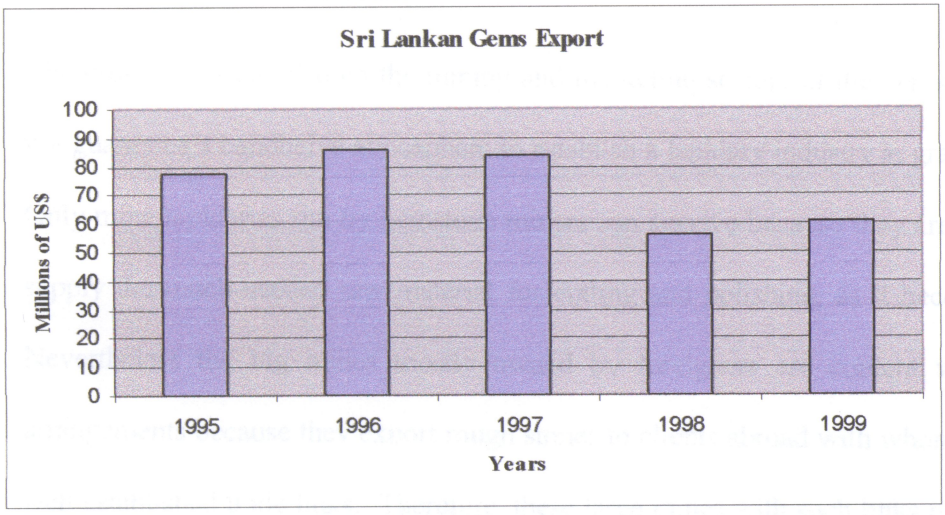


Data Source: Overview of the Gemstone Industry - Phase 1

Figure 5.4 Employment Data for The Sri Lankan Gemstone Industry

These measures created very remarkable results in terms of employment generation. As indicated in Figure 5.4, Sri Lankan gemstone mining alone at 100,000 employment record surpasses the Zambian copper mining employment record which had its peak of 65,000 (ZCCM Annual Report, 1985). This demonstrates that if properly run the

gemstone mining can forestall the potential political and social unrest emanating from retrenchments that have come to characterize the free market economy due to the Structural Adjustment Programme (SAP) imposed on Zambia by the International Monetary Fund (IMF) and Word Bank.



Data Source: Central Bank of Sri Lanka

Figure 5.5 Sri Lankan Gem Exports 1995-99

The Zambian gemstone-mining sector employs about 1,500 as at 31st March 1999 while the value of exports for the same period was US$13.4 million only. This shows how much still needs to be done to bring the industry to the level of Sri Lanka which boasts of 100,000 employment and about US$60 million for the same year. The great disparity that exists between these two Commonwealth countries is that Sri Lanka has invested substantially in the lapidary and jewellery making.

CHAPTER SIX

Discussion, Conclusion and Recommendations

6.1 *Discussion*

The prevailing state of both the mining and marketing sectors of the gemstone industry do not guarantee a conducive atmosphere to establish a lapidary industry at grand theatre scale. Only mine lapidaries run by gemstone miners can survive because they are in a position to supply the much-needed raw material for cutting and polishing, as it becomes available[7]. Nevertheless the big mines mostly owned by foreigners are content with the current arrangements because they export rough stones to clients abroad with whom they have very well established trade links. Therefore, these large mines with such links may not succumb to a demand requiring the universal cutting of stones unless compelled by law. Small-scale miners are struggling to find resources to travel abroad to market their produce. Processing of rough material into polished products would widen the market spectrum from, that only restricted to Israel, India or Thailand, which only like buying rough, and expand into new markets like Japan, North America and the European Union who prefer already processed gem material because of their high labour costs. An even greater advantage brought about by cutting and polishing stones is that once a trusted client is established, travelling would no longer be necessary, as the consignment of gem merchandize would easily be exported by postal delivery.

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[7] Mine Lapidaries are gemstone cutting and polishing facilities that are part of a gemstone mine either located on site or elsewhere.

In Chapter Three, an elaborate description of Zambia's Mining and Investment Policies demonstrates how wide the doors have been flung opened to attract investment in the minerals sector. Contrary to the policy objectives the gemstone industry in general and the lapidary sector in particular has not seen any renewed economic activity. Although there has been some slight growth in the gemstone-mining sub-sector, the lapidary sector has actually recorded negative growth. From 158 Lapidary-Jewellery enterprises recorded in 1992 to less than 15 by the end of 2000. This decline can be attributed to lack of an aggressive government enforcement effort in order to achieve the intended objectives of the new mining policy.

The expected outcome of the new Mining Policy as stipulated by Government is itemised below from i. through vi. with each point accompanied by the author's comments.

i. Development of New Mines

Increased investment in the mining industry should result in new mines opened, thereby broadening the country's mineral output and sales.

This has been achieved in the gemstone-mining sector with many new mines such as Kuber, Grizzly, Storcks, etc. having come coming on stream.

ii. Increased Government Receipts

The major source of Government revenue has been copper and cobalt. With increased private participation, many new mines should open up. This will obviously broaden the source for Government receipts.

On one hand, this has been partly achieved from the mining side although much still needs to be done e.g. resuscitating the Hibernating Mines. On the other, downstream processing has not been emphasized for gemstones

iii. Foreign Exchange Earnings

Currently, the mining industry contributes about 90% of foreign exchange earnings. It is clear therefore, that with improved industry performance, increased number of mines opening up and increased export volumes, the mining industry will continue to perform a pivotal role in the economy.

This objective does not make any specific reference to further increase earnings through promotion of local processing of mineral products before export.

iv. Industrial Growth

Increased Mining activities will require the appropriate support services and consequently, new manufacturing and service industries will be developed.

This may be achieved, as growth of the industry supporting the mining sector is spontaneous depending on the performance of the mineral sector.

v. Labour

Mining operations normally require a sizeable number of qualified manpower and support staff. Increased investment in the mining industry will enhance the level of mining activities which will consequently result in the creation of employment opportunities in the country.

This objective was drawn with the copper mining industry in mind and quite the opposite has been achieved. A lot of retrenchments have come with renewed mining activity on the Copperbelt. There has been some recruitment of manpower in the new gemstone mines but not enough to absorb the influx of retrenchees from base metal mines. This trend can be reversed and the objective achieved if equal attention was paid to the gemstone sector as well. If the needs of the intermittent and idle mines were addressed, the goal of employment generation would be realized. Further employment can be generated through mandatory cutting of gemstones locally before export. The engineering support industry, which follows the establishment of the lapidary industry, would also add its thrust to the employment index.

vi. Infrastructure and Social Services

The development of new deposits which are mostly found in remote areas, will entail putting in place infrastructure and other social services such as hospitals, schools, roads, railways, electricity, etc. In addition other industries such as agriculture are bound to develop due to available infrastructure and market. This will result in an improved standard of life for the rural communities.

This has never been implemented in the entire gemstone mining areas.

It is very eminent in the policy objectives as stated above that they are biased towards large-scale base metal mining activities and that no specific emphasis has been placed on the gemstone industry. There is no mention in the expected outcome of seeing more and more mining-produce consumer industries getting established for downstream. With regards to the gemstone industry, from very little to none has been achieved from the

objectives of the new Mining Policy. Only gemstone licensing has been revised for the benefit of gemstone mining while processing and marketing still remain unreformed in their current desolate and chaotic states.

A number of other pertinent factors affecting the development of a vibrant lapidary sector are now discussed.

(a) *Rough Gemstone Production*

In Zambia, there are a good number of big gemstone mines that have maintained somewhat steady production that would provide bulk supplies for sustainable lapidary operations. However, these mining companies would not be relied upon because of their strong foreign connections. Unless appropriate legislation is put in place to curb this practice, the outflow of rough material at the expense of the local lapidary industry will continue.

Before the lapidary industry initiative is launched, the mining sector needs to be revamped in order to bring production on stream. The mines in the intermittent and idle categories as described in chapter four need to be assisted in order to increase the volume of rough gemstones that would sustain a lapidary industry. Given the preponderance of problems facing the small-scale miners the vision of a successful lapidary industry can still be a farfetched idea. The few small-scale mines that are still operating should be encouraged to own lapidaries that would add value to their produce and increase earnings. This would in turn improve cash flows and re-capitalize this time the pits are still shallow which would help underwrite the problems of mining at depth. Such an initiative would avoid the situation common in Ndola Rural were a lot of miners had

squandered the earnings from shallow workings without reinvesting in order to prepare for future mining at depth. Now most pits are deep, water logged and no finances to solve the impasse.

(b) *Gemstone Exchange and Brokerage*

The establishment of a local gemstone exchange in Zambia has long been overdue. Once established such a facility would be a more reliable guarantor for a steady supply of stones to independent lapidaries and in return would provide a ready market for cut and polished gems further providing a wider choice of commodities for international buyers. The gemstone exchange should be of international standards where gem prices prevailing in other gemstone markets of the world can be displayed on the billboard on the trading floor for buyers and sellers to compare.

There has always been a market for cut and polished stones on the global scene though the prices fluctuate depending on the strength of demand and supply. On the home front, if Gemstone Brokerage was set up with a strong equity base, public trust and unlimited access to credit facilities, it would be in position to buy all stones and stockpile in times of poor demand on the international market and release the same when the prices become favourable. Such an arrangement would guarantee a market for both rough and cut stones.

(c) *Credit Facilities*

One of the major constraints for the lapidary sector's stagnation and decline is lack of credit facilities. Credit lines are required for working capital and capitalization.

Deliberate measures must be put in place to facilitate the easy flow of funds for the sector to grow.

Similarly, small-scale miners experience difficulties in assessing loans. As previously discussed, this has grossly affected production levels. Small-scale mining of gemstones is considered high-risk business by financial institutions.

(d) *Equipment Availability*

Although Zambia is one of the major leading producers of gemstones in the world, on the contrary, gemstone-processing equipment is hardly found in the country. Despite this equipment being for mineral processing it does not enjoy the sweeping zero rate import duty imposed on all mining machinery.

(e) *International Trade Links and e-commerce*

The Government should expose the Zambian gemstone dealers to the international market by sponsoring or encouraging local producers to participate in foreign trade exhibitions. On the local scene, EBZ should be organizing gemstone trade expositions to attract international buyers to the Zambian gemstones.

In marketing very little or nothing at all has been done to trade with specific world gemstone clients conducting gemstone commerce on the Internet. The powerful tool of the Internet in this respect has not been taken advantage of. The advent of the Internet has seen a proliferation of web-based gemstone buyers and sellers. The development of

internet is increasingly making the world become smaller and has eliminated the need of middlemen even a formal market structure, as trade can be conducted in an office before a personal computer. The Internet can provide a direct link of speedy communication and trade between the producer and a remote buyer. There are several gemstone reputable dealers on the Internet that are looking for stones to buy. As of June 2000, the http//:www.Google.com internet-search engine yielded the results as illustrated in Table 6.1. This technology can benefit the gemstone sector if great caution is taken to be wary of the scams that have become rampant on the Internet.

Table 6.1 Internet Search Results for Gemstone Trade

Search Query	Results
"gemstone trade"	17,600
"gemstone dealers"	4,640
"gemstone buyers"	6,220
"gemstone sellers"	2,818
"gemstone traders"	2,380

(f) *Human Resources Development*

To ensure a reliable supply of cutters, a gem-cutting curriculum must be introduced in some trade schools where artisans in cutting and polishing would graduate with certificates. The inaugural candidates should preferentially be drawn from eligible family members of small-scale gemstone miners who at the end of the programme should be granted loans to start lapidary shops that would start processing the output from the mine. The other advantage of such candidates is that they would provide their own gemstone specimens for training. The reason of choosing the relatives of mine owners is that experience from other countries has shown versatility of cutters tending to quit and set up own lapidaries. Secondly, the small-scale miners have always be known of paying low wages and they would not afford to hire and pay an ordinary qualified cutter adequately.

Other candidates should be employees of the major gemstone mining companies nominated by their employers with a few places reserved for outsiders. For subsequent intakes, selection would be drawn from the open market.

(g) *Legislation*

Paramount, above all stated factors, is supportive legislation that would back up, promote and protect the lapidary industry should be put in place. The promotion of the local industry could be achieved through tax incentives on export of products and import of machinery and consumables. Protection should be by way of ensuring that all rough gemstone exporters have an obligation to satisfy the local lapidaries' demand quotas. Later outright banning of all exports of rough, unless under exceptional circumstances, should be considered. Namibia passed similar legislation in 1999 forcing all diamond producing companies to sell a percentage of their production onto the local market for local lapidaries.

(h) *Jewellery Industry*

Once the lapidary industry has been successfully established, the jewellery industry would eventually evolve. The remarkable increased earnings from cut and polished above rough gemstones would stimulate the desire of even more earnings by further extending the operations into gemstone-jewellery manufacture. Moreover, preference is being shown for ready-made gemset jewellery on the international market. This is a developed world undeclared way of outsourcing gemset jewellery manufacturing to developing countries were labour is cheap. Since more than 80 % of the Zambian population are poor

beyond level of personal adornment, this industry, like copper and cobalt, is targeted exclusively for the export market with very little prospects at home.

(i) *Alternatives in Establishing Lapidaries*

There two forms of lapidaries that can be established depending on the pre-qualification conditions available. The pre-qualifying conditions are:

i. The existence of a local gemstone exchange.

ii. Non- existence of a local gemstone exchange.

iii. Legislative backing for gemstone cutting and polishing

The following types of lapidaries are established under these preconditions.

1. Mine Lapidaries

These lapidaries can be created under pre-conditions second and third conditions above. Such lapidaries would cater initially for the mines that would establish them in the event where the Government imposes restrictions on exported rough material and makes it compulsory for all mines to establish lapidaries. Under this category can be found:

i. Small Lapidary Shops

This initiative would be realized by allowing each small-scale mining enterprise to establish a small lapidary shop that would process the mine production so that during the 'dry spells' the lapidary labour can be re-deployed to the mine. When production resumes at the mine the cutters can be withdrawn back to the lapidary until the stockpiles are depleted. This would solve the incessant recessions in production, which an independent lapidary suffers in waiting for supplies from the producers.

ii. Multi-purpose Lapidaries

Large lapidaries should be set up by the big gemstone mines to be part of the continued processing of run-of-mine (rough) to gemstone cutting and polishing. Where the mine lapidary fails to cope with the excess production, the surplus would be sold to the local independent lapidaries or the local gemstone exchange once such a facility is established. This arrangement already exists for copper mines. Finished-product processing facilities exist at almost every mine and exports of concentrates are prohibited. The big gemstone mines are the main culprits in exporting large volumes of rough which is an equivalent of concentrate in base metals.

2. Independent Lapidaries

These lapidaries are those that can be established by investors who do not have mines and would entirely depend on the open market for rough supplies. Such lapidaries can only be realized if the pre-qualifying condition of establishing a gemstone exchange is met. The sizes under this category would vary according to the capacity of investment involved.

Under this classification falls Pemba Lapidaries limited in Ndola, which has automated gem cutting and polishing equipment. It has the capacity of producing 47 stones in 20 minutes and an average of 600 stones per hour. Nevertheless, since its inception, this plant has never operated at full capacity because of lack of raw materials for input. The company, which has good market contacts in the European Union for cut and polished stones, thought of establishing an ultramodern lapidary facility right at the heart of the gemstone-producing region. The results have been disappointing. Due to the absence of a gemstone exchange, stones in sufficient quantities of rough have never been obtained to utilize the full capacity of the lapidary. At the time of the visit to this lapidary as part of this study the workers where just idling due to lack of raw materials. This situation may

compel Pemba Lapidaries to consider backward integration by venturing into the mining business in order to be self-reliant an option that is outside the initial business interest.

Economic liberalization if not used in moderation can be detrimental to local industries. It is imperative on the part of the government to pass legislation that can protect industries like Pemba Lapidaries. Similar circumstances led to the demise of ZEIL. The mine lapidaries once established, as part of the existing mines, they would not suffer from problems like those that have plagued Pemba Lapidaries Limited.

6.1.1 Consequences of the Current Policies

The impact of the current structure of the gemstone industry is very conspicuous. Apart from losing revenue through export of rough and under-valuation there are other consequences, as listed below, that have developed.

(a) De-motivated Government

The government on its part has been reluctant to provide services and develop infrastructure to gemstone mining areas because it does not benefit anything in terms of revenue collection to justify such development. As a direct consequence of government's laxity to police the gemstone-mining sector many mines though have been in operation for several years have never declared any production at all. According to the Director of Mines and Minerals Development, despite that a large number of mineral rights have been issued the performance of the sector in particular small scale mining has not shown corresponding rise in either output or earnings. The records of MDD indicate that gemstone sales figures are seriously under reported even when the current status of the

industry is factored out. The dismal performance is partly blamed on MDD's failure to implement the Mines and Minerals Act.

To encourage a high level of activity in the sector, the Act has a number of provisions directed at allowing the Ministry to issue licences only to those with the capability to plan and operate mining operations sustainably using safe and environmentally sound practices. The Ministry, however, has not rigorously implemented this important procedure in the application process. For a gemstone mining to commence for a sizable pit of 20 to 30m deep approximately US$ 1.5 to US$ 2 million is required. Many of the Zambians that have acquired Mineral rights do not have proof of possession of such an amount or any reasonable variation from it.

The reputation of under reporting of production by the miners has backfired on the miners as the Banks use the same record to justify not to lend money to an enterprises that have been so long in business but has never produced. This further adds justification to classify gemstone mining as "high risk ventures" where one can be in business for many years without producing.

The existing mistrust between the government and the gemstone miners can only be eliminated if miners become sincere and honest enough as to start declaring their true production records. The Government would be encouraged from the revenues that would be generated and in turn provide extension services and infrastructure to mine areas which are usually in remote areas. Until trust is established, the government and lending institutions will continue to withhold their services from the gemstone industry.

(b) Loss of National Identity

From Chapter Four under International Gemstone Trade it is disappointing to note that Zambia's counterparts or competitors in dominating world production for gemstones like emerald and amethyst still dominate the export market. Zambia has always been second to either Colombia or Brazil in emerald production. (At the moment Brazil is the leading producer.) However in exports to the US, EU and Japan, the same two countries, Brazil and Colombia still dominate while Zambia is completely eclipsed. In a similar situation with Thailand, Zambia once again, is out-ranked.

This situation has arisen because Zambia exports most of its gemstones as rough mainly to Israel, India and Thailand. These countries cut and polish gemstones and sometimes set them in jewellery, which they later re-export under their respective national identities. It is an export form of 'piracy' of natural resources of one country by another which the Government has voluntarily permitted. This is a challenge, which as a nation Zambia should seize by reversing the practice in the other direction in order to preserve the national identity. Gemstones have 'finger prints' which are associated with the geology of the area that puts a certain imprint on its gems that is readily identifiable by geographical origin. It hurts national pride to find gemstones by all evidence are Zambian, entering world markets under a different national flag. These unique features associated with gemstones that easily identify them with countries of origin can therefore qualify to be 'National Flag Carriers'.

Zambia's loss of identity to India, Israel and Thailand through the export of rough gemstones can be arrested if the lapidary industry is established and supported with appropriate legislation.

The high labour costs in the Developed World, the largest consumer of gemstone products, take advantage of cheap imports from the Third World countries an opportunity Zambia has not exploited despite possessing all necessities but initiative.

6.2 *Conclusion*

Zambia produces significant quantities and varieties of gemstones. This coupled with a guaranteed international market for cut stones justifies the establishment of a sustained lapidary industry. Great potential exists for this industry. For a successful gemstone cutting and polishing industry to develop supportive legislation should be put in place in order to protect the industry. The inadequacies of the law and policies pertaining to the gemstone sector and the outright absence of them to support the lapidary sub-sector in particular has left the industry in depredation. The absence of any policy framework to regulate the natural resources of this magnitude and value in an economy in dire straits is tantamount to wholesale negligence by Government and is unrealistic. This has led to the difficulties the lapidaries, ultimately the economy, are currently facing. Passing appropriate comprehensive legislation and policies, in addition to establishing an autonomous Gemstone Exchange, can resuscitate the lapidary industry. Lack of such policy framework explains why despite the conducive investment climate prevailing in the country, as guaranteed in the Investment Act, no remarkable activity has been recorded in the lapidary sector. Setting up a lapidary does not demand large capital outlays as compared to base metal refining. The positive NPV

calculated in this dissertation for different and varying scenarios supports the lapidary initiative.

In the absence of a gemstone exchange the alternative way to jump-start the lapidary industry is to compel all mining companies to extend their operations to cutting and processing.

6.3 *Recommendations*

The Government should put a deliberate policy to specifically address the needs of the gemstone industry instead of formulating a general policy with an implied application for the industry's specific needs like gem cutting and marketing.

In order to establish a viable lapidary industry in Zambia the government should promote and strive to accomplish the following factors have to be addressed.

- Measures to increase a sustained steady supply of the rough gemstone material from mines.
- Establishment of a gemstone exchange that would bring order in the marketing of gemstones.
- Ease the availability of credit facilities to licenced gemstone miners and dealers.
- Ease the availability of lapidary equipment, accessories and consumables.
- Linking Zambian gemstone producers to international markets for cut and polished stones.
- Ease the availability of skilled manpower.
- Provide legislative back up to promote and protect the industry.

To satisfy the foregoing points, the following recommendations are being proposed for the development of a successful lapidary industry.

- Legislation governing the gemstone industry be reviewed to protect and promote the lapidary industry. This can be achieved by discouraging exports of rough gemstones through imposition of high tariffs and stiff penalties while providing incentives for cut and polished material export.
- Alternatively outright banning of rough exports would also be an option ultimately worth considering. When such legislation is passed a grace period of six months from its commencement should be granted to allow all intending exporters of rough to acquire the lapidary equipment while those who cannot afford to be loaned such machinery by the Government or its agent (s).
- The lapidary industry should be transferred from falling under the Ministry of Commerce, Trade and Industry to the Ministry of Mines and Minerals Development. This would allow this industry to enjoy all incentives in form of tax relief granted to the Minerals Sector to apply to the lapidary since its part of mineral processing. Such transfer would help monitor the industry. At the moment the Ministry of Commerce, Trade and Industry has no record of how many lapidaries there are let alone their workforce.
- At the Ministry of Mines a completely separate department for Gemstones Development should be set up which would be entirely detached from the Mines Development Department. This will eliminate the problem of the ministry officials' tendency in concentrating on policies that only favour large scale base metal mining while being oblivious to the needs of the gemstone industry.

- VAT exempt on imports of tools, machinery and other equipment for the jewellery and gem industry.
- Exempt from customs duty on imports of all items specified above.
- Imports of rough gemstones for cutting and polishing should also be exempt from VAT, customs and excise duty.
- Manpower training in gemstone cutting and polishing should be introduced at existing Trade Schools to cater for the lapidary industry. For this programme the initial candidates should preferentially be drawn from existing mines under affirmative action in order to accelerate the implementation of the promotion of the industry.
- A gemstone exchange should be established to serve as a one-stop centre for international buyers. Such a centre would instil confidence in the prices demanded by various dealers, as there would be competition and transparency backed by on-line links with other major world gemstone markets whose daily trading prices would easily be accessible.
- For establishing large multi-purpose lapidary enterprises, investors should be encouraged to list the companies on the Lusaka Stock Exchange (LuSE). Unlike gemstone mining, lapidary business is not as risky. It only demands considerable equity to buy good quality and enough quantity of rough that can be cut and polished for foreign markets at short notice.
- Since problems affecting the gemstone mining sector are contagious and transmissible to the cutting industry, in order to increase the flow of rough material on the market, necessary measures to address problems facing gemstone miners, such as given below, should be put in place.

(a) The government should help establish equipment-leasing services to let equipment to small-scale miners whose payment would be deferred until production of gemstones. Stiff penalties to deter defaulters should be introduced. Experience from other sectors like agriculture has shown that loan repayments in Zambia are not taken seriously by borrowers. Perhaps, for such an agreement to be effective, the entire family and other people closely related to the lessee should be signed-on as sureties who would bear the full consequences of the law in the event of defaulting.

(b) Financial lending institutions should be convinced by government to extend their services to gemstone miners upon producing a Bankable Document issued by a qualified and competent person.

- Small-scale gemstone miners should be educated about the value of the stones and the trends in the international gemstone markets. Through extension officers the government should be holding workshops on a regular basis to inform the miners about market and prevailing prices of various gemstones and the scams that are very rampant in the industry.
- Through EBZ the government should embark on an aggressive marketing policy to help small-scale gemstone producers access international markets.
- In order to create a formidable gemstone export position, the gemstone companies must form a single agency or corporation modelled Zambia Export Growers Association Limited (ZEGA) on that would in charge of international trade[8]. This would allow the agency to meet international clients' demands of consistent and sustained supply a condition which individual companies may not meet.

- In order to create a local market for gemstones, precious stones mineral wealth of the country should be introduced in the school curriculum for pupils to start appreciating them at a tender like has been the case with copper mineral. Gemstone and Jewellery Clubs must also be encouraged in schools.
- Take strong or additional measures to discourage smuggling (include local authorities in the new mining law, enforce the law by making sharp distinctions between legal and illegal operations)
- Improve basic infrastructure and reduce usage costs (use revenues generated by the local authorities for updating the infrastructure)
- Assist miners to improved security (banks, safe deposit boxes, mobile task force etc.)
- Improve the fiscal regime and tax administration (avoid, multiplicity of taxes, levies and fees, duplications of licensing)
- Provision of essential support services
- Improve market and the technical information (Associations, Gem appraisal and certification centres)
- Support gem shows and other promotional activities (e.g. government to facilitate visas for foreign participants, etc)
- Training and extension
- Ensure sustainable economic development (wise investment, economic diversification, training, infrastructure improvement etc.)

[8] ZEGA Limited a Company that was formed by a consortium of farmers to be in charge of export of all fresh produce from member farmers because individual farmers could not meet the foreign overwhelming market demands collectively reducing the unit freight cost and making the products competitive.

The government must promote the lapidary industry with the same determination and vigour as it used to empower the Zambians with the gemstone mining rights. This would ensure every sector of economy to be accounted for and be made to contribute to the livelihood of the nation in every way possible.

APPENDICES

Appendix I **Commission of Inquiry Terms of Reference**

The Commission's terms of reference were as follows:
"To

1. Inquire into the state of the emerald industry in Zambia, with particular reference to –
   (a) the character and commercial value of the known deposits of emeralds;
   (b) the number of permits issued, their boundaries and duration;
   (c) the method and stage of prospecting and exploitation
   (d) the fixed assets at the site of the mine;
   (e) the facilities for washing, cleaning and processing;
   (f) general security measures and precautions angainst theft, pilferage and illegal mining;
   (g) maintenance records.
2. Inquire into the activities of illegal mining with particular reference to-
   (a) The manner in which illegal miners have penetrated the security measures introduced by the Party and its Government;
   (b) The distribution, character and methods of illegal mining;
   (c) action taken against illegal miners and persons illegally in possession of emeralds;
   (d) quantity of emeralds confiscated from illegal miners and the disposal of confiscated stones;
   (e) the methods by which emeralds have been smuggled out of Zambia; and action taken against apprehended smugglers.
2. Inquire into the arrangements made for the marketing of rough emeralds with details of the quantities of Zambian emeralds legally sold on the world market; the prices obtained for each consignment and the buyers thereof.
3. Examine possible measures which may be taken so as to facilitate the conclusion within Zambia of all commercial transactions with respect to the emeralds mined in Zambia.
4. Inquire into the financing and commercial structure of an emeralds industry, with particular reference to –
   (a) The amount of capital required to establish such an industry;
   (b) Alternative methods of financing and management;
   (c) Facilities for establishing a cutting and polishing industry for high grade emeralds and industries capable of utilising emeralds of the medium and lower grades; and
   (d) Marketing procedures which will be to the best advantage of the nation.
6. Inquire into any other matters, which appear to the Commission to relate to the foregoing, and which opinion of the Commission ought, in the public interest, to be inquired into.
7. Make such recommendations with regard to the foregoing matters as the Commission may, in the light of its findings, deem appropriate."

Appendix II **Invitation to tender for the purchase of emeralds**

MEMACO SERVICES LIMITED

Invitation to tender for the purchase of emeralds

1. The above-named company ("the company") as agents of the sellers, invites tenders for the purchase of the emeralds referred to in Schedule A attached hereto ("emeralds").

2. Tenders must be made on the offer form attached as schedule B hereto.

3. Tenders may be for all the emeralds or for any separate lot as shown in Schedule A.

4. Tenders should be made in US Dollars unless other wise agreed with the Company.

5. Tenders must be enclosed in an envelope securely fastened and marked on the outside "Tender for Emeralds offered by Memaco Services Limited".

6. Tenders must be delivered to the Company before 4.30 p.m. on the day of 197 .

7. Tenders must be opened by the Company on the day of 197 .

8. The Company does not undertake to accept the highest or any particular tender and reserves the right to accept the whole or such part of any tender at it may think fit.

9. The successful tenderer or tenderers (hereinafter referred to as "the Buyers") will be notified immediately and an invoice will be rendered by the Company as soon as possible thereafter.

10. Within fourteen days of notification that their tender has been accepted the Buyers will pay the full amount of their tender, free of bank charges, by means of bankers' draft or by direct payment to Sellers designated Bank account.

11. Buyers shall collect the emeralds purchased by them (at a time to be agreed with the Company) against Bankers' Draft as aforesaid or after Bank confirmation that the moneys have been received in full in the Sellers' account.

12. Title to emeralds shall not pass until all sums due have been paid

13. The Buyers, whether or not they have inspected the emeralds either before or after the making and acceptance of the tender, purchases with notice of all defects therein and shall not reject the same because of any defects in quality if they do not conform to any description or they are not fit for any purpose. Every express or implied

warranty or condition statutory or otherwise (other than in relation to title) is hereby excluded.

14. The emeralds will be at the Buyers' risk from the time and date agreed with the company for collection pursuant to Condition 11 above.

15. If the emeralds are not collected at the time and place agreed pursuant to Condition 11 above the Company shall be entitled to recover from the Buyers any insurance and/or other costs incurred by the Company in storing the Emeralds together with interest on the purchase money at the current Minimum Lending Rate charged by National Westminster Bank Ltd. Plus 3½.

16. In the event of the Buyers failing to pay the purchase money in full within four weeks from the date of acceptance of their tender, Seller or Company shall have the right (but without prejudice to such other rights to which they may be entitled) to dispose of the Emeralds elsewhere on the Buyers any balance of the purchase money still outstanding together with the costs which they may have incurred. Any excess moneys received from such sale shall be paid to the Buyers.

17. Time shall be of the essence to the Contract.

18. The making of the tender hereunder implies the acceptance of the terms and conditions contained herein.

19. Those conditions and the contract made shall be subject to and construed in accordance with English Law.

Appendix III **List of visitors to the emerald auctions held by Memaco**

LIST OF VISITORS TO THE EMERALD AUCTIONS HELD BY MEMACO AT ZIMCO HOUSE, LONDON DURING 1977/78

1. LPG Gem Corp	New York, USA
2. Dihaco Limited	London, UK
3. Barkat Gems S.A.	Geneva, Switzterland
4. Joema	Rio de Janeiro, Brazil
5. Diamenta Co. Limited	London, UK
6. Sterling Enterprises	London, UK
7. Bight Ede/Stein Gems	Idar-Oberstein, West Germany
8. Mehta Bros.	London, UK
9. Fine Gems	London, UK
10. Corona (Overseas) Ltd	London, UK
11. Gebruder Leyser	Idar-Oberstein, West Germany
12. Mineragem S.A.	Geneva, Switzterland
13. Charles Mathews Ltd	London, UK
14. Benj, Warwick	London, UK
15. Rubgems Ltd	Reading, Middlesex,UK
16. Macleans Gem Co.	Edinburgh, Scotland
17. Rosenthal and Cie	Paris, France.
18. Patrick Aldrige Ltd	London, UK
19. Dallas Gems and Minerals	Hong Kong
20. ETS Grospiron	London, France
21. Precitone	London, France
22. H. Fakirbani	Bombay, India
23. Rediam Ltd	London, UK
24. Lothar Haag	Idar-Oberstein, West Germany
25. Gem and Rock Distributors	Johannesburg, S. Africa
26. Ramanial M. Shah Ltd	London, UK
27. Lentin Jewellers Ltd	Kitwe, Zambia
28. Kroussaniotakis Bros.	London, UK
29. Mehdi Co.	London, UK
30. Li En Mi Co.	London, Uk
31. Nestelle Mining and Finance Co.	Lausanne, Switzerland
32. E. A. Engel	Rio de Janeiro, Brazil
33. Rue du Mont - Blanc	Geneva, Switzterland
34. Rajendrakumar A Shah	Bombay, India
35. Gemtick Co.	Ramat-Gan, Israel
36. Israel Emerald Syndicate Ltd.	Tel Aviv, Israel
37. Precious and Semi-Precious Stones	Idar-Oberstein, West Germany
38. Jean Wunderlich	Hanau, West Germay
39. Maurer and Bros.	London, UK
40. T. O'Donoghue Ltd	London, UK
41. Mr. A. Issacharoff	London, UK
42. Julius Persch Junior	Idar-Oberstein, West Germany

43. United Gem	Tel Aviv, Israel
44. Real Gems Inc.	New York, USA
45. Solar Gems Inc.	London, UK
46. Tracina	London, UK
47. Bezalel Gems Co.	London, UK
48. Vanoco S.A.	Geneva, Switzterland
49. A. J. Suchde	Idar-Oberstein, West Germany
50. G. Garion Sarl	Idar-Oberstein, West Germany
51. Bright Edelstein Gem	Idar-Oberstein, West Germany
52. Kothari & Co.	San Francisco, USA
53. Sobhagumul Gokalchaud	Jaipur, India
54. Emda International Ltd	London, UK
55. Green Fire Gems	Johannesburg, S.Africa
56. London Diamond Bourse	London, UK
57. Australian Pearl Co. Ltd.	London, UK
58. Gemlite Ltd	London, UK
59. E. and W. Hopkins Ltd.	London, UK
60. Tramarsa	Geneva, Switzterland
61. Transworld Trading Co.	New York, USA
62. New World Exchange	Bangkok, Thailand
63. Max Schuster	Los Angeles, USA
64. A-Z Trading	New York, USA

Appendix IV **The range of Bids at the Auction**

Range of Bids at the Auction Held by Memaco at Zimco House, London during 1977/78

DATE	PRINCIPAL	WEIGHTS (kgs)	PARCEL BIDS (US$)		
			LOWEST	HIGHEST	DIFFERENCE
17.03.77	Nkuralu	3.217	7 000	61 850	54 850
15.12.77	"	5.249	41 000	151 000	110 000
06.04.78	"	5.400	20 00	110 447	90 000
21.09.78	"	11.772	142 000	201 001	59 001
19.10.78	"	4.491	15 250	103 000	87 000
09.06.77	Mindeco	4.975	3 750	82 090	78 340
09.11.77	"	10.093	13 748	231 000	217 252
10.08.78	"	13.041	30 051	50 330	20 279

Appendix V **1999 Million – Dollar Club Members**

COMPANY	USD	MAIN EXPORTS
ABOVE US$20 m		
1. Swarp Spinning Mills Plc		Cotton yarn, poly/cotton yarn
2. Lonrho Cotton Zambia Ltd		Cotton lint, fuzzy cotton yarn seed
3. Zambia Sugar Plc		Sugar, molasses
4. Zamefa		Copper rods & cables
SUB-TOTAL	**103,537,236.**	
BETWEEN US10 – 20 m		
1. Clark Cotton Zambia Ltd		Cotton lint, fuzzy cotton yarn seed
2. York Farm		Fresh Vegetables & flowers
3. Agriflora Ltd		Fresh Vegetables & flowers
SUB-TOTAL	**39,968,435.0**	
BETWEEN US5 – 10 m		
1. Chilanga Cemant Plc.		Cement
2. Zambia Coffee Growers Assn.		Arabica Coffee
3. Tobacco Association of Zambia		Virginia and Burley tobacco
4. Zambia National Oil Company		Gasoil
5. Zesco Ltd		Electricity
SUB-TOTAL	**38,762,356.4**	
BETWEEN US3 – 5 m		
1. Masstock Africa Ltd		Marigold , meal, paprika
2. Kagem Mining Ltd		Rough emerald
SUB-TOTAL	**8,305,529.44**	
BETWEEN US1 – 3 m		
1. ZCCM		Gold, scrap copper, platinum, silver
2. Stanbic Bank Zambia Ltd		Bank notes
3. Environ-Flor Ltd		Fresh rose flowers
4. Amanita Zambia Ltd		Stockfeed, cooking oil
5. Starflex		Cotton yarn
6. Bwana mukubwa Mining Ltd		Copper scrap, sulphuric acid
7. South Stream Enterprises		Rough gemstones
8. Mukuba Textiles Ltd		Cotton yarn
9. Sable Transport		Burley tobacco
10. Senegalia Farms		Burley tobacco
11. Southern Quarries Ltd		Rough gemstones crushed stone
12. Grizzly Mining Ltd		Rough Gemstones
13. Cheetah Zambia Ltd		Paprika
14. Kafue Textiles Ltd		Cotton loomstate fabric
15. Wangwa Farms		Fresh flowers
16. Zongwe Farming Enterprises		Crocodile skin
17. Great North Traders		Scrap metal
18. Sarunit Enterprises		Rough gemstones
19. Tobacco Development Company		Burley tobacco
20. Dunrobin Mining Limited		Gold
21. Hybrid Poultry Farm		Fresh eggs, Day old chicks, stockfeed
22. Kawambwa Tea Company		Tea
SUB-TOTAL	**37,567,689.2**	
TOTAL BY MILLION DOLLAR	**228,141,446.**	

Appendix VI Description Of The HS Codes With All Their Subdivisions

HS code	Product Description
7101.1000	Pearls, natural whether or not worked or graded, but not strung, mounted or set, ungraded natural pearls temporarily strung for convenience of transport (excl. mother of pearl
7101.2100	Cultured pearls, unworked, whether or not graded
7101.2200	Cultured pearls, worked, whether or not graded, but not strung, mounted or set, ungraded natural pearls temporarily strung for convenience of transport.
7102.3100	Diamonds, unworked or simply sawn, cleaved or bruted (excl. industrial diamonds)
7102.3900	Diamonds, worked but not mounted or (excl. industrial diamonds)
7103.1000	Coloured gemstones unworked or simply sawn, or roughly shaped whether or not graded (excl. diamonds and imitation coloured gemstones)
7103.9100	Rubies, sapphires and emeralds, worked, whether or not graded, but not strung, mounted or set, rubies, sapphires and emeralds, ungraded, temporarily strung for convenience of transport (excl. rubies, sapphires, emeralds, simply sawn or roughly shaped, imitation coloured stones)
7103.9900	Other coloured gemstones, worked , whether or not graded, but not strung, mounted or set, other coloured gemstones, ungraded, temporarily strung for convenience of transport (excl. other coloured gemstones, simply sawn or roughly shaped, rubies, sapphires, emeralds, imitation other coloured stones)
7116.1000	Articles of natural or cultured pearls, not elsewhere specified.
7116.2011	Necklaces bracelets and other articles, wholly of natural gemstone, simply strung without fasteners or other accessories.
7116.2019	Articles made wholly of gemstones (excl. 7116.2011)
7116.2090	Articles made of gemstones, natural, synthetic or reconstructed (excl. 7116.2011 and 7116.2019)

Appendix VII **Classified List of Gemstone Exporters**

1. Apex Minerals Limited
2. Dai Star Trading Limited
3. Diakite Investments
4. Doost and Chiwele Mining
5. E. Kayaya Enterprises Limited
6. Edelstein Limited
7. Fantasy Gems Limited
8. Gemstone Marketing
9. Global Purchasing
10. Grizzly Mining
11. Hans Keith
12. Jagoda Gems Limited
13. Kagem Mining
14. Kariba Minerals
15. Kuber Mineral and Metal Mining
16. Laser Security and Hardware
17. Malachite Investment
18. Mwana Namusya Company Limited
19. Mwelwa Intertrade
20. Nioro de Sahel Transport
21. Pamodzi Gemstone Mining
22. Precious Transparency
23. R M Gemstones Export Zambia
24. Rama Investments
25. Sangare Transport
26. Sarunit Enterprises
27. Sitonia Limited
28. Southern Quarries
29. South Stream Enterprises
30. Zadio General Dealers

Appendix VIII Imports into the European Union(value in 1000 ECU)

HS - Code	Product Description	1989 Value	% Share	1992 Value	% Share	1996 Value	% Share	%Change '89 - 96
71 01 1000	Natural pearls	2.493	0.1	1.693	0.04	3.299	0,03	32.3
71 01 2100	Unworked cultured pearls	15.124	0.3	15.081	0.4	18.639	0.2	23.2
71 01 2200	Worked cultured pearls	57.351	1,2	81.906	2.1	115.946	1.2	102.2
71 02 3100	Non industrial diamonds unworked	1.760.347	37.1	1.403.245	35.1	5.402.778	57.2	206.9
71 02 3900	Non industrial diamonds worked	2.571.367	54.2	2.178.009	54.5	3.595.126	38.1	39.8
71 03 1000	Coloured gemstones unworked	46.496	1.0	39.090	1.0	31.175	0.33	-33.0
71 03 9100	Worked rubies, sapphires & emeralds	179.229	3.8	156.942	3.9	165.985	1.8	-7.4
71 03 9900	Worked gemstones excl. 71039100	35.648	0.8	32.800	0.8	45.242	0.5	26.9
71 16 1000	Articles of natural or cultured pearls	25.663	0.5	34.888	0.9	25.794	0.3	0.5
71 16 2011	Articles of gemstones	7.822	0.2	8.362	0.2	8.804	0.1	12.6
71 16 2019	Articles of gemstones excl. 71162011	21.905	0.5	20.714	0.5	16.882	0.2	-22.9
1 16 2090	Articles of gemstone excl. 71162011	2082	0.4	21.998	0.6	21.693	0.2	8.0
	And 71162090							
otal		**4.741.034**	**100**	**3.993.035**	**100**	**9.448.064**	**100**	**99.3**

Source Precious and Semi Precious Stones, 1998

Appendix IX Questionnaire I: Gemstone Miners

Dear Sir or Madam,
You are one of the persons selected at random to contribute to this questionnaire. The information gathered will be treated with strictest confidentiality. The input provided is purely for academic purpose. This questionnaire is intended to establish the prospects of creating a Lapidary industry in Zambia. It is designed to get views, opinions and information from selected stakeholders in the gemstone industry.

The study is part of the research by a Master of Mineral Sciences student of the University of Zambia for the project entitled: **"Assessment of the Small-Scale Lapidary Industry in Zambia.**

Your co-operation would be highly appreciated.
Yours faithfully,
School of Mines
For multiple choice question tick where appropriate

1. Is the gemstone industry receiving due attention from the governments

   A.Yes ☐ B. No ☐ C. Not sure ☐

2. What do you think, in your opinion, needs to be done for the aspirations of the industry to be met?

   _____
   _____
   _____

3. It is generally believed that the government harbours some suspicion about the dealings in gemstone industry. Do you think such suspicions are founded?

   A.Yes ☐ B. No ☐ C. Not sure ☐

4. If the answer to question 3 is yes, in your opinion, what needs to be done to eliminate these suspicions?

   _____
   _____
   _____

5. Do you think gemstone use for personal adornment is appreciated by a majority of indigenous Zambians in general?

   A.Yes ☐ B. No ☐ C. Not sure ☐

6. It is more profitable to process gemstones before they are exported. In your opinion why do you think Zambian gemstones are usually exported as rough?

   _____
   _____
   _____

7. Can you think of any reasons why there is no matching established lapidary industry in Zambia despite a strong gemstone production history.

   _____
   _____
   _____

8. If the government were to establish a lapidary, would you freely supply your production to such an enterprise for cutting before export?

A.Yes ☐ B. No ☐ C. Not sure ☐

9. If policies where changed to favour exporting cut and polished stones by encouraging the private sector through tax concessions and any other incentives you may think of, would extend your operations to include a lapidary?

A.Yes ☐ B. No ☐ C. Not sure ☐

1 0. In your on opinion, what do you think led to the collapse of the of the Zambia Emerald Industries Limited?

_____

_____

_____

11. Most of Zambian rough gemstones are find cutting and polishing markets outside. If a market were to be created locally would you welcome such initiative?

A.Yes ☐ B. No ☐ C. Not sure ☐

12. Have you made any contributions to the recent govermnent invitation to make submissions to the POVERTY REDUCTION STRATEGY PAPER (PRSP).

A.Yes ☐ B. No ☐ C. Not sure ☐

13. Do you think the government is going to take the contributions seriously and implement the submissions to PRSP?

A.Yes ☐ B. No ☐ C. Doubtful ☐

14. If a pressure group was formed through ESMAZ was to request the government to extend **non-traditional- export status** to polished stones. Do you think such request would be granted?

A.Yes ☐ B. No ☐ C. Doubtful ☐

Appendix X Questionnaire II: Lapidary-Jewellery Enterprises

Dear Respondent,
As part of research entitled. " **Assessment of the Lapidary industry in Zambia"** you are one of the few people nominated to participate in this study by answering the questions below.

The information provided in this study will be treated with utmost confidence.
Your anticipated co-operation will be highly appreciated.
Yours faithfully,
School of Mines
For multiple choice questions tick where appropriate

1. The Lapidary-Jewellery industry is **'all** by **itself '** i.e. does not receive any form of government support. Do you agree to the statement?
   A. Yes ☐ B. No ☐ C. Not sure ☐

2. If the answer to question 1 is A,. Briefly, what problems, if any, are you currently facing due to lack of goverrunent support?

   _____
   _____
   _____
   _____
   (If this space is not enough, you may continue on the blank sheet provided on the last page)

3. In what ways, if any, can the government help solve the problems outlined above?

   _____
   _____
   _____
   _____
   (If this space is not enough, you may continue on the blank sheet provided on the last page)

4. Currently, is there any Legislation that governs the Lapidary-Jewellery industry?

   A.Yes ☐ B. No ☐ C. Not sure ☐

5. If the answer to question 4 is A, what are the weaknesses, if any, of such legislation?

   _____
   _____
   _____
   _____
   (If this space is not enough, you may continue on the blank sheet provided on the last page)

6. If the answer to question 4 is B, what sort of legislation must be enacted to best address the needs and expectations of the industry, if you can think of any?

   _____
   _____
   _____
   _____
   (If this space is not enough, you may continue on the blank sheet provided on the last page)

7. If the govermnent was to change policy and request that all exported gemstones from Zambia are cut and polished. Would you welcome such a move?

   A.Yes ☐ B. No ☐ . Not sure ☐

8. Do you, at the moment, have the capacity to handle such challenge?

A.Yes ☐ B. No ☐ C. Not sure ☐

9. If the answer to question 8 is B, would be prepared to expand your existing facilities to accommodate the increased volume of gemstones since all producers would be required to export polished stones?

A.Yes ☐ B. No ☐ C. Not sure ☐

1 0. What arrangement would you prefer:

A. ☐ To buy the rough stones from producers then process and export yourself

B. ☐ To Process the stones on behalf of the producers on a Toll arrangement.

11. Would you please list, if any, any other points that you feel need to be noted but have not been covered above?

_____

_____

_____

_____

(If this space is not enough, you may continue on the blank sheet provided on the last page)

12. Which of the following statements below best describes your clientele.

A. ☐ Largely non-indigenous.

B. ☐ Largely indigenous.

C. ☐ Both groups show almost equal interest.

D. ☐ Difficult to tell.

13. Do you think you fall under the appropriate Ministry?

A.Yes ☐ B. No ☐ C. Not sure ☐

14. How easily accessible is the acquisition Lapidary equipment here in Zambia?

A. Very Easy ☐ B. Very Difficult C ☐ t sure ☐

Appendix XI **Questionnaire III: Potential Clients**

Dear Respondent,
As part of research entitled **"Assessment of the Lapidary industry in Zambia"** you are one of the few people nominated to participate in this study by answering the questions below.

The information provided in this study will be treated with utmost confidence and it will help in assessing the potential of the Zambian Jewellery Market.

Your anticipated co-operation will be highly appreciated.
Yours faithfully,
School of Mines
For multiple choice questions mark an **X** *in the appropriate box against the alternative that best describes your opinion.*

1. How do you best describe your interest in Jewellery?

   A. Very Strong. ☐ B. Slight. ☐ C. None at all. ☐

2. How do you rate your knowledge about gemstones and jewellery?

   A. Very Good. ☐ B. Slight. ☐ C. None at all. ☐

3. To what extent can you explain the difference between the terms: **Carat** and **Karat** commonly used in Jewellery?

   A. Very well. ☐ B. Not Very well ☐ C. Not sure ☐ D. Not sure ☐

4. Given a choice between a Very good 10-carat piece of Diamond and a Toyota Camry, which one of the two so called luxuries would you choose?

   A. Diamond piece. ☐ B. Toyota. ☐ C. Not sure. ☐

5. Of the two items described above which of the following alternatives below better. describes your opinion?

   A. ☐ Can better describe the price of a Camry

   B. ☐ Can better estimate the price of a diamond piece

   C. ☐ Can comfortably estimate the prices of both items

   D. ☐ Cannot estimate the price of either.

6. Can you estimate the price of any cut gemstone?

   A. Very good . ☐ B. Slight. ☐ C. None. ☐

7. Which of the following precious metals commands the highest price?

A Platinum. ☐ B. Gold ☐ C Silver ☐

8. Do you know of any place in Zainbia where they make Jewellery?

A. Yes ☐ B. No ☐

9. Which of the following gemstones do you know or have heard of.?

A. Diamond. ☐ B. Emerald. ☐ C. Ruby. ☐

D. Garnet ☐ E. Sapphire. ☐ G. Aquamarine ☐

H. Tourmaline. ☐ I. Amethyst. ☐ J. Quartz. ☐

K. Cubic Zirconia ☐ L. Topaz ☐

Appendix XII **High Court Cases**

Some of Litigation Cases Involving Emerald Mining Licenses

	Defendant	**Vs**	**Complainant**
1.	Dabwisha S. Mines	Vs	Koukoudis
2.	Sandawana Gemstones	Vs	Goneous
3.	Norodom Mine	Vs	Gems of Africa
4.	Twampane Cooperative	Vs	Stavrous
5.	Pirala Cooperative	Vs	Grizzly Mining Limited
6.	Mwali Cooperative	Vs	Grizzly Mining and Kuber Mines mited
7.	Rama Mine	Vs	Kasongo Ramazani and Others
8.	Chimpundu Mine	Vs	Knutsen
9.	Fibolele Mine	Vs	Chani Fisheries
10.	Lubunga Mines	Vs	Engine Reconditioners of Zambia (ERZ)
11.	Gentina Mine	Vs	Kiesil Swets
12.	Mitondo Mine	Vs	Mr. Ram
13.	Rural Mines	Vs	Mr. C. T. Hughes
14.	Hakopa	Vs	Knutsen
15.	Nkwazi Mine	Vs	Stavrous
16.	Lamba Mine	Vs	Rajmit E. S. (Mr. Singh)
17.	Norodom Mine	Vs	Aakala, Kasongo
18.	Pirala Cooperative	Vs	Malachite Investment
19.	Pirala Cooperative	Vs	Malachite Investment
20.	Ngwira	Vs	Kafubu Minerals Mines Coop Society Ltd
21.	Alcam Limited	Vs	Shears Mining Limited

Appendix XIII Specimen Case of Misunderstandings among Directors

IN THE [illegible] COURT FOR [illegible] AMBIA

AT THE [illegible] AE DISTRICT REGISTRY 1996/HK/

IN THE [illegible] TER OF; THE COMPANIES ACT NO.26 OF 1994

AND

IN THE [illegible] TER OF; THE MINES AND MINERALS ACT CAP 329 OF THE LAWS OF ZAMB

B E [illegible] E N;

FIBOLELE SMALL MINES LIMITED 1st Plaintiff

PAUL BWALYA CHILUFYA 2nd Plaintiff

and

EX PARTE MOSES KATUMBI Defendant

~~EX PARTE~~ SUMMONS UNDER ORDER XLI(4) OF THE HIGH COURT RULES

LET THE PARTY CONCERNED attend before the Honourable Justice V. H. CHILES In Chambers on the 1ST day of APRIL 1996 at 08:[illegible] hours on the hearing of an application on the part of the Plaintiff that the Order granted by this Honourable Court be enforced by:-

(i) Ordering that in future the Defendant herein be refrained from closing Fibolele Small Mines Limited unless the Court so orders.

(ii) Ordering that the stones which have been produced since this Honour Court's order on 22nd February 1996 be shared equally amongst the shareholders of the 1st Plaintiff company.

(iii) Ordering that the 2nd Plaintiff and the other shareholders of Fibol Small Mines Limited be allowed to take their share of the stones produced even in the absence of the Defendant as long as the Defendant's representatives and a zambian Policeman are present on sharing of stones.

DATED THIS 29 DAY OF MARCH 1996.

.....

ASSISTANT REGISTRAR

This Summons was drawn by:-
Directorate of Legal aid
3rd Floor, Compensation House
P. O. Box 21300
KITWE

ADVOCATES FOR THE PLAINTIFFS

Appendix XIV Specimen of Injunction

IN THE HIGH COURT FOR ZAMBIA 1994/HK/331

AT THE KITWE DISTRICT REGISTRY

B E T W E E N

MALANI WINSTON NGWIRA (Male) Plaintiff

and

KAFUBU MINERAL MINES CO-OPERATIVE SOCIETY LIMITED Defendant

INTERIM INJUNCTION

UPON HEARING Counsel for the Plaintiff and the Plaintiff by his Advocates' unde taking to abide by any Order this Court or a Judge may make as to damages shoul this Court or a Judge be hereafter of the view that the Defendants may have suf by reason of this Order which the Plaintiff ought to pay

IT IS ORDERED THAT the Defendants be restrained and an Injunction is hereby gra restraining the Defendants their agents or servants from doing any of the follo things that is to say:-

(i) Entering upon and carrying on Mining operations at the Defendants' Emerald Mines at Ndola Rural

(ii) Selling, Marketing or in any parting with possession of any emeralds that may have been produced or mined recently or tha are in the custody of the Defendants their agents or servants

AND FURTHER TAKE NOTICE THAT this Order will be valid until the 5th day of S 1994 when the matter will be heard Interpartes

Dated the 5th day of August 1994

JUDGE/COMMISSIONER

TO: The Defendants & their Advocates
Messrs. Mwanawasa & Company
Tazama House
P.O. Box 71729
NDOLA

Whose Agents are:-

Appendix XV **1992 Lapidary-Jewellery Directory** **Page 1**

1992 DIRECTORY OF JEWELLERY AND LAPIDARY OPERATORS IN ZAMBIA

No.	Remark	Company Name	Postal Address	Residential Address	City
1	Operating	Advance Suppliers Ltd	Box 50773	1044 Los Angeles Rd.	Lusaka
2	Operating	African Copper Art Ltd	Box 72283		Ndola
3	Closed	Afro Gems and Crafts Ltd	Box 50628		Lusaka
4	Closed	Anderson and Jackson	Box 37		Kitwe
5	Closed	Anyikenu Mining Co. Ltd	P/Bag E101	Anchor House 1st Floor	Lusaka
6	Closed	Apex Gem Enterprises Ltd			Lusaka
7	Closed	Apex Logging and Mining	Box 50403	693 Barlastone Park	Lusaka
8	Closed	Apogo-Inter Trade Ltd			Lusaka
9	Closed	Arbaaz Enterprises		5 Shinde Street	Ndola
10	Closed	Banjalanga Ltd	Box 71034	No. 46 Mupundu	Ndola
11	Closed	Bond Industires	Box 22081	C/O Copper Crafts	Kitwe
12	Closed	Bulsaras	Box 70198	E3 Vitanda Street	Ndola
13	Closed	Calustone	Box 23467		Kitwe
14	Closed	Carlitas Holdings	Box 34211	Plot 234g Close Chelstone	Lusaka
15	Closed	Cecil Associates Corporation			Lusaka
16	Closed	Central Chemical &	Box 33163		Lusaka
17	Closed	Central Jewellers	Box 70716	2710, President Ave.Nue	Ndola
18	Closed	Ceramic Industries			Unknown
19	Closed	Changevange Agencies			Unknown
20	Closed	Chikolongo Enterprise Ltd			Unknown
21	Closed	Chima Jewellery	Box 20990	Plot 171 Accra Road	Kitwe
22	Closed	Chipazuba Co. Ltd			Unknown
23	Closed	Chunwee Enterprises			Unknown
24	Closed	CIC Agencies	Box 72236	Plot 550, President Avenue	Ndola
25	Closed	City Hardware	Box 72236		Ndola
26	Closed	Coloured Gemstone	Box 30194	Near Steam Laundry	Lusaka
27	Closed	Copshape Ltd	Box 21686	Plot 506 Accra Road	Kitwe
28	Closed	Cosae Jewellers	Box 90193		Luansya
32	Closed	D'agnamo Domenica Og	Box 37527	19 Chiparamba Road	Lusaka
30	Closed	Diamond Finance and Trade			Unknown
31	Closed	Die Casting Industries	Box 22049	5958 Accra Road	Kitwe
29	Closed	Dj Construction Ltd			Unknown
33	Closed	Electronic Technologies	Box 30583		Lusaka
35	Closed	EM Jay Jewellers	Box 23270	Plot 507 Accra Road	Kitwe
34	Closed	Ember Wholesalers	Box 34034		Lusaka
36	Closed	F Mbewe Ltd	Box 23270	15, 16 Accra Road 2nd Class Area	Kitwe
37	Closed	Facet Jewellers	Box 22270	840 Nyerere Road	Kitwe
38	Closed	Filalo Investments	Box 36159		Lusaka
39	Closed	G & G Investment Co.			Lusaka
40	Closed	Garankuwa Investment Co.			Lusaka
41	Closed	Gazelle Ltd	Box 240209		Ndola
42	Closed	Gem Industries	Box 32201	Intercontinental Hotel Basement	Lusaka
43	Closed	Global Purchasing Services (Z)	Box 34123	Plot 96, Mutandwa Road, Roma	Lusaka
44	Closed	Ifintu Auctions	Box 21287	1215 Zomba Road	Kitwe
45	Closed	Heritage Investments Ltd	P/Bag Rw 288x	Plot 557c, Leopards Hill Rd.	Lusaka
46	Closed	Hi Power	Box 35653		Lusaka
47	Operating	Jagoda Gems	Box 33373	Sd/E of 10 Farm, Villa Elizabetha	Lusaka
48	Closed	Jenet Gemstones	Box 20164	Plot 839d Off Nyerere Road	Kitwe
49	Closed	Jesperson Investments			Unknown
50	Closed	Jeweller Arts Zam/Zim	Box 10588	Central African Engineering	Chingola
51	Closed	Jocks Enterprises Ltd	Box 41164		Mufulira
52	Closed	K and K Ltd			Unknown
53	Closed	Kaba Link Co. Ltd	Box 23054	Villa Promesse 7 Mposamabwe	Kitwe
54	Closed	Kabushi	Box 71034	E4 Vitanda Street	Ndola
55	Closed	Kafwanka Trading Agency			Unknown
56	Closed	Kakas Jeweller	Box 240453	375a Makoli Avenue	Ndola
57	Operating	Kee Gems	Box 32603	396a Makeni Road	Lusaka
58	Closed	Kishnare Jewellery	Box 20211	2500 Kaunda Sq. Anchris House	Kitwe
59	Closed	Kmk Beads	Box 31850	Kofi Scrap Metal Dealers	Lusaka

Appendix XV **1992 Lapidary-Jewellery Directory** **Page 2**

No.	Remark	Company Name	Postal Address	Residential Address	City
60	Closed	Kwacha Jewellers	Box 21078	Plot 1280, Freetown Road	Kitwe
61	Closed	Kwick Build Ltd			Unknown
62	Operating	K.R. Jewellers	Box 31818	Plot 71490 Mwembeshi Road,	Lusaka
63	Closed	Lentin Jewellers	Box 21766		Kitwe
64	Closed	Longe Investments			Unknown
65	Closed	Lua Lua Investments	Box Ch 310033		Lusaka
66	Closed	Lukundo Brothers	Box 35643		Lusaka
67	Closed	Lunga Crafts			Unknown
68	Closed	M S Import/Export	Box 50751		Lusaka
69	Closed	Makoye Gemstones	Box 37561	Vis Chinika Complex	Lusaka
70	Closed	Malachite Works (Invst)	Box 33126	Manchinchi Road	Lusaka
71	Closed	Malemu Enterprises	Box 50837	71a Makeni Road	Lusaka
72	Closed	Mate Jewellery	Box 21743	Plot 1046b Accra Rd	Kitwe
73	Closed	Medema Co. Ltd	Box 35822	Vis Chinika Complex Shop No 3	Lusaka
74	Closed	Medusa Arts	Box 22874	3044 Lilongwe Road	Kitwe
75	Closed	Melida Jewellers	Box 23270	507 Accra Road	Kitwe
76	Closed	Mindeco Small Mines			Unknown
77	Closed	Mmumbo Co. Ltd			Unknown
78	Closed	Mukendi Wa Tsienda			Unknown
79	Closed	Mukunga Investments Ltd			Unknown
80	Closed	Musako and Co.	Box 33300		Lusaka
81	Closed	Mutata Enterprises			Unknown
82	Closed	Mwalawadona Lapidaries	Box 31312	Chachacha Road	Lusaka
83	Closed	Mwashi Glassworks	Box 71647	Plot 1987 Nganga Close	Ndola
84	Closed	Natural Gems Ltd	Box 36057		Lusaka
85	Closed	Ndola Engineering	Box 70199	Plot H6 and H9 Arusha Street	Ndola
86	Closed	Nepthune Fisheries			Unknown
87	Closed	New Master			Unknown
88	Closed	Newton Siame	Box 33509		Lusaka
89	Closed	Nikafuma Enterprises			Unknown
90	Closed	Nishiva Ltd	Box 71689	4710 Marconi Close	Ndola
91	Closed	Noya Enterprises	Box 35724		Lusaka
92	Closed	Nishiva Ltd	Box 71689	4710 Marconi Close	Ndola
93	Closed	Noya Enterprises	Box 35724		Lusaka
94	Closed	NS Mulenga	Box 30373		Lusaka
95	Closed	Olman Enterprises	Box 33373	S/Div Freetown Road	Lusaka
96	Closed	Onamaibe Enterprises	Box 8070		Kitwe
97	Closed	Oskaben Osak Enterprises			Unknown
98	Closed	Pama Enterprises			Unknown
99	Closed	Panabod Services	Box 71193		Ndola
100	Closed	Pioneer Mining Enterprises Ltd	Box 30531	380 Great East Road	Lusaka
101	Closed	PIPECO (Z) Ltd	Box 35888		Unknown
102	Closed	Premji Industries Ltd	Box 30115	52 Chachacha Road	Lusaka
103	Closed	Prestige Sales			Lusaka
104	Closed	Reibett Ltd	Box 80215	Old Coryndon Street	Unknown
105	Closed	Rejof Commercial	Box 330186	Plot 2459/M	Lusaka
106	Closed	R K Holdings			Unknown
107	Closed	Sachin Ltd			Unknown
108	Closed	Sally's Enterprises	Box 32546		Lusaka
109	Closed	Sam Lubwe Lusaka Lab			Unknown
110	Closed	Sangwani Mineral Exploers Ltd			Unknown
111	Closed	Sep Gem	P/Bag 24		Lusaka
112	Closed	Shardeep Gems	Box 34796		Lusaka
113	Closed	Shaws Autoelectical Ltd			Unknown

Appendix XV **1992 Lapidary-Jewellery Directory** **Page 3**

No.	Remark	Company Name	Postal Address	Residential Address	City
114	Closed	Shefro Ltd			Unknown
115	Operating	Shree Rang Jewellers	Box 81425	Freedom Way	Kabwe
116	Closed	Silver Investments	P/Bag Rw 26	G. Williams Cons.	Lusaka
117	Closed	Silver Mine	Box 32526	Plot 1046a, Accra Road	Kitwe
118	Closed	Silver View	Box 32526	7153 Mutakasha Road	Lusaka
119	Closed	Simunda Enterprises			Unknown
120	Closed	Siwito Import and Export	Box 36169	Waddington Centre	Lusaka
121	Closed	Southstream Enterprises	Box 33199	Lima Hall, Show Grounds	Lusaka
122	Closed	Spears Mining Co. Ltd			Unknown
123	Closed	Spectrum Ltd	Box 196		Choma
124	Closed	Star Jewellers	Box 30185	Luangwa House Cairo Rd	Lusaka
125	Closed	Sumika Investments			Unknown
126	Closed	Sunroute Agencies Ltd			Unknown
127	Closed	Supermetal Industries	Box 80232	Plot 1352/ 1353 Kwacha Rd.	Kabwe
128	Closed	Tan Internationsl	Box 50987		Lusaka
129	Closed	Taurus	Box 21097		Kitwe
130	Closed	Teddy Jewels	Box 50522	Vis Chinika Complex Shop No 11	Lusaka
131	Closed	Tengu Copper Products	Box 22142	Plot 5026 Kafulafuta Rd.	Kitwe
132	Closed	Thatchers' Silver Chain			Unknown
133	Closed	The Chain Industries	Box 50247		Lusaka
134	Closed	Timba Jewellers	Box 20622	Ifintu Auctions Plot 1255, Zomba	Kitwe
135	Closed	Toomabuku Lapidary Co. Ltd	Box 36118	10234 Mwalule Road	Lusaka
136	Closed	Twikatane Arts	Box 20445	Hotel Edinburgh Shop No 11	Kitwe
137	Closed	United Industries	Box 30056		Lusaka
138	Closed	Valve Industries			Unknown
139	Closed	Verpillar Mining	Box 36016		Lusaka
140	Closed	Versa Jewellers	Box 23435	C7 Katete Road Parklands	Kitwe
141	Closed	Vitesse Transport			Unknown
142	Closed	Yakashika Ltd	Box 70016	Plot 3762 Itawa Chalochesu Road	Ndola
143	Closed	Zambezi Waters	Box 34086		Lusaka
144	Closed	Zambia Emerald Industries	Box 73717	Ncr Location	Ndola
145	Closed	Zambia Gemstones	Box 31149	1654 Panganani Road	Lusaka
146	Closed	Zoran Ornamental	Box 32625	131 Freedom Way	Lusaka
147	Closed	Zuva (Z) Ltd	Box 30851	5184 Chishango Road	Lusaka
148	Closed	Bodalia PH			Unknown
149	Closed	Mwale B			Unknown
150	Closed	Vachecha CH			Unknown
151	Closed	Kayaya E	PO Box 37572	Chiparamba Rd	Lusaka
152	Closed	Gold Water and Mfg.Co.			Unknown
153	Closed	Katilungu MD			Kitwe
154	Closed	Luyanga M			Unknown
155	Closed	Matunda PN	PO Box 3588		Unknown
156	Closed	Parakh RJ	P O Box 80215		Kabwe
157	Closed	Gweniwelve Shardeep			Unknown
158	Closed	Stuart Nicole			Unknown

Appendix XVI Selected Gemstones Price Tables

SPECIES/VARIETY	© Copyright ICSL	APPLICABLE
AQUAMARINE	COLOURED STONES PRICE GUIDE RELATING TO ICSL FINAL GRADES CORRECT GRADING IS ESSENTIAL FOR APPLICATION OF THESE VALUES A guide to approximate average values at a Dealer's level. Excludes VAT and surcharges that may be applicable. Based on a correlation of data obtained from several sources and updated from time to time **NB: PRICES QUOTED IN US DOLLARS (US $)**	**2000**
Other Beryl prices below		**PAGE 9**

Weight in Carats	Exceptional	Excellent	Very Good			Good		Moderate Good		Medium		Fair/Medium		Fair		Fair/Poor		Poor		V poor
	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1 to 3	NEGOTIABLE	225	200	177	150	108	90	60	47	27	22	11	9	8	4					
4 to 7		383	340	301	255	173	144	75	59	32	26	14	11	10	5					
8 to 20		518	460	407	354	205	171	108	85	32	26	14	11	10	5					

21-30 USE AVERAGE IF 4 – 7 ABD 8 – 20 ct PRICES FOR EACH GRADE
31-50 USE 4 – 7 ct PRICES FOR EACH GRADE
ABOVE 50 USE AVERAGE OF 1 –3 and 4 – 7 ct PRICES FOR EACH GRADE

NOTES: CABOCHONS SEE PAGE 5

GREEN BERYL

90 Grade and above 40% of above prices
85-70 Grade 30% of above prices
65 Grade downwards 20% of above prices
$3 per ct minimum

PINK BERLY

4 – 15ct SIZE RANGE:
90 Grade and above 66% of above price
85-70 Grade 33% of above prices
65 Grade downwards 24% of above prices
$3 per ct minimum

YELLOW BERYL

70 Grade and above 40% of above prices
65 Grade and below 30% of above price
$3 per ct minimum

USERS PLEASE NOTE:
The only really true prices are those at the point of sale which are at the time acceptable to both buyer and seller.

This guide is therefore applied entirely at the user's own risk and the compiler is not held responsible in any manner for dealings based on the use of it.
SEE NOTES AT THE FRONT and BACK OF THESE SCHEDULES.

Appendix XVI Selected Gemstones Price Tables

SPECIES/VARIETY

EMERALD

Other Beryl prices below

COLOURED STONES PRICE GUIDE RELATING TO ICSL FINAL GRADES

CORRECT GRADING IS ESSENTIAL FOR APPLICATION OF THESE VALUES

A guide to approximate average values at a Dealer's level. Excludes VAT and surcharges that may be applicable. Based on a correlation of data obtained from several sources and updated from time to time

NB: PRICES QUOTED IN US DOLLARS (US $)

APPLICABLE

2000

PAGE 2

Weight in Carats	Except	Excellent		Very Good		Good		Moderate Good		Medium		Fair/Medium		Fair		Fair/Poor		Poor		V poor
	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
MM Rd II 1.5 .015	NEGOTIAB	1197	1050	840	693	546	378	244	183											
3.0 .10 .16		1482	1300	1040	858	676	468	302	226	131	100									
.30 to .45		1710	1500	1200	990	780	540	348	261	147	112									
.50 to .60		2223	1950	1560	1287	1014	702	510	383	184	140	65	54	46	28	20				
.70 to .80		2736	2400	1920	1584	1248	864	754	566	289	220	132	110	94	58					
.9		3705	3250	2600	2145	1690	1170	858	644	341	260	156	130	111	68	38	25			
1.0		5700	5000	4000	3300	2600	1800	1160	870	389	296	163	136	116	71	51	34			
2.0	NEGOTIAB	8550	7500	5880	4851	3822	2646	1705	1279	525	400	240	200	170	105	75	50	20		
3.0		9918	8700	6960	5742	4524	3132	2018	1514	620	472									
										735	560	264	220	170	105	75	50	20		

NOTES:

AN APPROXIMATE GUIDE IS GIVEN ON NEXT PAGE FOR 4cts and LARGER CABOCHONS: SEE PAGE 5

MATCHING CALIBRATED MELEE SETS: UP TO 15% PREMIUM

1.00ct+ MATCHED SIZES OF GOOD QUALITY OR BETTER UP TO 30% PREMIUM

EMERALDS ARE BEING OVER-GRADED AND/OR OVERPRICED IN THE HIGHER QUALITY RANGE, PARTICULARLY DARKER

TONED STONES DARK TONES ADVERSELY AFFECT PRICE

USERS PLEASE NOTE:

The only really true prices are those at the point of sale which are at the time acceptable to both buyer and seller.

This guide is therefore applied entirely at the user's own risk and the compiler is not held responsible in any manner for dealings based on the use of it.

SEE NOTES AT THE FRONT and BACK OF THESE SCHEDULES.

COMPARATIVE GRADES GIVEN AS ADDITIONAL INFORMATION (GUIDE ONLY)

ICLS	DESCRIPTIVE GRADE	ZIMBABWE
95-80	Excellent to very good	K
75-65	Good to Moderately Good	L
60-50	Moderately Good to Medium	M
45-35	Fair-Medium to Fair +	N

TAKE NOTE:

LARGER SIZED POORER QUALITY EMERALDS ARE BEING SOLD AT TOO HIGH PRICES

QUALITY MUST ACCOMPNAY SIZE TO REALISE A HIGH PRICE

FINE QUALITIES ARE EXPENSIVE

SPECIES/VARIETY	© Copyright ICSL	APPLICABLE
GARNET (I) RED SERIES (ii) RHODOLITE	COLOURED STONES PRICE GUIDE RELATING TO ICSL FINAL GRADES CORRECT GRADING IS ESSENTIAL FOR APPLICATION OF THESE VALUES	**2000**
ESTIMATES GIVEN HERE ARE FOR SOUTH AFRICAN USE ONLY	A guide to approximate average values at a Dealer's level. Excludes VAT and surcharges that may be applicable. Based on a correlation of data obtained from several sources and updated from time to time **NB: PRICES QUOTED IN US DOLLARS (US $)**	**PAGE 3**

Weight in Carats	Except	Excellent		Very Good		Good		Moderate Good		Medium		Fair/Medium		Fair		Fair/Poor		Poor		V poor
	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
i) RED SERIES																				
Red calibrated rounds 1.25 mm to 5.00 mm		Good grades $1.00 to $4.00																		
.50 to 1		9	9	8	8	7	7	6 each	6 each	5 each	5 each	5 each	5 each	5 each	5 each					
2 to 5		19	15	13	13	8	8	7	7	6	6	5	5	5	5					
6+		24	18	15	15	12	12	9	9	7	7	5	5	4	4					
ii) RHODOLITE																				
Up to 1		25	24	21	18	17	13	10	8	7	7	5	5	4	4					
2 to 5		63	60	42	36	34	26	20	16	14	14	6	6	5	5					
6 to 10		92	88	70	60	57	43	36	32	28	28	10	10	5	5					
15+		153	147	136	117	110	84	65	52	28	28	13	13	5	5					

NOTE: **CABOCHONS: SEE PAGE 5**

USERS PLEASE NOTE:

The only really true prices are those at the point of sale which are at the time acceptable to both buyer and seller.

This guide is therefore applied entirely at the user's own risk and the compiler is not held responsible in any manner for dealings based on the use of it.

SEE NOTES AT THE FRONT and BACK OF THESE SCHEDULES.

Appendix XVI Selected Gemstones Price Tables

SPECIES/VARIETY	© Copyright ICSL	APPLICABLE
QUARTZ: AMETHYST	COLOURED STONES PRICE GUIDE RELATING TO ICSL FINAL GRADES CORRECT GRADING IS ESSENTIAL FOR APPLICATION OF THESE VALUES	2000
ESTIMATES GIVEN HERE ARE FOR SOUTH AFRICAN USE ONLY	A guide to approximate average values at a Dealer's level. Excludes VAT and surcharges that may be applicable. Based on a correlation of data obtained from several sources and updated from time to time	PAGE 4

NB: PRICES QUOTED IN US DOLLARS (US $)

Weight in Carats	Except	Excellent		Very Good		Good		Moderate Good		Medium		Fair/Medium		Fair		Fair/Poor		Poor		V poor
	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
Up to 3		32	24	20	15	14	12	6	5	4	4	4	4	3	3					
4 to 7		45	34	28	21	20	17	9	8	6	5	5	5	4	4					
8 to 20		55	41	34	26	24	21	10	9	7	7	5	5	4	4					

SMALLS:

APPROXIMATE TRADE PRICE (VARIES BETWEEN SUPPLIERS)

MM EACH	COST OF DARK - LIGHT
2.5	2.75
1.70	
3.0	3.00
2.00	
3.5	4.00
3.00	
4.0	5.50
3.75	
4.5	6.70
4.30	
5.0	8.00
5.60	
6.0	10.75
8.00	

SPECIAL NOTE ON SYNTHETHIC AMETHYST

Fine qualities are marketed in South Africa in relatively large quantities now. Many of these synthetics are not easily gemmologically distinguished from natural material – generally done on the distinction between twinning (natural) or not (synthetic). Twinned synthetic material is now being made as well.

ROUGH (uncut) crystalls sell in RSA for approximately 50 US cents to $1.00 per gram (medium toned purple hues) but can be higher for better materials. Based on 20% recovery, this means +/- $1.00 per ct cut as a cost base plus cutting.

NOTE: CABOCHONS: SEE PAGE 5

USERS PLEASE NOTE:

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SEE NOTES AT THE FRONT and BACK OF THESE SCHEDULES.

Appendix XVI Selected Gemstones Price Tables

SPECIES/VARIETY	© Copyright ICSL	APPLICABLE
TOURMALINE BLUE	COLOURED STONES PRICE GUIDE RELATING TO ICSL FINAL GRADES CORRECT GRADING IS ESSENTIAL FOR APPLICATION OF THESE VALUES	**2000**
ESTIMATES GIVEN HERE ARE FOR SOUTH AFRICAN USE ONLY	A guide to approximate average values at a Dealer's level. Excludes VAT and surcharges that may be applicable. Based on a correlation of data obtained from several sources and updated from time to time	**PAGE 6**
	NB: PRICES QUOTED IN US DOLLARS (US $)	

Weight in Carats	Except 100	Excellent 95	90	Very Good 85	80	Good 75	70	Moderate Good 65	60	Medium 55	50	Fair/Medium 45	40	Fair 35	30	Fair/Poor 25	20	Poor 15	10	V poor 5
1 to 3	280	240	200	160	130	100	80	50	45	30	25	15	14	9	7	4	3			
4 to 7	431	370	308	246	238	183	146	100	90	60	50	30	28	18	14	8	6			
8 to 20		540	463	386	309	390	300	192	120	108	72	60	36	34	22	17	12	9		

21-30	USE AVERAGE OF 4 – 7 and 8 – 20ct PRICE FOR EACH GRADE
31-50	USE 4 – 7 ct PRICES FOR EACH GRADE
Above 50	USE AVERAGE OF 1 – 3 and 4 – 7ct PRICES FOR EACH GRADE

SPECIAL NOTE:

IF GREY TINTS ARE OBVIOUS and DETRACT FROM THE BLUE BODY COLOUR. PRICES FOR LOWER GRADE STONES MUST BE ADJUSTED AS REFLECTED IN THE GRADE OPPOSITE HUES APPROXIMATELY 60% OF THESE FIGURES

BLUISH – GREY

COMMENT:

100 TO 90 GRADE NEGOTIABLE
PARAIBA "ELECTRIC" BLUE, LIGHTLY INCLUDED, FOREIGN QUOTES GIVE PRICES AS BEING $1200 00 PER ct and HIGHER
FOR LARGE STONES THESE ARE IN A CLASS OF THEIR OWN and BEAR NO RELATION TO VALUES ON THIS PAGE

USERS PLEASE NOTE:

The only really true prices are those at the point of sale which are at the time acceptable to both buyer and seller.

This guide is therefore applied entirely at the user's own risk and the compiler is not held responsible in any manner for dealings based on the use of it.

SEE NOTES AT THE FRONT and BACK OF THESE SCHEDULES.

Appendix XVII Emerald Mining – A Historical Perspective

Beryl was found in Zambia in 1928 at Miku, 40 km west of Luanshya by N. F. Dicks of the Rhodesia Congo Border Concession Company (Brunelli-1, 1994)(a). The presence of emeralds was confirmed by G. J. Baker in 1931. At the time, the stones were considered to be too flawed to be used as gems. However, Louis Oppenheimer was sufficiently impressed to suggest continued work since the samples might lead to a better yield. In 1962, Mineral Search of Africa (Rio Tinto) staked a claim and dug a few trenches. In 1966, they transferred the claim to Miku Enterprises Ltd. In 1970, Mindeco Small mines took over and produced approximately 2 kg of emeralds which were sent to London for valuation. Emeralds continued to be produced through 1973 to date.

The news of this find excited many people mainly the West Africans and Congolese. Together with illegal miners locally known as "Illegal miners", they penetrated Chief Nkana's area administratively known as Ndola Rural. They settled among the villages around the emerald area and engaged in marriages of convenience. Wielding financial strength, these foreigners pre-financed the Zambian illegal miners who were engaged in the actual digging. With time, the traditional tranquil cultural setting of this remote part of the country became effervescent with social activity. All urban attributes and vices like bottled liqueur, expensive cars and prostitution respectively followed. This type of opulent life created rural-based Oligarchs a status which was unusual in a typical Zambian rural life setting. This prompted the Government to take remedial measures by appointing a commission of inquiry.

Appointment of the Commission of Inquiry

The money the 'Illegal miners' were generating, which was far above the average income of most Zambians in a socialist oriented economy, sent the prices of commodities in the area skyrocketing by as much as hundred times the government recommended price of commodities. The newly found life style led to the local musical band Mulemena Boys to compose a calypso entitled '*Pamuzhi pa Lubabo*' which was a hit single in 1980. The song is about the famed Lubabo Village which was galvanized in all sorts of activities and had become the envy of anybody who wanted to get rich quickly. These economic indicators had their own implications. A capitalist enclave was created in a largely socialist economy. The ripple effects resounding from the changed living styles backfired on the community as the Government through Special Investigations Team for Economy and Trade (SITET) realized that a lot of money was being generated by the foreigners from smuggled-emerald sales. At the time, Zambia's share of the world's emerald trade by value was estimated at 35 to 40 %, a proportion that put Zambia among the foremost producers of emeralds in the world (Bruce, 1979). Despite Zambia's dominant position in the emerald world, foreign exchange earnings accruing to government were insignificant because the bulk of Zambia's emerald production resulted from activities of Illegal miners and smugglers. It was not until 1976 that the Government through SITET attention was drawn to the illegal trade in emeralds. The value of emerald trade was then estimated as varying between K20 – 100 million (US$ 24 – 122 million) at the going exchange rate of US$ 1 = K0.82 (Bruce, 1979). The Government was compelled to take security measures to curb the activities of Illegal miners and smugglers. In March 1977, the then President Dr. Kenneth Kaunda issued a Presidential Order, in Statutory Instrument No. 194 of 1977 declaring Kafubu Emerald Mining Area "a protected area" in

terms of the Protected Places and Areas Act, Cap. 107 of the Laws of Zambia. This covered an area of approximately 800 km^2 covering most of the reserve land of Chief Lumpuma and parts of Chief Nkana's area.

On 1st February 1979, His Excellency the President under the Inquiries Act (Laws of Zambia, Volume IV Cap. 181), gazetted under Statutory Instrument No. 27 of 1979, appointed the Commission to look into the Emerald Industry. For Terms of Reference see appendix I.

Table Appendix 1 The Known deposits of Ndola Rural Emerald Area

i. Miku or Kafubu	mined by Mindeco Small Mines Limited, holders of License No. ML 28
ii. Kamakanga	mined by Nkuralu Gem Prospecting Company Limited (Nkuralu) holders of the License No. ML 44
iii. Fwaya Fwaya	granted mining license (Mindeco Small Mines Limited)
iv. Fibolele	granted mining license (Mindeco Small Mines Limited)
v. Pirala	the subject of an application for mining license by Pirala Emerald Company.
vi. Libwente	the subject of an application for mining license by Mindeco Small Mines Limited
vii. Mitondo	the subject of an application for mining license by Mindeco Small Mines Limited
viii. Kabashila	the subject of an application for mining license by Mindeco Small Mines Limited

Under a separate Statutory Instrument No. 29 of 1979, the President ordered cessation of production of emeralds by all holders of any mining license in respect of emeralds. Under a subsequent Statutory Instrument No. 30 of the same year the Minister of Mines was directed that all uncut emeralds and stones deemed to contain emeralds, wherever the same were to be found in Zambia, be placed in the custody of the Chief Mining Engineer.

During this period, there were eight separate known deposits of emeralds (ref. Table Appendix 1).

In 1975, Nkuralu obtained a prospecting license and later a mining license over the Kamakanga deposit which had been discovered by Illegal miners. Production started in 1977. At the same time illegal mining continued unabated. In an attempt to contain the situation, Mindeco small Mines was mandated in 1977 to take over the responsibility for all emerald prospecting and mining outside the area held by Nkuralu.

Thus by 1979, there were only two emerald producing companies in Zambia: Mindeco Small mines and Nkuralu. It was also observed that the former achieved little production despite their extensive areas while the latter maintained a reasonable level of production. Their production in addition to what Illegal miners were producing put Zambia as the world's largest emerald producer at 40 % of the global stake (Bruce,1979). Zambia, Brazil and Colombia were estimated to have been controlling 80 % of the world trade in emeralds. It was estimated that 80% of the emeralds produced in the country were mined and exported illegally.

Recommendations of the Commission

The Commission recommended that in view the vastness of the area and the problem of providing adequate security, exploitation of the whole area could not be entrusted to a single company, the Government or otherwise. A wholly owned Government company was completely ruled out learning from the experiences of Mindeco Mines coupled with finding necessary finance for both mining and security. Given the uncertainty of the

extent of the deposits it was found unadvisable for the government to organize the industry on its own.

The Commission settled for the following proposals:

(a) The Government to go into joint venture with a foreign company that had expertise in emerald Mining business

(b) Zambians to be empowered to exploit emeralds through:

i. Cooperatives

ii. Individual ownership of mineral rights

iii. Registered wholly owned Zambian Company

(c) Buying and marketing to be left to a wholly owned Government Buying Agency

(d) The emeralds should be cut and polished locally in order to increase earnings accruing to Government.

Under this scheme, the emerald area was divided into two regions. One area, embracing the eight known deposits mentioned earlier was to be reserved for companies. Only wholly owned Zambian companies were recommended to be permitted to operate in this area though special consideration was to be given to existing companies: Mindeco Small Mines and Nkuralu because they had already made investments in the area. The operations of these mines were to be confined to areas in respect of which they held mining licenses viz.: Kamakanga for Nkuralu and Fwaya Fwaya, Fibolele and Miku for Mindeco Small Mines. The remaining were to be made available for allocation to other companies.

It was emphasized that only wholly owned Zambian companies would be permitted to operate in the area. The Commission felt that before any license was issued to a

company, consideration was to be given to the nature of management. No Company was to be given a license if its management was in foreign hands. It was recommended by the Commission that whenever Zambian management required technical advice, they would resort to the pool of experts provided by the Buying Agency.

Under the proposed scheme, individual miners would be required to belong to a Miners' Association. The functions of such an association would be to register and issue annual permits to prospective miners; to arbitrate in case of disputes between miners and to act as channel of communication with other organizations particularly the Government.

Formation of Emerald Mining Companies

The outcome of these recommendations led to the relaxation of mining licensing restrictions and allowed the area to be re-partitioned into small plots or 'claims' that would later be allocated to individuals, companies and co-operatives. The only restriction that remained in force was that of nationality.

On its part the Government through ZIMCO Group established the Reserved Minerals Corporation (RMC) in 1980 with the sole objective of exploiting the emerald deposits either by itself or through joint ventures. RMC immediately took over all the mining and prospecting rights of Mindeco Small Mines (MSM). In 1981 RMC had started operations at Fwaya Fwaya and by 1982 the the corporation had acquired mining rights over Miku deposit.

In April 1984, Kagem Mining Limited was formed as a joint venture between RMC and Hagura Group an Indo-Israeli company owned by two Indians and one Israeli. The RMC had a majority share holding of 55 % and Hagura holding the remaining 45 %. Kagem acquired the assets and liabilities of RMC at Fwaya-fwaya mine. Now Kagem has several mining licenses within its single prospecting license (PL 230) and successful emerald production has been achieved from Fwaya-fwaya, Fibolele, Libwente, Dabwisa, Chama, and Lushungwa.

Other major successful mining companies that were formed as a result of the Commission's recommendations were Lumpuma, Kafubu Mines Cooperative, Pirala Mines Cooperative, Twampane Mining Cooperative, Norodom Mines and Hiwa Mines. Meanwhile MSM concentrated on mining other gemstones after surrendering all its emerald licenses to RMC. MSM further diversified into gem cutting through its lapidary in Lusaka. Almost all the founder companies of the Ndola Rural Emerald mining area are facing one form of litigation or another (see Appendix XII), have serious liquidity problems, have been dismembered or have changed ownership.

RMC ceased existing in 1998 when virtually all of its operations, like gemstone marketing, were overtaken by events as a result of economic liberalization and the other operations like amethyst mining and non-metallic mineral mining through MSM were outsourced. ZEIL, which was a subsidiary of RMC, went under in 1998. These developments stripped RMC of all its responsibilities to justify its continued existence. To date, as at 30th April, 2001, there are 468 Mining Licenses that have been issued out of which fewer than 35 mining companies are producing.

In 1991 when the new Government came into power and liberalized the economy, the nationality restriction for gemstone licensing was lifted. This has led to the proliferation of new companies owned by foreigners, like Kuber Mines limited and Grizzly Mining limited, to mention two. Kagem Mining has since been advertised for privatization of the 55 % shares the government holds. To date the Government has not disclosed the outcome.

Appendix XVIII Representative Case of Problems Facing Emerald Miners– The Sachin Emerald Gemstone Mining Project (Mandona, 2000)

Location

Sachin Limited are the holders of a gemstone license for an emerald mine located in Ndola Rural, about 60 km south west of Kitwe in the Copperbelt Province of Zambia.

Operations

Following Trenching and Pitting work lasting about a year mining operations began in 1988. For the first two to three years the mine was highly productive but due to poor Government-imposed marketing arrangement not much revenue was realized. The sell of emeralds was not permitted except through the parastatal company Reserved Minerals Corporation and its subsidiary, ZEIL (ref. section 4.4.2). Without independent valuation the company's production was subjected to severe under-valuation which led to very low earnings. At one moment, Sachin Limited was forced to withhold production in the hope that the marketing restrictions would be lifted but to no avail. The bank interest charges forced the company to release the production through the authorized channels.

With the advent of market liberalization that came with the Third Republic in Zambia in the early nineties, the gemstone marketing restrictions were virtually eliminated. The company was able to sell the emeralds on the open market.

The liberalized economy created other secondary problems for small-scale gemstone miners. Prior to market liberalization, the Company relied on hired earthmoving equipment from an equipment hire company established by the copper mining giant ZCCM. Liberalization led to the restructuring of ZCCM to concentrate on its core business of copper mining. All the equipment that was being hired out was withdrawn and re-deployed to its operating

Divisions. In its place came the proliferation of equipment-hire companies whose charges were very high and reliability very low. Equipment supply became very erratic and never on time. Equipment ordered and intended to work in the dry season would only be made available in the wet season which is operationally difficult. As a result of the difficulties, the company's operations are now in abeyance.

Manpower Skills and Expertise

Notwithstanding the operational difficulties, the running of the company has not been constrained by skill deficiencies. Exploration geologists and other experts have been hired when needed. Currently the operations of the mine are being managed by a Gemmologist. He is supported by a crew of experienced employees many of whom are part of a large pool of former illegal miners in the area. Most of emerald miners rely on former illegal miners for expertise. Illegal miners possess a wealth of practical knowledge and experience of emerald mining.

Equipment Availability

Although the company lacks heavy earthmoving equipment, it has on site a compressor, an explosives magazine and fuel tanks. It has in the past made its equipment available to other nearby mine operators, on a hire basis but most miners in the vicinity are no longer in operation due to various constraints as outlined under section 4.2.4.

Financial Access

Commercial Banks

The company has over the years sought capital investment and working capital from commercial banks without much success. In 1989 the company succeeded in securing K300,000 as an overdraft for working capital. The Bank only approved the transaction by

using the gemstone production deposited with it as security. In the end the facility was discontinued because the company could not sustain the high interest charges. Commercial banks do not consider giving long-term investment finance because gemstone mining is considered very risky.

Leasing Companies

All efforts failed though the Commonwealth Development Corporation (CDC) showed interest in offering a leasing facility of about US$ 75,000 but this also did not materialize after a key official was transferred. The risk factor was again cited as the reason.

Investment Forum

At FORMIN 94 representatives from European Investment Bank (EIB) and other banks showed little or no interest in gemstone projects. Their preferences were for gold or base metal projects.

Equipment – Production Swap

An arrangement where the company agreed with a buyer to swap its production in exchange for mining equipment from the buyer's home country, India, failed. The failure of the deal followed the buyer's receipt of the first consignment of 200 kg of assorted emeralds, he attempted to alter the terms in preference to proposals for an outright purchase of the mine instead.

Comment

The foregoing account of Sachin Mining is a representative summary of a typical illustration of the problems facing the emerald miners in Ndola Rural. The proprietor of this mine is one of the few exceptions that hires qualified manpower like services of a Geologist and Gemmologists.

Appendix XIX Case Example of Problems facing SSM in Amethyst Mining - Chipazuba Mine (Mundia, 2000)

Location

This Amethyst Mine project, located in Mapatizya area of Kalomo was initiated in 1987. It is one of the few mines owned by a woman.

Organization

The mine started with four partners. Two of the partners later withdrew after some differences. The mine remained under the full control of the lady Mrs. Pauline Mundia and her father.

In the early years the mine was financed from family resources. A proportion of earnings from the operation was reinvested. The operation reached the current stage of production around 1993. Among the key developments were, the owner participated in gemstone fairs in different parts of the world and secured markets in Austria, Germany, India, Thailand and Hong Kong. The marketing trips were self-financed from the proceeds of amethyst sales.

Geology

Chipazuba Amethyst area seems to be one of the richest mineralized parts of the Kalomo amethyst fields, with regards to the number of veins, quality of the amethyst and the high proportion of medium to high grade material. Chipazuba amethyst shares the boundary

with Kariba Minerals Limited a Joint -Venture with the Zambian Government and Lonrho, which has been in existence since the 1950's.

On the property, there are 27 known veins so far which range in thickness from 0.1- 0.5m in granitic gneisses and calsilicate rocks. They extend over 100m and have been followed in places to more than 200m horizontal distance. Near the contacts to the wall rock in white quartz or agate-quartz, followed by amethyst quartz and more inside crystals of fine flow amethyst, on surface, the amethyst is gray-greenish discolored. Good quality starts below the present digging in 4 – 6m depth. Resources are estimated only for the depth of 5 – 18m, which can conveniently be open pit mined. There is additional potential in strike extension. Beyond 18m there is an underground mining alternative, which requires skills and experience, which the mine owner lacks.

Mining Constraints

The major problem facing the operations of the mine is inaccessibility to investment finance. In 1994 efforts to get ZAR 84, 000 loan from the Zambia National commercial Bank failed because of the now all-too-familiar cited reason – small-scale mining ventures are too risky.

With a work force of 25, the predominantly pick and shovel operation is able to produce between 500 – 1000kg per month which can rise to about 1500kg when mining thinner veins. The output can increase to between 1500kg and 3000kg which can rise to 4500kg per month when mining wide veins of about 0.5m. In contrast, a D8 bulldozer operating for 8 hours in an area of wide veins yielded 4000kg of saleable material. This particular

production was sold as unwashed run-of-mine at US$ 1/kg. On another occasion the use of a hired bulldozer for about 8 hours in area with exposed thin veins, 2000kg of cobbed material was produced. Out of this production 35kg of knocked material was produced. Of the knocked material 1.5kg was the highest quality and fetched US$ 1/gram while the remainder of 33.5kg sold for US$ 135/kg during a Gemstone Trade Fair in Thailand. The rest of the 1800kg crystals was exported to Hong Kong at US$ 3/kg. This amounted to total revenues of US$ 11422 (Mundia, 2000).

During the rainy months of the year (mid-December – mid-March normally) operation are badly affected because pits are full of water and the mine has no capacity to acquire the right equipment to pump out the water. This problem forces the operator to open new pits on slope ground. This nomadic way of operating affects the flow of production because the pick and shovel method gives very low productivity of about 1 – 4 BCM per man-hour and the method is in ineffective in hard rocks.

Marketing Constraints

Despite managing to undertake aggressive market research overseas, the operator does benefit much because the demand for amethyst is so overwhelming that she fails to meet the required orders. As a result buyers lose confidence as the supply flow is unreliable. This situation is caused by inadequate production and this has cost the operator a lot of money In seeking new markets. Efforts of establishing co-operative marketing arrangements have failed due to mistrust among the small-scale miners.

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