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**ANALYSIS OF THE RWANDAN COLTAN COMPETITIVENESS ON THE  
WORLD MARKET THROUGH ITS OFFER SPECIFICATIONS**

**Submitted for the award of Master's Degree in Business Administration (MBA)**

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**Kigali, April 2016**

## **DECLARATION**

I, Alain NTUNGANE, hereby declare that this dissertation is my original work and to the best of my knowledge, it has never been presented to any university or institution for any award. However, I acknowledge that citations got from workers, scholars, academicians have been duly referenced in the bibliography.

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## APPROVAL TO SUBMIT

This is to certify that the research work entitled "*Analyzing the Rwandan coltan competitiveness on the world market through its offer specifications*", is recorded as my original work written in partial fulfillment of the requirement for the award of Master's Degree in Business Administration (MBA) in the University of Rwanda, College of Business and Economics.

Signed: .....

**Prof. Murty S.KOPPARTHI**

Date:.....

## **DEDICATION**

To my beloved wife Jeanne for her support;

To our beloved children Bianca and Jayden;

To my dear father, brother and sisters;

This thesis is dedicated.

## **ACKNOWLEDGEMENT**

Above all, I thank Almighty God for making this possible and for introducing into my life all the people who have been contributed in one way or another to my education.

The eventual and successful completion of this work requires plenty of dedication and above all a collective effort. I therefore would like to thank my supervisor Dr. MURTY S.KOPPARTHI who devoted his valuable time, advised me without reservations and always available for consultation in the development of this body of knowledge.

My sincere gratitude goes to my parents, brother, and sisters, specially to Mrs Alène KANEZA for her guidance and support. I must register sincere and heartfelt thanks to my wife and friends who supported me morally throughout the tedious years.

Finally, errors and omissions are solely my responsibility and not of those acknowledged, I owe you gratitude.

## **ABSTRACT**

Today, the Rwandan mining sector is one of the country's key export sectors and Rwanda is one of the world's fourth largest producers of coltan (MACIG,2014). The coltan from Rwanda is known from its high quality which affects positively its price on international market. This research was conducted to analyze the competitiveness of Rwandan coltan through the specification of its offer. An hypothesized model has been used to measure the competitiveness in identifying variables and their relationship The study was a case study which adopted a mixture of qualitative and quantitative approaches. Data were collected by using self-administered questionnaires, interviews and documentation. Data were analyzed using descriptive statistics and thematic analysis. The major findings include that the territorial qualification (high tenor in oxide of tantalite) and the certification as specifications contribute to the competitiveness of the Rwandan coltan. Although the Rwandan coltan is said to be of high quality, there are some challenges which still hinder its full success on the market.

However, some ways addressing the challenges have been identified for a sustainable development and productivity growth for Rwanda: a renewing strategic focus on building the geological knowledge base, on value addition, on broader development outcomes, on domestic processing, on development of technological and business skills. The creation of future high institutions training, a regional political integration and the mobilization of funds may also enhance the competitiveness of the Rwandan coltan.

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## LIST OF ABBREVIATIONS

<b>AMV</b>	: African Mining Vision
<b>ASM</b>	: Artisanal Small scale
<b>AU</b>	: African Union
<b>BDEGL</b>	: Banque de Développement des Etats des Grands Lacs
<b>BGS</b>	: British Geological Survey
<b>CEC</b>	: Coltan Extracting Companies
<b>CEO</b>	: Chief Executive Officer
<b>CEPGL</b>	: Communauté des Pays des Grands Lacs
<b>DRC</b>	: Democratic Republic of Congo
<b>EAC</b>	: East African Community
<b>EADB</b>	: East African Development Bank
<b>EDPRS</b>	: Economic Development and Poverty Reduction Strategy
<b>EU</b>	: European Union
<b>FDI</b>	: Foreign Direct Investment
<b>HCSS</b>	: Hague Centre for Strategic Studies
<b>GDP</b>	: Gross Domestic Products
<b>IFC</b>	: International Finance Cooperation
<b>ICGLR</b>	: International Conference of the Great Lakes Region
<b>ITC</b>	: International Trade Center
<b>ITRI</b>	: International Tin Research Institute

**JV** : Joint Ventures

**MDG** : Millennium Development Goals

**MINICOM** : Ministry of Trade and Industry

**MINIRENA** : Ministry of Natural Resources

**MSA** : Minerals Supply Africa

**NBR** : National Bank of Rwanda

**OECD** : Organization for Economic Cooperation and Development

**OGMR** : Rwanda Geology and Mines Authority

**PSF** : Private Sector Federation

**PTA** : Prospective Target Areas

**PTA Bank** : Preferential Trade Area Bank

**RBS** : Rwanda Bureau Standards

**RDB** : Rwanda Development Board

**Reg No** : Registration Number

**RMGA** : Rwanda Mining and Geology Agency

**SEZ** : Special Economic Zone

**SGS** : Société Générale de Surveillance

**SMEs** : Small and Medium Enterprises

**TIC** : Tantalum-Niobium International Study Center

**TSCI** : Tin Supply Chain Initiative

**UAE** : United Arab Emirates

**UNCTAD:** United Nations Conference on Trade and Conference

**USD** : American Dollars

**USGS** : United Sates Geological Survey

# CHAPTER ONE

## 1.0 INTRODUCTION

This chapter covered elements like background of the study, statement of the problem, purpose, objectives, research questions, scope, the significance and the structure of the study.

## 1.1 BACKGROUND OF THE STUDY

Nowadays, minerals have become an increasingly important source of revenue for Rwanda, showing potential as an avenue to facilitate growth and economic transformation in the country. Rwanda's primary mineral exports include the so-called 3T minerals: tin (cassiterite), tungsten (wolframite) and tantalum (coltan) ore. The mining sector has developed into one of the country's key export sectors. According to the National Bank of Rwanda report (2013, p. 25), Rwanda's mineral export revenues increased up to 44% per year, between 2008 and 2012, the coltan's export of 1,145 tons in 2012 was valued at \$56.9 million. Mining exports are Rwanda's biggest single export product, bringing \$136 million in 2012 and reached \$225 million in 2013. Today, Rwanda ranked the world's fourth largest producers of tantalum (MACIG, 2014).

Besides export earnings, however, the sector shows promise for non-farm job creation, an important pillar of the government's poverty reduction strategy. By mid-2014, mining in the rural areas employed more than 33,000 persons directly. Importantly, mining jobs pay better when compared to other wage workers in the rural areas. For instance, the annual income for miners was almost 200,000 Frw compared with 69,000 Frw for farm wage workers (World Bank, 2015, p.36).

Artisanal mining remains dominant in Rwanda, with few industrial and semi-industrial mining activities. Due to its economic importance, the Government of Rwanda has revised its mining policy and laws, a legal and institutional framework was established to improve geological knowledge, investment conditions and value addition. There are few exploited reserves with sufficient production for industrial mining, though knowledge of potential reserve in the



country is still lacking. Rwanda is the second biggest producer of tin in Africa (after the DRC) and is among the world's top 10 tungsten producers. In 2009, the EU imported 8.6% of its tantalum from Rwanda and Rwandan tungsten was responsible for 2.4% of total EU imports.

With mineral exports, its production growing and relative importance for Rwanda as a source of Foreign Direct Investment (FDI), mining is now one of its priority export sectors. Back in 2006, the United Nations Conference on Trade and Development (UNCTAD) viewed the country's mining sector as one of the most promising sectors for economic growth and development (Teeffelen, 2012, p. 27).

In the last thirty years, the market of the coltan has been strongly volatile due to the variability in the products from which coltan serves as the required inputs, like phones, TV and this has led to increase the demand of the mineral more on the international markets associated with the volatility of international prices.

Moreover, incomes from exportation of these products constitute one of the main determinants of the equilibrium of balance of payment, of external debt, of fiscal situation, of savings and investments in Rwanda. There is also the importance of mining products in the reduction of poverty, in the rural areas in developing countries. As expressed in EDPRS II and Mining Sub-Sector Strategy 2013/2014–2017/2018, the government recognizes mining's potential to contribute to jobs, exports, and foreign direct investment (FDI).

In fact, some countries like Rwanda cannot influence demand and offer prices because their production is low compared to the global supply and demand on the market. It is in this context the present study sought to assess the competitiveness of one of the mineral ore, the coltan, extracted in Rwanda, on the world market.

## **1.2 STATEMENT OF THE PROBLEM**

Rwanda is an extracting and exporting country of the Colombo-tantalite, the question of its positioning on the world market is explained by its product ability to compete on the global market. Positioning may be understood as the evolution of the offer, the production costs and the prices of the Rwandan coltan at the world market.

Currently producing tin, tungsten and coltan, Rwanda sits on the mineralized. Given that Rwanda ranks as the eighth largest producer of unsmelted tin in the world, and accounts for 1.5% of global tin ore production. Furthermore, known for its high-quality tungsten, Rwanda is the world's fourth largest producer and contributes 2% to total global supply. A top producer of tantalum, Rwanda also ranks as the fifth largest producer of this mineral, accounting for about 12% of global production, according to the US Geological Survey. In addition, tantalum has stronger prospects to produce high quality concentrate: currently its grade is 45% to 50% Ta<sub>2</sub>O<sub>5</sub>. It is also worth mentioning that the tungsten ore produced in Rwanda has very high grades up to 70% and now there is a mineral traceability system, Rwanda's products are more internationally competitive (MACIG, 2014).

Rwanda as a small country cannot influence the world market prices due to its low quantity supplied. Nevertheless, its current artisanal mining sector presents a relatively low production costs which allow the country to bet on the competitiveness-cost to increase its revenues and compared to the world prices, Rwanda gets rather high price, competing the Congolese minerals (MACIG, 2014). Given that the price is an important indicator of the commodity quality, it is obvious that the Rwandan coltan is known to be of higher quality.

Although Rwanda is not able to influence the price due to the low supply, it can bet on the quality of its coltan as raw material. Little is known about the competitiveness of the Rwandan Coltan on the world market. Within this framework, the study in hand sought to bridge the gap by assessing the competitiveness of the Rwandan coltan and trying to find out how Rwanda can influence the coltan price through the differentiation of its offer. The reasons of this choice are explained by the fact that since 2012, the Rwandan coltan, by its quality, gets high prices compared to the world average. Runner of the assertion which considers that it is the consumer and not the producer who specifies his willingness to pay much (Pecqueur, 2009, p. 9), the Rwandan coltan presents an example of differentiation of its offer, its specifications. Thus, this research assessed the competitiveness of the Rwandan coltan through its specifications.

### **1.3 RESEARCH OBJECTIVE**

The main objective of this research was to analyze the Rwandan Coltan competitiveness on the international market through specifications of its offer.

The specific objectives are:

1. To identify specifications of Rwandan coltan competitiveness;
2. To analyze the relationship between competitiveness and specifications of Rwandan coltan;
3. To identify challenges faced by Rwandan coltan on the world market and give some recommendations.

#### **1.4 RESEARCH QUESTIONS**

1. What specifications affect Rwandan coltan competitiveness on the international market?
2. What is the relationship between the specification of the Rwandan Coltan and its competitiveness on the world market?
3. What challenges does Rwandan coltan face in competitiveness on the world market?

#### **1.5 THE SCOPE OF THE STUDY**

Taking into account the time and financial means, it was difficult to get information from all Rwandan companies extracted ores, especially artisanal, consequently, the study was delimited in content, space, time and the field of research.

##### ***Content scope***

The study focused on the specification of the Rwandan coltan as the independent variable and the competitiveness on the world market as the dependent variable and aimed at establishing the relationship between the two variables.

##### ***Geographical Scope***

The study was conducted only on mining companies legally registered (small & big scale) due to financial, time limitations while other related information were collected from different stakeholders including ministries and agencies namely Ministry of Natural Resources, Ministry of Trade and Industry, Private Sector Federation, Rwanda Development Board (RDB), Rwanda Bureau of Standards (RBS) and Rwanda Mining and Geology Agency (RMGA).

##### ***Time scope***

The research covered the period from 2006 to 2013. This period coincided with the beginning of excavation of coltan by mining companies formally registered in RDB.

## **1.6 JUSTIFICATION AND SIGNIFICANCE OF THE STUDY**

The study added some knowledge to the existing literature on the trade policy in general and mining in Rwanda in particular. It provided a better understanding to investors, government's officials, private sector in mining industry export opportunities, and some recommendations were formulated to export trade policy of Rwanda. This study shed light to a theoretical framework as trade openness and trade opportunity. It helped to align Rwanda export trade policy to the needs of free trade and globalization because the vision of the Government of Rwanda is to build Rwandan economy oriented to the export.

Due to difference in prices of coltan and other Rwandan mining ores on the international market, the coltan was a case study. This research would be also useful to other students who can use it when writing their dissertations and theses.

## **1.7 STRUCTURE OF THE STUDY**

The research in hand was divided into five chapters. The first chapter introduced the subject matter, the problem statement, objectives, the scope, the significance and the structure of the study; the second chapter reviewed both theoretical and empirical literature on the Rwandan coltan and its competitiveness on the world market; the third chapter was the research methodology which focused on the research design, conceptual framework, sampling design and procedures, data collection instruments and procedures, methods of data analysis and presentation; the fourth chapter presented the analysis and interpretation of findings while the last chapter made the summary of findings, recommendations and conclusion.

## **1.8 SUMMARY**

In this chapter, the general introduction presented the background of the study by showing the situation of mining sector and the importance of Rwandan mineral in terms of exports revenues, especially for the Rwandan coltan, the problem statement specifying the challenges that undermined the mining sector, research objectives for this study, research questions, the scope of the study, justification and significance of the study and lastly the structure of the study into five chapters.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

The review of literature provided contextual and theoretical grounds for the study. The selection of literatures for inclusion in the study followed systematic reviews for the studies published in international peer review journals, books and other literatures. The theoretical literature was therefore reviewed under the following sub aspects: competitiveness, coltan (Colombo-tantalite), properties and uses of tantalum, primary and secondary production, concentration trading processing and product positioning. The researcher reviewed the empirical literature of the Rwanda coltan market after an overview of the international market. This chapter also aimed at narrating the problem which faced the Rwandan coltan on the world market through a gap analysis.

#### **2.2 DEFINITION OF KEY CONCEPTS**

##### **2.2.1 Competitiveness**

Competitiveness refers to "the ability of a country to produce goods and services that meet the test of the international markets and simultaneously to maintain and expand the real income and also rise the welfare level of its citizens" (Haque, 1995). Similarly, the Online English business dictionary (2014) defined competitiveness as the ability of a firm or a nation to offer or supply product and services that meet the quality standards on the local and world markets at prices that are affordable and provide adequate returns on the resources employed or consumed in producing them. As far as this work is concerned, the word competitiveness was used with its meaning from Cambridge Business Dictionary (2016) where it is referred as the ability of a product to compete successfully on the market.

##### **2.2.2 Coltan**

Coltan is short for columbite–tantalite, a mineral containing the elements tantalum and niobium. Niobium was formerly known as columbium, hence the name columbite-tantalite. The commercial value of mined coltan is mainly determined by its tantalum content. Coltan or

colombo-tantalite called ‘black gold’ is the name of an ore containing two rare metals with the same atomic structures: columbium (niobium, Nb) and tantalum (Ta). Tantalum is twice as dense as metal and has a high melting (2996° C) point. It is not present as such in the nature and beforehand there must be a transformation process. So, this makes it an excellent element for the production of heat resistant super-alloys and capacitors (The Hague Centre for Strategic Studies [HCSS], 2013).

### **2.2.3 Properties and uses of tantalum**

Tantalum is a rare metal with unique properties. Thanks to its high strength, resistance to high temperatures and corrosion, ductility, inertness to the human body and other properties, tantalum is used in many metal alloys and has applications in numerous industries. Tantalum joined the group of commercially useful elements in the last century. Despite the comparatively short history of its technological use, tantalum is now a key enabler of our information and communication-intensive society (HCSS, 2013).

Since the 1960s, the leading use of tantalum was as a powder or wire for capacitors within the electronics industry. Capacitors are electrical components that are used to store energy in an electric field. They are used in the electrical circuits of many common electronic devices. The tantalum capacitor has a high capacitance, which is the ability to store an electrical charge, per volume and weight. This makes tantalum capacitors smaller and lighter than their alternatives (for example, made from aluminum).

Despite their higher price, tantalum capacitors are widely used in mobile phones, computers and automotive electronics, where saving on weight and space is important. Besides capacitors, tantalum is used in many alloys thanks to its high melting point and resistance to corrosion. It is an essential component of many nickel-based super alloys, which are used for highly stressed parts, such as the turbine blades in aircraft engines and land-based gas turbines. Other uses of tantalum include mill products for sputtering targets and chemicals for audio and video components. Tantalum is also being used in the medical industry. Its chemical inertness and non-irritant reaction to living tissue make tantalum ideally suited for surgical instruments. (Espinoza, et al. 2012).

In the combination of coltan, the tantalum is the most appreciated. To determine the value of coltan, it is necessary to know its rate of oxide of tantalum. The value of coltan is proportional in its percentage of tantalum (generally between 20% and 40%) and in the content of oxide of tantalum (according to regions, between 10% and 60%).

#### **2.2.4 Primary and secondary production**

In addition to specialized tantalum mining, tantalum is also produced from tin slag and scrap. Tin slag is a by-product of tin smelting. Over the last decade tin slag has accounted for up to 20% of total tantalum supply. As stated by Roskill limited, tantalum and other metals, can be produced from different sources of scrap metal. There is scrap from manufacturing and scrap from products at the end-of-life. New scrap is the most widely available and most tantalum scrap is generated during the manufacturing of electronic components, cemented carbides and super alloys. The recycling efficiency and ultimately also the share of recycled tantalum in the total tantalum consumption, are determined by the amount of tantalum in scrap; tantalum prices; previous industrial experience; and available technologies for processing scrap. Before 2008, 60% of tantalum supply came from primary concentrates, a further 10% each from secondary concentrates and from tin slag. The final 20% of global production was accounted for by scrap recycling. After 2008, the share of production coming from primary concentrates dropped sharply to 10% in 2010, recovering to 27% by 2011. To compensate for the gap, tantalum production from tin slag and scrap increased.

#### **2.2.5 Concentration trading processing**

After mining, tantalum-containing ores are concentrated at or near the mine site to increase the share of tantalum oxide ( $Ta_2O_5$ ) in the concentrate. Tantalum ore traded on international markets should contain a minimum of 30% of  $Ta_2O_5$  (MACIG, 2014). Ores with lower grades of a minimum 20%  $Ta_2O_5$  may be acceptable to some buyers.

The next step after mining is the trading and processing of tantalum. Tantalum is usually traded in three forms: as ore concentrate, as tantalum oxides and salt, or as capacitor-grade tantalum. Tantalum is not traded on an open exchange, such as the London Metal Exchange. Instead, negotiations take place on a bilateral basis between buyers and sellers around the world. Prices

are privately discussed and purchase contracts between buyer and seller are confidential. Large shares of tantalum are sold through long-term contracts with fixed prices.

Traders subsequently ship the tantalum concentrates to processors. The processors extract the tantalum from the concentrates and then sell the refined material to producers of capacitors, sputtering targets and alloys, who in turn supply circuit board assemblers, and manufacturers of semi-conductors and components. They subsequently sell their products to original equipment manufacturers, which constitute the end of the global tantalum supply chain.

### **2.2.6 Product positioning**

Positioning a company's product or service is simply defining who you are in the customer's eye. Marketers attempt to create an image or identity for a product, brand or company and usually express positioning relative to other competitors in the market. When positioning a product or service, the key is to decide what the sustainable competitive advantage of the product is versus its chief competition. If a product has a sustainable advantage, meaning that the product has some unique offering competitors do not have and that it can hold long term, the product will have a better chance of success. Product positioning can be functional symbolic or experiential (Nielsen, 2016). For the case of Rwandan coltan, it can position itself based on its high quality which makes buyers buy it at a higher price compared to other minerals (coltan) from the rest of the world (MACIG,2014).

## **2.3 THE WORLD MARKET OF THE COLTAN**

This part described a portrait of quantified data relative to the world market of the coltan. It detailed the reserves, the production, exports, imports and the world consumption, as well as the establishment of the market value of the ore. This allowed to describe the structure of the coltan on the world market.

### **2.3.1 Coltan and international trade**

Tantalum materials are not openly traded, there is no stock market or spot market where prices could be compared. Purchase contracts are confidential between buyer and seller. Current data evidence reveals that Central Africa has become the major supplier for coltan on world markets in 2009 and 2010.



### **2.3.2 The Coltan Offer**

#### **➤ Reserves**

Reserves are the part of the resources that can be economically extracted using existing technologies at the time of determination. Tantalum reserves are quite significant and do not suggest any geological constraints on tantalum production at least in the medium-term perspective. Global tantalum reserves amounted to 120,000 tons in 2012 according to the United States Geological Survey (2012), one metric that can be used to compare the geological availability of different minerals is the reserves to production ratio. For tantalum this ratio suggests that there are more than 130 years of available supply (using the average primary production of tantalum in 2007-2011 of circa 910 tones). This is much more than for many other minerals.

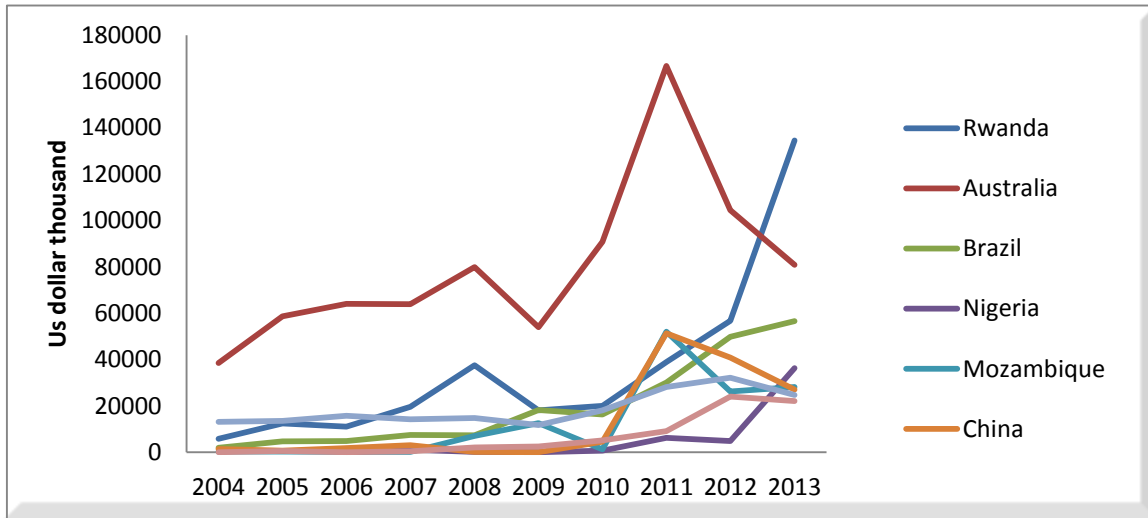
Generally, Australia, Brazil, Central Africa (mainly the RDC), Canada and Nigeria contain the biggest resources of coltan of the world, a scientific agency of the United States government, estimated, in 2013, the world reserves of tantalite, available short-term, 100,000 tons, distributed as follows: Australia 62%; Brazil 36%; other 2%. Tantalum resources and reserves are geographically widespread (Burt, 2010).

#### **➤ Evolution of offer**

The global tantalum production peaked in 2004 at just over 4500 tons; since then it has declined to about 3186 tons in 2007. Due to high demand by the electronics industry where it is a vital component in a wide range of consumer products, its production in 2008 increased. There was a decline of production (2009-2012) due to the temporary closure of both, the Wodgina and Green bushed mines, in Australia (MACIG,2014).

Production of tantalum is much more widespread although Africa, predominantly Rwanda and DRC, accounted for over 60 percent of tantalum production in 2012. Additional production comes essentially from Brazil and China. In 2012, six main producers (Rwanda, DRC, China, Australia, Canada & Brazil) represented only 80% of the world production.

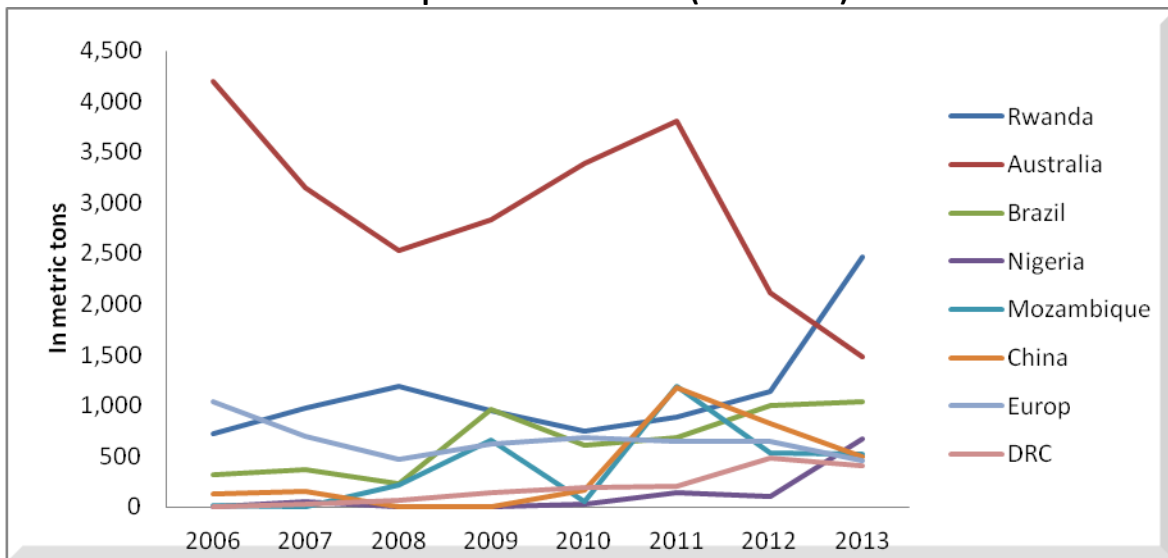
**Chart 2.1 Evolution of world exports (USD dollar thousand)**



**Source:** <http://www.intracen.org/itc/market-info-tools/trade-statistics/>

Contrary to the situation where Australia and China were remained long time the big world producers, the chart 2.1 highlights the advantage of Rwanda in 2013 which outclassed Australia, due to an increase of 200% compared with year 2012 (in term of revenues).

**Chart 1.2 Evolution of world exports in metric tons (2006-2013)**



**Source:** <http://www.intracen.org/itc/market-info-tools/trade-statistics/>

In comparison to their production, the chart above shows that Brazil and Australia exported over their production in last five years (2008 till 2013), whereas over the same period, Rwanda exported 100 % of their production. It means that Brazil and Australia export their reserves estimated more than 70.000 tons in 2013.

The principals exporting countries represent only 55% of the world exports. Africa supplies approximately 52%, and then Australia arrives far behind with 18% of the exports, follows South America and China with respectively 17% and 6% (USGS,2013).

The coltan is a product which depends strongly on geological conditions and this dependence has a strong incidence on export and is partially responsible of offer's fluctuations but geological conditions are not the only variables determining the offer, other factors should influence its increasing or its reducing like the geopolitical situation of Central Africa, the quality or superiority of grades, the price level, the extent and timing of inventory drawdown's, and the availability of financing for development of Greenfield projects (USGS,2011).

### **2.3.3 The demand of coltan**

#### **➤ Evolution of the demand**

Currently, the coltan is used, after refining to tantalum powder, in the production of electronic components, mainly as tantalum capacitors. Alloyed with other metals, tantalum is also used in making carbide tools for metalworking equipment and in the production of super alloys for jet engine components. Substitutes, such as aluminum, rhenium, titanium, tungsten, and zirconium, exist for tantalum but are usually made at either a performance or economic penalty.

Between 2006 and 2008, the imports of coltan decreased over 10% due to the international recession. After a sensitive increase of imports during two years, then a pick in 2011, the demand decreased from 2012. According to analysis from statistical data of International Trade Center (2012), this evolution reflects the reduction of imports by main consumers since 2012.

#### **➤ Analysis of the consumption**

According to International Trade Center statistics database (2012), the main consumer countries of coltan as raw material are mainly China, Australia, Spain and United Kingdom. China constitutes of the large part of the market. China consumes only 52% of the world total consumption.

Except China, the evolution of the consumption is relatively stable. The evolution of the consumption should be understood by an analysis of demand.

#### **2.3.4 The world price of the coltan**

Like the prices of other minerals, prices for tantalum ore are mainly influenced by developments in the supply and demand for products in which it is used.

According to (Papp, 2008), the first price surge occurred from 1978 to 1980 when average prices rose from about 66 US\$/kg in 1977 to over 284 US\$/kg in 1980 (these are nominal average prices at the end of the year as reported by the USGS). The second rapid escalation in tantalite prices occurred in 1988 when tantalum prices almost doubled from about 70 US\$/kg in 1987 to 135 US\$/kg in 1988. This price peak was due to increased tantalum demand and depleted tantalum inventories.

The third price boom led to record tantalite price levels in 2000. From 1999 to 2000, prices rose more than six-fold from 91 to 590 US\$/kg due to expectations of high demand in the electronic industry, over-ordering and apparent shortage.

Finally, after the period of quite stable prices from 2001 to 2010, in 2011 tantalite prices surged to 340 US\$/kg, more than the double level of 2010 or triple of 2009. It is probably too early to single out specific factors driving the current price surge but most likely that significant cuts in mine production have played a substantial role.

By early 2011, demand for tantalum weakened again during 2011 and the average spot price published by Metal Pages slipped from US\$133/0.45kg to about US\$100/0.45kg by year-end. Another recovery in prices occurred in 2012, with a level of US\$125-135/0.45kg being reached by October. In late 2012, renewed fighting in the DRC once again raised the possibility of a widespread reluctance to purchase tantalum minerals from anywhere in the region, and with it the possibility of a sharp upward movement in tantalum prices (Teeffelen, 2012, p 28).

#### **2.3.5 Dodd-Franck Act**

In recent years, there has been an increasing international focus on “conflict minerals” emanating from mining operations in the Democratic Republic of the Congo and adjoining countries. Armed groups engaged in mining operations in this region are believed to subject

workers and indigenous people to serious human rights abuses and are using proceeds from the sale of conflict minerals to finance regional conflicts.

On 21 July 2010, in response to these concerns, the United States Congress enacted legislation that requires certain public companies to provide disclosures about the use of specified conflict minerals emanating from the DRC and nine adjoining countries (Central Africa Republic; South Soudan; Zambia; Angola; Congo; Tanzania; Burundi; Rwanda and Uganda). The Dodd–Frank Act in section 1502 is intended to make transparent the financial interests that support armed groups in the DRC area. By requiring companies using conflict minerals in their products to disclose the source of such minerals, the law is aimed at dissuading companies from continuing to engage in trade that supports regional conflicts (Ernest Young, 2012).

## **2.4 THE MARKET OF RWANDAN COLTAN**

This part analyzes the positioning of the Rwandan coltan at the level of the world market after an overview of the Rwandan mining sector, the artisanal and the industry of coltan, highlighting the stakes which it faces. Rwanda being a producer and exporting country of the coltan, its positioning in the world market will be approached at the level of offer, demand and evolution of the price.

### **2.4.1 The mining sector of Rwanda**

The mining sector was recently privatized. Less than 10 years ago, all mining businesses were owned and ran by the government. The privatization process for mineral concessions, began in 2006, followed several attempts to finance the country's mining activities since independence, which improved production levels, productivity and value addition. In 2012, high export growth rates have been supported by international commodity prices for Rwanda (World Bank, 2014, p.59).

According to the National Bank of Rwanda report (2012, p 45), FDI inflows in 2012 of US\$73 million were mainly concentrated in the mining sector. The value of mineral exports for 2013 is set at USD 225 million slightly more than half way to reaching its 2017 target of US\$ 400 million set by the second Economic Development and Poverty Reduction Strategy (EDPRS2).

Mining in Rwanda concentrates on base metals such as cassiterite, coltan, and wolfram, and is primarily small scale in size and method. In 2013, Rwanda has issued 548 mining permits to 213 registered mining entities, most on surface areas averaging less than five hectares. Among

213 registered mining entities, only 5 are operational with either total foreign involvement or joint ventures with the government. The remaining constitutes small domestic entrepreneurs or mining cooperatives (World Bank, 2014, p13).

The Rwandan government has identified mining as a high priority industry in Vision 2020 of our country. It has turned a careful eye towards encouraging private sector development and expanding the country's mineral portfolio. The Rwanda Mines and Geology Authority's strategic plan for 2010-2013 furnishes a roadmap for industry improvement.

#### **2.4.2 Artisanal mining**

The tantalum supply chain starts with the mining of tantalum containing ores. Conventional, artisanal and small-scale mining take place around the world. The Great Lakes region is the center of tantalum mining in Africa with the DRC being the largest African producer. Most of tantalum mining in Africa is artisanal and small-scale.

Artisanal and small-scale mining are done by individuals, family units, worker cooperatives or small companies with minimal or no mechanization, often informally or illegally. Not every mineral is suitable for artisanal mining. Geological factors that support economies of scale and mechanization (uniformity of deposit, width of ore bodies, depth, overburden) tend to render artisanal and small-scale mining unprofitable (Dorner, Franken, Liedtke and Sievers, 2012).

The most important factor for the economic competitiveness of artisanal mining is a high value per unit of weight of the ore mined. Coltan is a quite valuable material in this respect with prices having exceeded US\$100 per kg of tantalum content. It is therefore no coincidence that artisanal mining accounted for more than a quarter of total global production of tantalum in 2009, which is one of the highest percentages compared to other metals. According to Dorner et al., (2012) since Artisanal Small scale Mining is based on extensive use of labor, low wages are also essential for its economic competitiveness. Finally, the factors that make large mining investment more expensive or risky also make small scale mining comparatively more attractive. Such factors might include remote location of deposits, difficult terrain, absence of infrastructure (roads, electricity, water), and high political risk including lack of rule of law.

Compared to industrial mining artisanal mining is a less capital-intensive method of mining. Other features of ASM include flexibility and a fast response time. For a large industrial mine,

it typically takes many years to bring the mine into production, while mines developed by artisanal miners can often start producing in a few days. The ability of artisanal mining to react quickly to changes in the market comes from the fact that artisanal miners typically do not have labor contracts with fixed wages but are paid on a fixed percentage of their production (HCSS, 2013).

### **2.4.3 The industry of coltan**

By far the smallest subsector of the industry, tantalum production accounted for roughly 3.7% of Rwanda's mineral production in 2008. Tantalum production and exporting are managed by a range of small mining cooperatives and several mineral traders. The production of coltan in terms of metric tons increased more than 60 per cent from 2006 to 2008 due to the entry of semi-industrial companies in the sector but its production remained little compared to other minerals.

After 2008, the production declined till 2010, there was a distrust of Rwandan producers and traders due to the global economic downturn and to the implementation of Dodd Franck Act.

In recent years, the production augmented more than 60 % every year. The price of coltan by kilo is better than other ores.

The supply chain of coltan industry comprises three stages: production, inspection/certification, trade and export. In the first stage, miners work on permitted sites granted by the Ministry in charge of mining. Sites are organized according to working teams that perform extraction, washing, and minimal processing at the site.

In the second stage, there are inspection of the sites to empower the mining law and certification of the mineral according to international requirements. The certification can be done just before or after trading.

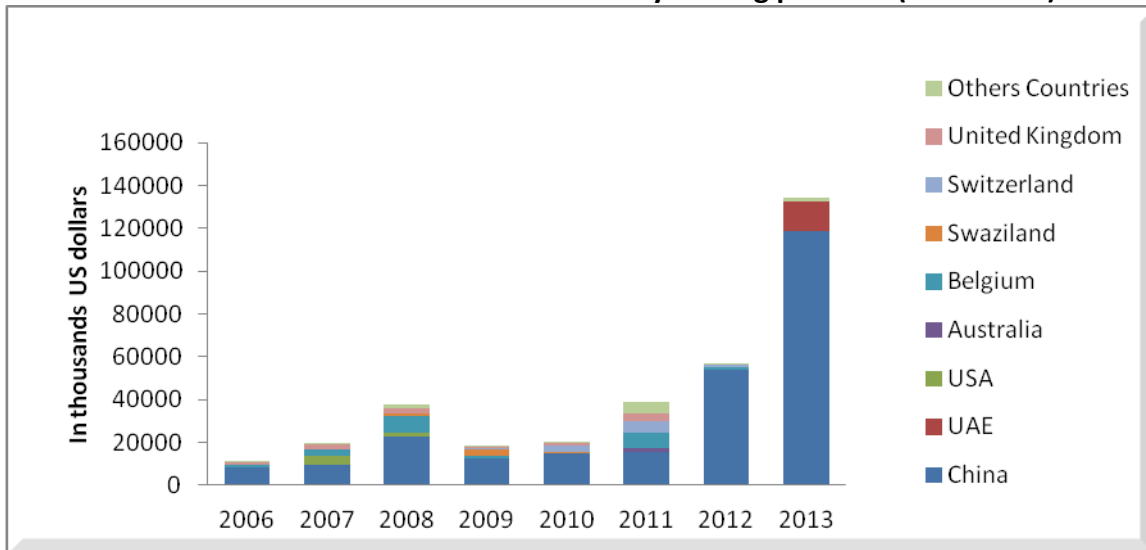
In the third stage, mineral traders purchase production from the various mine sites. In Kigali, this domestic production is aggregated either from mine sites or through middlemen to a few mineral traders who carry out processing and exporting. Although traders typically have long-standing relationships with specific mine sites, ultimately the price offered and the time lag between purchase and payment determine to whom a mine operator sells.

## 2.4.4 The positioning of the Rwandan coltan on the world market

### *a. Positioning with regard to exports*

Since 2010, exports of coltan increased compared to other minerals. In 2010, the exports of coltan represented 6.22% of total exports and 27% of total mineral exported in terms of value while in 2013, they represented 14% of total exports and more than 60% of minerals exported (NBR, 2013, p.25). The value of coltan exported increased more than 700% in 10 years. Thus, the Rwandan industry of coltan is promising for investors.

**Chart 2.3 Evolution of trade of Rwandan coltan by trading partners (2006-2013)**



**Source:** <http://www.intracen.org/itc/market-info-tools/trade-statistics/>

Today, as stated in the International Trade Commercial (2013), Rwanda being the one of the biggest exporter of coltan as raw material on the world market is also the first supplier of the first consumer, China. In recent years, China oriented its demand to the Rwanda by the quality of the product; the oxide of tantalite could exceed 45%. The Dodd Franck Act is not applied by this country (MACIG, 2014). The Rwandan part in the exports remains very high (first semester 2014) at the world market (World Bank, 2014).

### *b. Positioning with regard to price*

From 2011 up to now, Rwanda has sold the quasi-totality of its coltan to the Asian market specifically in China at lower price compared to European or American prices, due to the law



of Dodd and Frank Bill which forbid the purchase of coltan from the Central Africa due to mineral conflicts.

The evolution of the world price and the one of the Rwandan coltan on the world market increased in parallel but the price of Rwandan coltan on the world market remained low compared to the world market, except in 2008 and 2011. However, the differences are not important; they are less than 10% since 2011. Rwanda produces a coltan of quality (more than 40 % tantalite by kg of coltan). During the period 2006-2013, the Rwandan coltan has been sold to some markets at high prices (MACIG, 2014). For instance, from 2009 to 2013, the Rwandan company, Roka, sold the coltan at the best price compared to the companies of the region, respectively from 25.1 USD/Kg to 64.58 USD/kg in Australia, Turkey and United Arab Emirates. So, Rwanda can succeed in competing at the level of price in proposing on the world market, given the top-quality of coltan.

In this context, comes a question related to alternatives which can enable the Rwandan coltan to have a durable position on world market in increasing its level of prices. Since 2011, Rwandan coltan thanks to its quality can grasp high prices compared to the average of the world.

## **2.5 GAP ANALYSIS OF MINING INDUSTRY**

Gap analysis compares the gap between an industry's actual performances against its potential performance. In gap analysis, you typically list out the industry's current situation, its desired state, and a comprehensive plan to fill out the gap between these two situations. This analysis has been reflected to the table below:

**Table 2.1 Gap analysis**

<b>Objectives</b>	<b>Current status (end 2013)</b>	<b>Current deficit</b>	<b>Strategies to be implemented</b>
<p>Investments in mineral exploration to delineate mineral resources /reserves in all identified Prospective Target Areas (PTAs);</p> <p>Three medium-scale mines and 100 small-scale mines by 2017;</p> <p>USD 500 million as investments by 2017;</p> <p>USD 400 million on mineral exports by 2017;</p> <p>Increase mineral production to 18,000 tons by 2017;</p>	<p>Investments in mineral exploration are not regulated;</p> <p>Small scale mining sector and few semi-industrial activities;</p> <p>USD 125 million as investments (premises included);</p> <p>USD 225 million from mineral exports;</p> <p>Mineral production: 8,000 tons;</p>	<p>Gap in geological suveying/exploration. There is need to update the national potential;</p> <p>Largely unregulated artisan mining;</p> <p>Lack of basic field and laboratory equipment for OGMR to carry out adequate generation of new geological data;</p> <p>Very few professionals and technicians in the sector;</p> <p>No value addition;</p> <p>High cost of energy and transport;</p>	<p>Build the geological knowledge base for future investment;</p> <p>Modern technology is needed to upgrade sector to a semi-mechanized;</p> <p>Creation of geological institutions for training relevant professionals;</p> <p>Aiming at value addition and production;</p>

60,000 jobs by 2017/2018, at least 30 % female;	33, 368 miners registered;	Low level of financing of local mining companies/cooperatives;	Attractive reforms;
Mining and quarrying contribution to nominal GDP is projected as 5.27 % by 2017/2018;	Mining contribution to GDP : 1,6%;	Export of no refined mineral ores;	Eliminate trade barriers;
The percentage of the certified mines to 100% by 2017.	Percentage of the certified mines: 22%.	Low level of investment in industrial minerals and rocks;	Mobilize funds from partners and private sector.
		Little participation of local financial institution in direct investment in the mining sector.	

**Source:** World Bank (2014, pp 7-48)

## **2.6 GAP IN LITERATURE**

There is a gap in the literature. Books that the researcher used analyzed the impact of coltan as sub-mining sector on the development of Rwanda, they did not address an important aspect of the research problem. Indeed, the link between specifications of the Rwandan coltan as raw material and its competitiveness was not deeply addressed by authors and scholars, especially in the context of Rwanda. It is also a particular question which preoccupies the researcher in his particular research. The central question “What are the effects of specifications of the Rwandan coltan on its competitiveness?” is a specific question which has not been purposefully addressed by researchers but will be explored and discussed in the next chapters.

## **2.7 SUMMARY**

This chapter highlights definitions of key concepts, the existing literature and theories of different authors on the world market of coltan through its demand and supply, the coltan exported, imported and consumed. This chapter has also analyzed the positioning of Rwandan coltan on the world market with regard to export, prices and production costs.

The following chapter is centered on research methodology showing how the study explored the effects of specifications of Rwandan coltan as raw material on its competitiveness. Research design, conceptual framework, study population, sampling techniques and sample data collection are relevant to this chapter.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

The purpose of this study is to analyze the Rwandan coltan competitiveness on the international market through specifications of its offer, to identify specifications which characterize the competitiveness of Rwandan coltan; and to identify possible challenges faced by Rwandan coltan on the world market and proposed mitigation measures.

To conduct this research, a mixture of qualitative and quantitative approaches were adopted. This part covers the research design, the conceptual framework, the study area, population of the study, sample size, sampling procedure, data collection methods and instruments, procedure for data collection and data analysis.

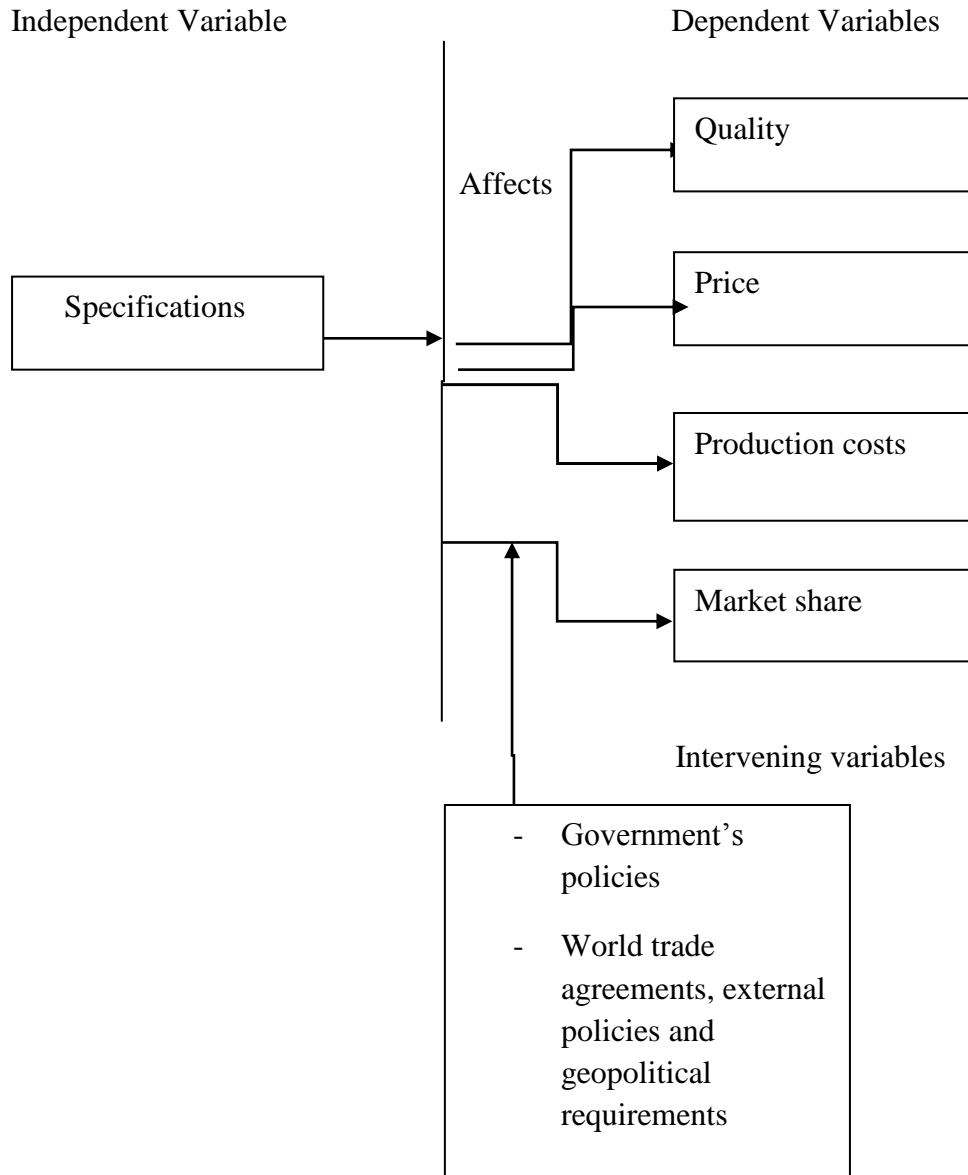
#### **3.1 RESEARCH DESIGN**

The study in hand adopted both qualitative and quantitative approaches. The design of the present research was a case study. This facilitates in-depth examination of all variables at play with a view of providing rich data and a more comprehensive understanding of issues and problems related to competitiveness of Rwandan coltan specifications on international market.

#### **3.2 CONCEPTUAL FRAMEWORK**

A conceptual framework is an hypothesized model identifying the concepts under study and their relationships. In this framework, there are effects of specifications of the Rwandan coltan, as raw material, on its competitiveness.

**Figure 1 Conceptual framework of the study**



This figure demonstrates the direct link between specifications of the Rwandan coltan (the independent variables) and competitiveness composed by 4 central pillars which are: quality, price, production costs and market share (dependent variables).

Indeed, quality is one of the key determinants of the competitiveness. It is determined by its technical ingredients or features. When these features respect international requirements, the

product is considered as high qualified when specificities exceed the average. For the case of the Rwandan coltan, its tenor in oxide of tantalite exceeding 35% often per tantalum kilo considered as the maximum average.

The level of price is generally regarded as a key feature of competitiveness, and an essential prerequisite for its measurement. Two options can be presented, either the product is cheaper with high quality or the product is expensive due to its quality. Our case is reflected by the second option.

Given that the Rwandan coltan as raw material has its territorial specificity, benefiting any value added and worked without mechanization, cheap labor costs, some production costs are not important. Thus, mineral traders take this advantage contributing to the competitiveness.

The Rwandan coltan being qualified will allow the country to increase its market share on world market.

In this framework, the specifications could directly or indirectly influence the competitiveness. Indeed, features of the Rwandan coltan are relevant because they basically contribute estimating a high quality product, cheap production costs towards achieving the right results and so increase the market share.

The Governments' economic, political, legal and social policies, external policies and geopolitical requirements (intervening variables) may become a big obstacle to enhance the competitiveness of the Rwandan coltan. As mentioned above, government's policies have a significant impact to improve the competitiveness in attracting investors and in solving some geopolitical issues. These factors may affect the competitiveness of the Rwandan coltan obtained by its qualified specifications.

### **3.3 STUDY POPULATION**

This refers to population from which the sample actually was drawn and which conclusion could be made. The total population for this study was 92 including 67 coltan mining companies (including cooperatives) officially registered in RMGA and 25 officers from stakeholders agencies and ministries (See appendix 4).

## Sampling methods and sample size

A sample is part of the target population, carefully selected to represent that population. The sample size for this study is 48 respondents and they include 27 Chief Executive Officers, 4 Managing Directors and 5 Directors of operations of mining coltan's firms (including traders), in particular and other part, 12 analysts involved in elaboration of policy and reforms about the mining sector in Rwanda (MINIRENA, MINICOM, RMGA, RDB, RBS and PSF). For getting representative sample for the study population, the researcher used purposive sampling method and Sloven's formula to arrive at sample units; sampling consisted of selecting 1 from extracting company and 2 respondents from government's institutions. The rationale behind is that it is believed that purposive sampling provides sample units with relevant information for the study.

The following Sloven's formula is used to compute the sample size from the total population of 48 people as mentioned above.

### Sloven's formula:

$$n = \frac{N}{1+NE^2}$$

Where:

n = sample size

N = population size

E = margin of error 0.10

$$\begin{aligned} \text{Sample} &= \frac{92}{1+(92 \times (0.10)^2)} \\ &= 92/1.92 \\ &= \mathbf{48} \end{aligned}$$



**Table 3.1 Categories of respondents**

Respondents	Population	Sample size	Sampling method
Officers (government's institutions)	25	12	Purposive
CEO (27), MD (4), Directors of operations (5) of mining companies	67	36	Purposive
<b>Total</b>	<b>92</b>	<b>48</b>	

**Source:** Analysis from Sloven's formula

The study involves a total of 48 respondents.

To get the sample size for quantitative data, simple random sampling method which refer to a subset of individuals (a sample) chosen from a larger set (a population) has been used to select the respondents and the lottery method used to determine the sample size. The researcher conducts a lottery where slips of paper containing the names of all coltan extracting companies and by constant shaking at different intervals, the researcher picks out 36 representatives of companies (CEO,MD and Directors of Operations) involved in the mining sector, particular in coltan ore and considers them to participate in the study. This method is used because each and every item of population has an equal chance of inclusion in the sample and each one of the possible samples, in case of finite universe, has the same probability of being selected.

For qualitative data, the key informants selected using purposive sampling and by definition are a non-representative subset of some larger population, and are constructed to serve a very specific need or purpose. Those informants were given in depth interviews. The sample size is 48 informants. This method is used because the results are expected to be more accurate.

### **3.4 DATA COLLECTION INSTRUMENTS**

The study was a mixture of quantitative and qualitative approaches. Primary data forms a significant part of the study. The primary data was collected using open and closed ended questionnaires and interviews of respondents. Primary data was collected to obtain data on every research question of the study. The researcher used face to face interview and self-administered questionnaire to a large sample of population and was therefore intended to find facts in relation to study.

This study used both primary and secondary data in order to test and answer questions concerning the current status of the subject of study through the administration of open and closed ended questionnaires study respondents.

Primary sources come straight from the people or works being researched and therefore the most direct kind of information that can be collected (Roth, 1989, p 57).

This regards raw data collected through individual efforts of the researcher. The techniques adopted are questionnaires and interviews. The questionnaire has been prepared to give respondents the occasion to give their opinion and at the same time not to waste too much of their time hence the inclusion of the closed ended questions. Printed questionnaires were self-administered to all respondents (48).

The interview was used and discovered how respondents (MINIRENA, MINICOM, RDB, RBS, RMGA officials in charge of trade and CEO and Managers Directors for mining companies) perceive the competitiveness of Rwandan coltan on world market by a specification of its offer.

Interviews were conducted where necessary to obtain relevant required data. With this method, selected respondents were asked questions to find out what they do, they think or feel about the competitiveness of the Rwandan coltan.

#### **Secondary data**

Secondary data is the data that already exist in some companies or organizations in the form of documents and the internet (David Crowther, 2005, p 95). The researcher reviewed literature of

previous researchers, scholars and academicians related to the topic under study, reports and others sources like internet.

The data collected was quantitative in nature. The secondary data was useful in providing detailed insights and knowledge on the investigated topic and it provided guidance to the formulation of research goal.

### **3.5 PROCEDURE FOR DATA COLLECTION**

The researcher has communicated to relevant authority to look for access to respondents. The researcher gave explanation that the information given was for research purposes. The face-to-face interview guide used for key informants in their respective capacities through appointments. Self-administered questionnaires gave out personally by the researcher to the selected sample.

#### **3.5.1 Variables**

A variable is a measurable characteristic that varies, it may change overtime. There are two different types of variables which are: independent variable (specification of Rwandan coltan) is thought to influence the dependent variable (competitiveness of the Rwandan coltan) which is a variable that is explained by one or more variables.

#### **3.5.2 Reliability and validity of the research instruments**

The content validity was made sure through the utilization of valid concepts which measure the study variables. Construct validity was based on the fact that questionnaires are valid content and this was achieved through a pilot study where the researcher first tested the questionnaires with five members from the main respondents before going into data collection. Not only that but also it was based on the results from the pilot study and then the researcher was able to ascertain the reliability of the data collection tools (<http://www.ajhepworth.yolasite.com/resources/9817-Reliability%20and%20validity.pdf> levied on 13<sup>th</sup> December, 2013).

The questionnaire used in this research was very concise and clearly related to the subject in such that respondents were very comfortable to answer the questions and thus having reliability and validity of this study. The researcher has chosen a sample of more than 50% of the population

working in the Government's institutions and Managing Director of mining's firms to ensure that the information given is accurate.

### **3.5.3 Administration of research instruments**

Primary data like the original information was collected using questionnaire. After approval of the research proposal, an introductory letter from University of Rwanda which was addressed to different actors involved in the excavation of mines and establishing reforms and policies about trade that the questionnaires were given out. The respondents were explained about the research and asked to answer the questionnaire. On retrieval, all returned questionnaires have been checked. The gathered data was collected during five months, from May 2014 to September 2014, encoded into the computer and treated using the excel software for interpretation through tables for two months.

The research questionnaire has been answered within three months while the interview guide took more time due to many appointments postponed.

## **3.6 DATA ANALYSIS**

The rationale is that once questionnaires have been administered, the mass of collected raw data was systematically organized in a manner that facilitated analysis. The data from responded questionnaires (48) were collected and checked for completeness, this involves presenting the results in a logical and sequential way for making conclusions.

### **3.6.1 Qualitative analysis**

Qualitative data were edited, coded and analyzed into themes, which were made using concepts originating from the objectives of the study, if any specification to colombo-tantalite extracted in Rwanda contributes to its competition, the relationship between specification and competition, constrains of Rwandan coltan to face to the world market and solutions to the identified restrictions.

### **3.6.2 Quantitative analysis**

To analyze quantitative data, descriptive statistics were used to show percentages of how respondents agree or disagree with the statement.

So, quantitative data are anything that can be expressed as a number, or quantified while qualitative data cannot be expressed as a number.

Both types of data are valid types of measurement, and both are used in education journals.

### **3.6.3 Data processing**

After data collection, it is duly processed to get meaning results. During data processing, relevant data to the objectives of the study was considered and transformed into meaningful information for easy interpretation and understanding. This was done through editing and tabulation.

In editing process, errors were identified and this was done first to ensure completeness and accuracy, uniformity and legibility in the questionnaires.

After editing process, tabulation was considered and involved putting data into statistical tables such a percentage and frequency to show the number of responses to particular questions.

The contents of the tables are usually frequencies, percentages or statistical measures. This is reduction of data gathered to some torn suitable for analysis and is done by the help of data processing that uses editing and tabulation. Therefore data was processed and findings were presented in form of tables from which recommendations and conclusions were based.

## **3.7 ETHICAL CONSIDERATION**

Before getting any information from the respondents, the researcher explained the purpose of the study to the respondent, and assured them that all data collected from them would be coded to protect their identity and privacy. The researcher had the obligation to protect from harm, unnecessary risks, or mental and physical discomfort that may be inherent in this research.

### **3.8 SUMMARY**

This study aimed at evaluating the impacts of specification on the competitiveness of the Rwandan coltan. It was an evaluative research design drawn from qualitative and quantitative approaches in order to discover if there was any relationship between the competitiveness of the Rwandan coltan and specification of its offer and to see how to get high price for the Rwandan coltan. The researcher has taken into account the location of the target population. The study involved Government's institutions and mining companies involved in the excavation and trading of coltan. The target population was 25 public officials from ministries and agencies and 67 seniors managers from mining companies. Library and internet were used to get information from authors and scholars who stressed on the subject even though they were not many.

This chapter gave an overview of the methods and instruments used by the researcher throughout his work. The instrument used was the questionnaire embodying questions (closed ended questions and opened questions) that allowed getting the accurate information the researcher needed. The next chapter analyzed and interpreted the results of the study.

## CHAPTER FOUR

### ANALYSIS AND INTERPRETATION

This chapter dealt with data analysis to assess the competitiveness of the Rwandan coltan on the world market through a specification of its offer. The fourth chapter presented findings of the research conducted for the purpose of identifying specifications which contribute to the competitiveness of Rwandan coltan and the possible challenges faced by Rwandan coltan in terms of competitiveness. Findings were presented in relation to the research questions and research objectives.

The researcher processed information collected on each of the statements (or questions). The questionnaire given to respondents comprised 23 statements using the likert scale and 5 open questions (48). The level of agreement in percentage of respondents (%) to the following statement using the likert scale stated below: **1** – Strongly Disagree (SD) **2** – Disagree (D) **3**- Neither agree nor disagree (NAD) **4**- Agree (A) **5**-Strongly agree (SA) **6**-No answer (NA)

#### 4.1 SPECIFICATIONS OF RWANDAN COLTAN

##### 4.1 Statements on specifications of Rwandan coltan

		<b>SD</b>	<b>D</b>	<b>NAD</b>	<b>A</b>	<b>SA</b>	<b>NA</b>
1	The tenor in oxide of tantalite characterize the quality of coltan				13	87	
2	The quality of Rwandan coltan is different according to regions				13	87	
3	There is a differentiation between the tenor in oxide of tantalite of coltan mined in Central Africa particularly the one extracted in DRC and the Rwandan coltan.	58	31	11			
4	Certifications done in Rwanda are accepted on the				37	63	

	world market						
5	The process of origin certification is imposed for all mineral exported	15	35			50	
6	No packaging of Rwandan coltan is done in Rwanda					100	
7	Rwanda re-exports coltan			52	25		23
8	The traceability of Rwandan coltan is electronic			58	42		

**Source:** Primary data 2014 N=48

The table above showed that 87% strongly agree that the tenor in oxide of tantalite characterize the quality of coltan while 13% agree with the statement. In the same view, 87% of the respondents strongly agree that the quality of Rwandan coltan is different according to regions. The tenor in oxide of tantalite in Rwanda varies from 35 % to 55 %. The coltan from Rwamagana District (45-55%) is different from the one excavated in Kamonyi District (35-40%) in terms of tenor in oxide of tantalite, confirmed also by the same respondents.

The analysis also showed that the coltan from DRC is not better than the Rwandan coltan. In spite of some geological features that can be considered to be not very different, it is noted that 58% of respondents working in the mining sector strongly disagree there is a differentiation between the tenor in oxide of tantalite of coltan mined in Central Africa particularly the one extracted in DRC and the Rwandan coltan. 31% of respondents disagree and 11% neither agree nor disagree. As far as the certification is concerned, the analysis showed that certifications done in Rwanda are accepted on the world market. From results, 63% of respondents strongly agree and the other agrees (37%). It is interesting to relate that the certification is done by a government agency (RMGA) and SGS, an international firm for origin certification. A quality analysis of the ore is done by Alex Stewart, an international laboratory.

The process of origin certification is imposed for all mineral exported and is initiated by mineral traders. The findings indicate that 35% of respondents disagree, 15% strongly disagree and 50% strongly agree. The certification is crucial because external policies enforced it.



For the statement asking whether no packaging of Rwandan coltan is done in Rwanda, it was reported that from results, all respondents (100%) agree. The Rwandan coltan as raw material benefits no packaging, it is tagged and putted in bags for export.

As displayed to the table above, 52% respondents questioned neither agree nor disagree that Rwanda re-exports coltan, 25% agree and the remaining didn't answer to this question (23%). It is not allowed by external policies to import ore from DRC or Burundi for re-exportation. However, the Rwandan law allows to re-exports coltan if there is a value added of 30% done in the country. Today, it is not the case but in the recent future, they expect to do it.

Concerning the traceability of Rwandan coltan, the findings indicate that 58% respondents neither agree nor disagree that is electronic. 42% agree. ITRI policies recommending the e-traceability according to e-commerce mechanisms (international transport).

Similarly, data collected from interview on the question where respondents were asked to say which region in Rwanda a good quality of coltan can be found (high tenor in oxide of tantalum 35-45%), more than eighty percent (80%) of the interviewees indicated that the Eastern Province (Rwamagana, and Gatsibo, Bugesera Districts), the Western Province (Kamonyi and Rutsiro Districts) and Southern Province (Huye and Nyanza Districts) contain a high potential quality of coltan, especially in Rwamagana District where the tenor in oxide of tantalite reaches 55%. However, these sites are quasi unexploited or insufficiently exploited due to the lack of investors.

**Table 4.2 Factors affecting the competitiveness of the Rwandan coltan**

<b>Factors</b>	<b>Relationship (%age)</b>
Price	<b>3</b>
Production cost	<b>15</b>
Quality	<b>20</b>
Refining	<b>15</b>
Certification	<b>5</b>
Packaging	<b>2</b>
Bank financing	<b>20</b>
Incentives reforms	<b>10</b>
Aggressive promotion	<b>3</b>
Great lakes good relationship	<b>7</b>
<b>Total</b>	<b>100%</b>

**Source:** Primary data 2014 N=48

As far as the question on what factors (Price, Production cost, Quality, Refining, Certification, Packaging, Bank financing...) should affect more the competitiveness of the Rwandan coltan in the world and at what extent in percentages, the data analysis from the table above showed that the majority of respondents believe that factors which should affect more the competitiveness of the Rwandan coltan are the quality (20%) and the financial capacity to transform the semi-scale mining sector into semi-industrial or industrial sector (20%). The refining process is also imperative but without capital, there is no transformation process. It is noted that this factor is the third (15%) with the production cost. By production costs, it is understandable expenses related to the process of supply chain (cost of land hiring, labor, energy, transport, certification, laboratory analysis...). Incentive reforms should also influence investors to capitalize the sub sector as observed in section above (10%). Prices, certification and packaging are not factors influencing predominantly the competitiveness of coltan.

## 4.2 THE COMPETITIVENESS OF THE RWANDAN COLTAN ON THE WORLD MARKET

**Table 4.3 Competitiveness of the Rwandan coltan on the world market**

		SD	D	NAD	A	SA	NA
1	The artisanal technology used by mining firms is more competitive than semi-mechanical technology		52	21	27		
2	The cost of production, particularly the labor cost is competitive on the world market			15	85		
3	The Rwandan coltan is competitive on the world market by its quality			7	62	31	
4	The Rwandan coltan can be competitive on the European and American market as of China market			21	79		
5	The price of Rwandan coltan is higher on others markets than China market			27		73	

**Source:** Primary data 2014 N=48

As far as the artisanal technology used by mining firms is more competitive than semi-mechanical technology. As displayed in the table above, 52% of respondents disagree with the statement, 27% agree and 21% neither agree nor disagree. Respondents noted that the using of semi-mechanical technology brings more added values, so that coltan becomes more competitive.

Concerning the cost of production, particularly the labor cost is competitive on the world market, data analysis indicated that 85% of respondents agree and 15% neither agree nor disagree. The labor cost of China is also very low comparatively to Africa.

For the Rwandan coltan which is competitive on the world market by its quality, the findings indicated that 31% of respondents strongly agree, 62% agree while 7% neither agree nor

disagree. The quality of Rwandan coltan is known by its high tenor in oxide of tantalite (more than 40%) compared to others countries which have only 15% of this oxide per tantalum kilo.

It was agreed that the Rwandan coltan can be competitive on the European and American market than on China market. Given that the price on the Western market is more attractive, 79% of respondents think that the Rwandan coltan can be competitive on those markets. 21% neither agree nor disagree.

Concerning whether the price of Rwandan coltan is higher on others markets than Chinese, findings indicate that 73% respondents involved directly in the international trade strongly agreed, the remaining (27%) neither agree nor disagree. Prices in Turkey and UAE are better than one's of China.

#### 4.3 CONSTRAINTS TO COMPETITIVENESS OF COLTAN MINED IN RWANDA

**Table 4.4 Statement on the constraints to competitiveness of coltan's product extracted in Rwanda**

		SD	D	NAD	A	SA	NA
1	The cost of land exploitation is not affordable		52		48		
2	Some requirement standards like reporting imposed to mining companies are not done, so their products are not sold on European and American markets		69	31			
3	The cost of certification is expensive		21		79		
4	The no existence of refining mining firm into powder from concentrate metal constitutes a constraint to competitiveness of Rwandan coltan		21	16	31	32	

**Source:** Primary data 2014 N=48

As displayed in the table above, results revealed that agents of ministries (52% of respondents) disagree while managers of mining companies (48%) agree that the cost of land exploitation is not affordable for small investors. The land is expropriated, there is a direct negotiation between the buyer and sellers (population). Thus, the cost of land depends on the price per square meter fixed by the population (seller). Generally, it is higher compared to the price imposed by the Government.

Concerning some requirement standards like reporting imposed to mining companies are not done, so their products are not sold on European and American markets. Results from questionnaire showed that 69% of respondents disagree and 31% neither agree nor disagree with the statement. Managers of mining firms submit reports every month to ITRI and fiscal authorities for a better traceability and tracking of mineral sources.

For whether the cost of certification is expensive or not, respondents specifically people involved in the trade of mining products like managers of mining firms, agents of MINIRENA, Federation of Private sector, RDB (79%) agree that the cost of certification is not affordable for mining cooperatives easily due to the lack of capital and knowledge. 21% of respondents disagree. However, for semi-scale firms, the cost is relative (From 200 USD to 550 USD/ton).

For the statement about the no existence of refining mining firm into powder from concentrate metal constitutes a constraint to competitiveness of Rwandan coltan, the analysis stated that 21% of respondents disagree, 16% neither agree nor disagree, 31% agree and 32% strongly agree. It is important to note that today, in Rwanda, there is no entity which can be transform raw material neither in concentrate metal nor in powder.

In the same view, the researcher wanted to find out whether there are some challenges hindering the value added to have effects on competitiveness of Rwandan coltan. Data from the interview where respondents were asked to state various challenges in the supply chain revealed that the majority of respondents (80%) admitted that the specific challenges in the supply chain of the Rwandan coltan are namely: undercapitalized artisanal and small scale mining sector; significant gaps in professional (geologists and mining engineers), and in business skills; lack of basic field and laboratory equipment for OGMR to carry out adequate generation of new

geologic data; no expertise for local laboratories; no value addition for coltan exported and low capacity of negotiating contracts with buyers for a long time.

Other respondents also mentioned other barriers including: a) small capacity of financial sector; b) high energy costs that minimize value addition to the mineral and quarry resources; c) unreliable transportation for effective inspection; d) speculation in mineral trading that discourages investment; e) fluctuations in international commodity prices; f) high export transport costs; g) thefts in some ports like Dar-es-Salaam which discourage investment; h) External mining policies enforced at Rwanda like traceability which delays the whole process; i) Geopolitical issues in the Great Lakes Region, with implications for its domestic mining policy and practice.

#### **4.4 WAYS TO IMPROVE THE COMPETITIVENESS OF RWANDAN COLTAN ON THE INTERNATIONAL MARKET**

**Table 4.5 How to improve the competitiveness of Rwandan coltan**

		<b>SD</b>	<b>D</b>	<b>NAD</b>	<b>A</b>	<b>SA</b>	<b>NA</b>
1	The Rwandan coltan can be competitive by the availability of capital			4	29	67	
2	The Rwandan coltan can be competitive by using adequate semi-industrial equipment			4	29	67	
3	The Rwandan coltan can be competitive by its quality in strengthening the extraction of coltan in areas with high tenor in oxide of tantalite (More 30%)			4	29	67	
4	The Rwandan coltan can be more competitive by its certification			69	31		
5	A good relationship between DRC and Rwanda shall constitute a factor determining the competitiveness of Rwandan coltan		10	65	12		13
6	The review and elimination of trade barriers in EAC shall reduce the cost of production and so the Rwandan				65	35	

	coltan become more competitive on world market						
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**Source:** Primary data 2014 n=48

The table above showed that the Rwandan coltan can be competitive by the availability of capital, by using adequate semi-industrial equipment and by its quality in strengthening the extraction of coltan in areas with high tenor in oxide of tantalite (more 30%). The findings revealed that 67% of respondents strongly agree, 29% agree and 4% neither agree nor disagree with the statement. Key solutions to bring a value added to Rwandan coltan are to mobilize funds for investments in the industrialization of mining sector.

Today, the certification is a standard requirement and it is not an option, that is the reason why more than 69 % of respondents neither agree nor disagree that the Rwandan coltan can be more competitive by its certification while 31 % of persons questioned agree.

Concerning whether a good relationship between DRC and Rwanda shall constitute a factor determining the competitiveness of Rwandan coltan, as displayed to the table above, the majority of respondents (65%) neither agrees nor disagrees, 10% disagree, 12% strongly agree and 13% did not confirm the statement. For some persons, investments could be made in common through community banks like BDEGL, EADB or PTA Bank.

For the review and elimination of trade barriers in EAC which shall reduce the cost of operation so that the Rwandan coltan become more competitive on world market, results stated that 35% of respondents strongly agree and the remaining agree (65%) with the statement. Many formalities as declarations can be avoided like the routing Kigali-Kampala-Mombasa. Only one declaration can be established in the loading and eliminates fees every time you cross a boarder.

Interviews also revealed the following ways to improve the competitiveness of coltan.

Respondents suggested the following as ways to address the constraints and challenges:

- Build the geological knowledge base for future investment in renegotiating the larger producing licenses given their more immediate impact on fiscal revenue potential and foreign investment and reviewing the status of existing small-scale mining licenses;

- Modern technology is needed to upgrade sector to a semi-mechanized and later on to an industrial level and augment production which is still low compared to the proven potential. There is a need for more mining equipment from basic to high techniques including drillers, bulldozers, gravity table shakers, jaw and cone crushers, conveyer belt systems, magnetic separators etc. The return of investment will be a guarantee;
- Aiming at value addition and production. Rwanda's mineral ores produced in the country are 100 % exported as raw mineral. The establishment of processing plants to smelt coltan into tantalite and niobium respectively is open to private investors; an additional strategy to increase production is to improve recovery techniques at sites;
- Attractive reforms (variety of fiscal and non-fiscal incentives, importation of mining equipment exempted from imports duties, withholding tax and value added tax, employment oriented tax discounts, tax discount on export earnings, free initial work permit & visa) and secure the enabling legal and regulatory environment for investment by the Government;
- Creation of future high institutions training relevant to professionals and technicians;
- Use other routes of export like Mombasa which is secure and dialogue with Tanzanian ports to resolve thefts problems;
- Negotiate with all stakeholders including ITRI to reduce external policies and put others measures to track the source of minerals;
- Mobilize Boards of banks to invest in the sub mining sector.

The researcher also asked respondents their views on whether Rwandan people can sell the coltan to America and Europe markets? Data from interviews revealed that different steps are needed to export Rwandan coltan in western countries. First, a dialogue between parliament authorities (American, European and Rwandan) has to be done to explain that Rwandan minerals are not from DRC. Secondly, a process of lobbying at high level (economic blocs like EAC, COMESA, ICGLR,...) or partnership with European or American blocs (ACP,...) should be established to talk about facilities for minerals exports. The regional political integration is also



needed. Once all those steps are followed, Rwandan traders could be allowed to sell their coltan everywhere at a good price.

#### 4.5 ANALYSIS OF DEMAND

The analysis of demand was conducted to shed light to causes of variation in consumption of coltan. Regression analysis was used to show that the higher the price, the higher the demand. The elasticity of the demand measures the degree of sensibility of the demand through variations of the price, income and price of substitute's products.

Within the framework of this study, the elasticity-demand is analyzed through three independent variables: the price of coltan, the price of aluminum and the income.

This analysis is made through a named econometric model, a log-log model, double log or log-linear.

This model arises from the exponential model of regression,  $Y_i = \beta_1 X_i^{\beta_2} e^{u_i}$  or  $Y_i = \ln \beta_1 + \beta_2 \ln X_i + u_i$  (1).

Where  $\ln$ =naturel logarithm (that is log in basis e, with  $e=2,718$ ).

The equation (1) can be written:  $\ln Y_i = \alpha + \beta_2 \ln X_i + u_i$  (2) where  $\alpha = \ln \beta_1$ ; this model is linear in the parameters and, in the logarithms of variables X and Y and can be estimated by a regression

By putting:  $\ln Y_i = Y_i$  et  $\ln X_i = X_i$ , the equation (2):  $Y_i = \alpha + \beta_2 X_i + u_i$  (3).

In this study of the elasticity, the dependent variable Y represents the imports (IMPORT) and independent variables X (coefficients) representing respectively the price of the coltan (PRIX\_COLTAN), the price of the product substitute, the aluminium (PRIX\_ALUMINIUM) and the GDP/Inhabitant.

u is the term of stochastic error. It expresses all the variables which affect the demand but which are not explicitly taken into account in the model. I is the ième observations, the used data represent years from 2002 till 2013.  $\alpha$  is the value of the orderly originally or smoothing constant;  $\beta_i$  are regressions coefficients.

They represent at the same time direct elasticity respectively compared with the price of the coltan, to the price of the product substitute (aluminium) and with the income.

According to the economic theory:  $\beta_1 < 0$  ;  $\beta_2 > 0$  ;  $\beta_3 > 0$

Having analysed the stationary between variables and the multi correlation between dependant variables, the use of the statistical analysis system gives us the following results for the China.

### Regression model : China

Dependent Variable: LOGIMPORT\_RU

Method: Least Squares

Date: 15/10/2014 Time: 09:27

Sample: 2002 2013

Included observations: 12

LOGIMPORT\_RU=C(1)+C(2)\*LOGPRIX\_COL+C(3)\*LOGPRIX\_ALI+C(4)\*LOGREVENU\_RU

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	2.9803183	0.260206	11.45364	3.055430
C(2)	0.0930976	0.179117	0.519757	0.617304
C(3)	0.0735779	0.203673	0.361253	0.727264
C(4)	0.6670848	0.135413	4.9262694	0.001154
R-squared	0.9815249			
Adjusted R-squared	0.9633912			
S.E. of regression	0.9496629			
Standard error	0.0466115			
Observations	12			

The elasticity of the demand compared to independent variables as prices, is relatively elastic. For the price of coltan, a positive variation of this one of 1 % USD, on average, pulls a positive variation of the quantity demanded of 0,09%, whereas for the income (GDP per inhabitant), its augment of 1% USD, leads to a positive variation of 0,66% of the quantity demanded of coltan

(high income elasticity).

Besides, a variation of the substitute's price of 1% USD, it is noted an increase of the quantity demanded of 0,07%.The regression equation is explained at 98%.

### Regression model : United Kingdom

Dependent Variable: LOGIMPORT\_RU

Method: Least Squares

Date: 15/10/2014 Time: 09:27

Sample: 2002 2013

Included observations: 12

LOGIMPORT\_RU=C(1)+C(2)\*LOGPRIX\_COL+C(3)\*LOGPRIX\_ALI+C(4)\*LOGREVENU\_R  
U

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-2.800068	9.772857	-0.286514	0.781763
C(2)	-0.630582	0.745800	-0.845511	0.422391
C(3)	0.888958	0.412544	2.155287	0.063250
C(4)	1.534331	2.363279	0.649238	0.534375
R-squared	0.614670			
Adjusted R-squared	0.377820			
S.E. of regression	0.144502			
Standard error	0.3112024			
Observations	12			

Software: Statistical Analysis System

The table above shows a perfect coltan price inelasticity of the demand. For example, as regards the price of the coltan, when this one falls, on average, with 1% USD, the quantity demanded (imported) increases by 0,63%, as for the substitute, aluminum, when the price increases by 1% USD on average, quantity demanded of coltan augments by 0,88 % (relatively elastic). Whereas the changes of the income of the consumers on the demand is significant (high income elasticity). Because for an increase of income of 1% USD, on average, the quantity demanded

increases by 1.53%. This table also highlights that 61% of the variation of the quantity demand of the coltan of the United Kingdom (IMPORT\_UK) is explained by the price of the coltan (PRIX\_COL), the price of the aluminum (PRIX\_ALI) and the income of the consumers (GDP/INH). This value is relatively high because the maximum is 1.

This inelasticity of the demand with prices as variables independent is understood by the fact that in the United Kingdom, the coltan faces certain bans (Dodd Franck Act).

### Regression model : JAPAN

Dependent Variable: LOGIMPORT\_RU

Method: Least Squares

Date: 16/10/2014 Time: 09:15

Sample: 2002 2013

$$\text{LOGIMPORT\_RU} = \text{C}(1) + \text{C}(2) * \text{LOGPRIX\_COL} + \text{C}(3) * \text{LOGPRIX\_ALI} + \text{C}(4) * \text{LOGREVENU\_RU}$$

	Coefficien	Std. Error	t-Statistic	Prob.
	t			
C(1)	-0.11710	7.33971	-0.01595	0.98766
C(2)	-0.07974	0.52934	-0.15064	0.88398
C(3)	-0.64478	0.59455	-1.08447	0.30975
C(4)	1.35575	1.80485	0.75117	1.80485
R-squared	0.57758			
Adjusted R-squared	0.33609			
S.E. of regression	0.08371			
Standard error	0.15288			
Observations	12			

Software: Statistical Analysis System

The elasticity of the demand compared to independent variables as prices, is relatively inelastic. For the price of coltan, a positive variation of this one of 1 % USD, on average, pulls a negative

variation of the quantity demanded of 0,07%, whereas for the income (GDP per inhabitant), its augment of 1% USD, leads to a positive variation of 1,35% of the quantity demanded of coltan (high income elasticity).

Besides, a variation of the substitute's price of 1% USD, it is noted a decrease of the quantity demanded of 0,65%. The regression equation is explained at 58%.

From regression analysis of figures above, it is noted that a niche of market can be captured by the Rwandan coltan.

#### **4.6 INTERPRETATION OF FINDINGS**

This study aimed at identifying what specification of the Rwandan coltan affects its competitiveness of the Rwandan coltan. It is anchored three objectives such as (a) to identify specifications which characterize the competitiveness of Rwandan coltan b) to analyze the relationship between the specification of the Rwandan coltan and its competitiveness and c) to determine challenges that can directly or indirectly affect the competitiveness of the Rwandan coltan and proposed mitigation measures.

The interpretation of findings in this study has been guided by three research questions such as (1) What specification of Rwandan coltan affects its competitiveness? (2) What is the relationship between the specification of the Rwandan coltan and its competitiveness on the world market? (3) What are the challenges affecting the Rwandan coltan to be more competitive? To ensure systematic interpretation, the data emanating from the respondents in response to these questions have been organized into three main sections:

##### **4.6.1. Effects of specifications of Rwandan coltan on its competitiveness**

The researcher's objective was to identify the effects of specifications of the Rwandan coltan on its competitiveness. According to the findings, in general, 87 % of respondents agree that the Rwandan coltan, as raw material, has a specific quality which is the high tenor in oxide of tantalite (more than 30%) compared to coltan from others countries. In some regions like Rwamagana District (Muyumbu sector), the coltan has a high intensity of tantalite, around 55%.

The cheap labor cost and the non mechanical technology may constitute, today, positive effects on the competitiveness of the Rwandan coltan.

Therefore, its price is the highest on Asian market, especially China market. In western countries, the coltan is bought in better conditions (price) than in Asian markets. The section below analyzes the relationship between the specification of the Rwandan coltan and its competitiveness on the world market.

#### **4.6.2 The relationship between the specification of the Rwandan coltan and its competitiveness on the world market**

The relationship between the specification of the Rwandan coltan and its competitiveness on the world market has been confirmed given that there are some specifications like the tenor in oxyde of tantalite of the Rwandan coltan and the cheap labor cost which affect positively the competitiveness through the demand. Those assumptions result from answers of more than 87% of respondents. However, there are many challenges to reach these markets.

#### **4.6.3 Challenges affecting the competitiveness of Rwandan coltan**

The researcher aimed at knowing the challenges hindering the competitiveness of the Rwandan coltan. 80% of respondents agreed that limited technical and business skills, the lack of adequate infrastructure (energy, road, railways) and capital for industrial equipment are challenges to the competitiveness of Rwandan coltan. Concerning the cost of certification not affordable for mining cooperatives, 80% of respondents explained that this situation is due to the lack of capital and knowledge. Regarding the lack of refining process of coltan as one of the challenges of the competitiveness, CEOs, managing directors and directors of operations believe that the non transformation of raw material is a main constraint to be competitive. Trade barriers, thieves and some world policies like the Dodd Franck Act are also challenges for coltan's export. This was confirmed by the majority of respondents (more than 80%).

### **4.7 SUMMARY**

The chapter four mainly focused on presenting, analyzing and interpreting the raw data from the field research. The responses were given in the form of perception using the questionnaire and the interview guide. The data were analyzed using frequencies and tables representations.

A regression analysis has been conducted to demonstrate that there are possibilities to capture niche markets. After presenting and analyzing data using a descriptive data analysis method, the researcher proceeded to data interpretation.

In the fifth chapter, the researcher summarizes findings. Also, conclusions were drawn conclusions and recommendations were formulated to different stakeholders.

## **CHAPTER FIVE**

### **SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS**

#### **5.1 INTRODUCTION**

The purpose of this chapter is to present a summary of findings based on the research problem, research objectives, questions as well as observations identified during this study. This chapter is also presenting key conclusions of the analysis of competitiveness of Rwandan coltan on the global market as presented by interviewees and key literature review, so to help us draw conclusions and recommendations to decision makers in the mining sector as well as to future researcher for better improvement of the mining sector and export of Rwandan coltan.

#### **5.2 SUMMARY OF FINDINGS**

Although, the Rwandan coltan needed to be refined in order to get more earnings (10 times more). A value addition of the ore with good strategies for supply management should generate more earnings, thus, contributes to the development of Rwanda. In this chapter, the task is to discuss the way forward and concrete actions that could be attempted in order to answer the question on effects of the specification of Rwandan coltan on its competitiveness. In this chapter, discussion of findings and implications of the research were discussed into three major areas.

The first research problem posits that specifications of Rwandan coltan contribute to its competitiveness. As discussed earlier, "competitiveness relates to quality, price and production costs" as the most determinants. Some specifications could directly strengthen the competitiveness of the Rwandan coltan. Based on the findings where respondents strongly agree that the Rwandan coltan by its high tenor in oxide of tantalite contributes to its competitiveness and in response to the research problem one, the territorial qualification (high tenor in oxide of tantalite) and the certification as specifications of the Rwandan coltan have positive effects on its competitiveness.

Besides, it was shown that the high tenor in oxide of tantalite and the certification have played an important role to enhance the qualification of the Rwandan coltan which reinforce the will to



buy a quality product. Indeed, the certification instituted in 2011 by the Government of Rwanda required by the world policies responds to the buyer needs, to know the technical ingredients of the ore and its origin describing the quality of the product. It has been discovered that technical specificities and certification produced good results in qualifying the Rwandan coltan and in creating a business-to-business approach and a fair trade label for minerals including certification of origin as well as responsible mining practice standards.

Furthermore, specifications of the Rwandan coltan contribute to evaluate a level of price; the reality in the field study shows that the high technical specificity (quality ingredients: oxide of tantalite more than 35%) and the certification reinforcing the trust of buyer on the quality of product and the recognition contribute to fix a high price. The implication is that in recent years, the market share on the world has been doubled for the Rwandan market.

It was also shown that, at the level of export, the coltan as raw mineral, the cheap labor cost incites traders or investors to deal with this ore in order to benefit more profits. However, the certification contributes slightly to variation of production costs due to its costs (less than 3% increase of production costs).

Concerning challenged facing the chain of Rwandan of the Rwandan Coltan to enhance its competitiveness, it was shown that despite the current signs of revitalization, the sub sector works far below capacity and still produces largely at artisan level. No mining venture is currently operating based on known reserves and the legal framework is the process of being strengthened. The constraints include poor knowledge of resources, lack of managerial capacity, and lack of sufficient mining inputs. The key weaknesses currently faced by the coltan industry include:

- Largely undercapitalized artisan mining and small scale mining sector;
- No value addition for coltan exported;
- High energy and export transport costs that slow down value addition to the mineral and quarry resources;

- Small capacity of financial sector;
- Negative effects of external mining policies and thieves.

### **5.3 CONCLUSION**

In conclusion, it was shown that specifications of the Rwandan coltan as raw material affect it competitively. The researcher demonstrated effects of the tenor of oxide contained by the Rwandan coltan on quality, price and production costs. The certification as a standard requirement, since few years, contributes to enhance the trust of the Rwandan coltan.

However, some challenges have been identified as largely undercapitalized artisan mining; small scale mining sector; no value addition for coltan exported; high energy and export transport costs that slow down value addition to the mineral and quarry resources and small capacity of financial sector. To be more competitive, the Rwandan coltan has to be refined, separated in niobium and tantalite to get more earnings.

### **5.4 RECOMMENDATIONS**

In accordance with the main argument of this research as reflected by the findings of the empirical research and the implications of increasing value addition on the competitiveness; the following recommendations are formulated and forwarded to decision makers for action and to future researchers:

- ✓ To overcome the inadequacy of skilled mining workforce as a competitive disadvantage; the Government of Rwanda should establish a higher learning institution and technical schools to offer mining related courses; the Government should approach the private sector to promote the linkage between the higher learning institutions and technical schools to increase innovation;
- ✓ Government of Rwanda should support financially and technically regional mineral certification programs like those developed by the ICGLR as standards certification based on the OECD Guidelines for Multinational Corporations;
- ✓ There should be reinforcement of regional integration and bilateral cooperation to boost the coltan sub mining sector and reduce trade barriers.

## **5.5 FURTHER RESEARCH**

Some important limitations have been raised while conducting this research and writing the research paper which could not allow the researcher to cover all aspects of the research namely:

- Lack of sufficient time: this study was conducted in a relatively short period of time to collect as much data as possible.
- Lack of availability of specific data: the majority of mining companies hesitated to give their own data about their production, their export, laboratory analysis and financial statements.

Through this research study, it was confirmed that some specifications of the Rwandan coltan contribute to its competitiveness. Therefore, it would be interesting to expand the study mainly in two ways.

First, the researcher recommends carrying out a comparative study of specifications of coltan in many mining firms from different districts. Indeed, this would significantly contribute to establishing a potentiality portfolio of mining sites and how it may contribute to the improvement of competitiveness.

Secondly, a future research aimed at analyzing a return on investment of a mining firm whether an operational refining process should be done. As a result, there would be a substantial understanding of effects of coltan's refining process on its competitiveness.

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## **APPENDIX 1: RESEARCH QUESTIONNAIRE**

**UNIVERSITY OF RWANDA (UR)**

**FACULTY OF ECONOMICS & MANAGEMENT**

**MASTER OF BUSINESS MANAGEMENT (MBA)**

Dear Sir/Madam, you are kindly requested to answer the following questions providing information to the best of your knowledge and in its best true sense. The information is purely for academic purposes as a partial requirement for the award of a Master degree of Business Management. The information provided in this questionnaire will be treated with utmost confidentiality. The research topic is ***“ANALYSING COMPETITIVENESS OF RWANDAN COLTAN ON THE WORLD MARKET THROUGH A SPECIFICATION OF ITS OFFER”***

Purposes of the study are to see how specifications to colombo-tantalite can affect it competitively; to establish a relationship between specifications and the competitiveness of Rwandan coltan and then to identify possible challenges of the Rwandan coltan while facing the competition on the world market.

For each of the following statements, please tick where it is applicable the extent to which you agree using a liker scale.

*Give your level of agreement in percentage (%) to the following statement using the likes' seals stated below:*

**1 – Strongly Disagree (SD)      2 – Disagree (D)      3- Neither agree nor disagree (NAD)**  
**4- Agree (A)    5-Strongly agree (SA)**

<b>A</b>	<b>Statement on specifications of Rwandan coltan</b>	<b>SD</b>	<b>D</b>	<b>NAD</b>	<b>A</b>	<b>SA</b>
1	The tenor in oxide of tantalite characterize the quality of coltan					
2	The quality of Rwandan coltan is different according to regions					
3	There is a differentiation between the tenor in oxide of tantalite of coltan mined in Central Africa particularly the one extracted in DRC and the Rwandan coltan.					
4	Certifications done in Rwanda are accepted on the world market					
5	The process of origin certification is imposed for all minerals exported					
6	No packaging of Rwandan coltan is done in Rwanda					
7	Rwanda re-exports coltan					
8	The traceability of Rwandan coltan is electronic					
<b>B</b>	<b>Statement on the competitiveness of the Rwandan coltan on the world market</b>					
1	The artisanal technology used by mining firms is more competitive than semi-mechanical technology					
2	The cost of production, particularly the labor cost is competitive on the world market					
3	The Rwandan coltan is competitive on the world market by its quality.					
4	The Rwandan coltan can be competitive on the European and American market as of China market					

5	The price of Rwandan coltan is higher on others markets than China market					
<b>C</b>	<b>Statement on the constraints to competitiveness of coltan's product extracted in Rwanda</b>					
1	The cost of land exploitation is not affordable.					
2	Some requirement standards like reporting imposed to mining companies are not done, so their products are not sold on European and American markets					
3	The cost of certification is expensive					
4	The no existence of refining mining firm into powder from concentrate metal constitutes a constraint to competitiveness of Rwandan coltan.					
<b>D</b>	<b>Statement on how to improve the competitiveness of Rwandan coltan on the international market</b>					
1	The Rwandan coltan can be competitive by the availability of capital					
2	The Rwandan coltan can be competitive by using adequate semi-industrial equipment					
3	The Rwandan coltan can be competitive by its quality in strengthening the extraction of coltan in areas with high tenor in oxide of tantalite (More 30%).					
4	The Rwandan coltan can be more competitive by its certification.					
5	A good relationship between DRC and Rwanda shall constitute a factor determining the competitiveness of Rwandan coltan.					
6	The review and elimination of trade barriers in EAC shall					



	reduce the cost of production and so the Rwandan coltan become more competitive on world market					
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**Thank you**

Entity or firm

Position

Customer ID

Date

## **APPENDIX 2: INTERVIEW GUIDE**

### **NATIONAL UNIVERSITY OF RWANDA**

#### **FACULTY OF ECONOMICS & MANAGEMENT**

#### **MASTER OF BUSINESS MANAGEMENT (MBA)**

Dear Sir/Madam, you are kindly requested to answer the following questions providing information to the best of your knowledge and in its best true sense. The information is purely for academic purposes as a partial requirement for the award of a Master degree of Business Management. The information provided in this questionnaire will be treated with utmost confidentiality. The research topic is ***“ANALYSING ON COMPETITIVENESS OF RWANDAN COLTAN ON THE WORLD MARKET THROUGH A SPECIFICATION OF ITS OFFER”***

#### **Part 1 Supply chain management of the Rwandan coltan**

Which region in Rwanda can we find a good quality of coltan (high tenor in oxide of tantalum 35-45%)?

#### **Part 2: Possible challenges and solutions facing mining sector**

1. Kindly state various challenges in the supply chain?
2. What are possible solutions for the challenges facing miners and traders of Rwandan coltan?
3. How can we orient the market of Rwandan coltan to America and Europe?

#### **Part 3: The differentiation of Rwandan coltan by a specification (value added)**

What factors (Price, Production cost, Quality, Refining, Certification, Packaging, Bank financing...) should affect more the competitiveness of the Rwandan coltan on the world and at what degree in percentage?

<b>Factors</b>	<b>Relationship (%age)</b>
Price	
Production cost	
Quality	
Refining	
Certification	
Packaging	
Bank financing	
Incentives reforms	
Aggressive promotion	
Great lakes good relationship	
<b>Total</b>	<b>100%</b>

**Thank you**

Entity or firm

Position

Customer ID

Date

## APPENDIX 3: REGRESSION ANALYSIS

### 1. PRICES OF COLTAN (USD/KG)

<b>Years/Countries</b>	<b>CHINA</b>	<b>UK</b>	<b>JAPAN</b>
<b>2002</b>	520	480	463
<b>2003</b>	466	474	511
<b>2004</b>	674	649	662
<b>2005</b>	815	846	775
<b>2006</b>	834	1,156	914
<b>2007</b>	829	1,185	946
<b>2008</b>	966	1,063	1,096
<b>2009</b>	923	1,243	1,174
<b>2010</b>	904	654	1,042
<b>2011</b>	1548	1,009	2,062
<b>2012</b>	1837	2,094	2,750
<b>2013</b>	1114	1,428	1,639

**Source:** <http://www.intracen.org/itc/market-info-tools/trade-statistics/>

## 2. PRICE OF ALUMINIUM(USD/KG)

<b>Years/Countries</b>	<b>CHINA</b>	<b>UK</b>	<b>JAPAN</b>
<b>2002</b>	26	252	24
<b>2003</b>	25	252	26
<b>2004</b>	29	252	36
<b>2005</b>	33	171	39
<b>2006</b>	35	138	40
<b>2007</b>	44	92	49
<b>2008</b>	64	391	64
<b>2009</b>	36	539	71
<b>2010</b>	44	520	82
<b>2011</b>	46	561	80
<b>2012</b>	48	591	93
<b>2013</b>	54	470	87

**Source:** <http://www.intracen.org/itc/market-info-tools/trade-statistics/>

### 3. GDP/UNHABITANT (USD/YEAR)

<b>Years/Countries</b>	<b>CHINA</b>	<b>UK</b>	<b>JAPAN</b>
<b>2002</b>	1,135	27,301	31,236
<b>2003</b>	1,274	31,437	33,691
<b>2004</b>	1,490	37,021	36,442
<b>2005</b>	1,731	38,432	35,781
<b>2006</b>	2,069	40,808	34,102
<b>2007</b>	2,651	46,591	34,095
<b>2008</b>	3,414	43,487	37,972
<b>2009</b>	3,749	35,455	39,473
<b>2010</b>	4,433	36,573	43,118
<b>2011</b>	5,447	38,927	46,204
<b>2012</b>	6,093	38,649	46,548
<b>2013</b>	6,807	39,337	38,492

**Source:** International Monetary Funds, statistical data (2013)

### APPENDIX 4: STUDY POPULATION (92)

<b>Government's institutions</b>	MINICOM	<b>5</b>
	MINIRENA	<b>5</b>
	RMGA	<b>5</b>

RDB	4
RBS	2
PRIVATE SECTOR FEDERATION	4
<b>S/TOTAL</b>	<b>25</b>
AFRIBUSINESS	1
AFRICOME INTERNATIONAL	1
AFRISET	1
AMIZERO	1
APT	1
AZ RWANDA	1
BEGAMEF LTD	1
CEMAC	1
CMK	1
CODEMICOTA	1
CODEMIKA	1
COEMIKI	1
COMAKI	1
COMAR	1
COMERUMU	1
COODEMIBU	1
COOPIMAR	1
EQUIM MINING COMPANY	1
EPROCOMI	1
ETS KARINDA	1
Ets MUNSAD	1
EUROTRADE INTERNATIONAL	1
FECOMIRWA	1

GATUMBA MININF CONCESSIONS LTD	1
GEM SMITH PRIVATE LTD	1
GREAT LAKES MINING INTERNATIONAL	1
KUNGABU	1
PHOENIX	1
PYRAMIDES LTD	1
RAP	1
RUTONGO MINES LTD	1
ROKA	1
SOTRACO	1
SORWAKI	1
SORWAMI	1
VIMICO	1
AMARONGI	1
ASSEMURU	1
COMIKABA	1
COOPEMIKA	1
COPABRITY	1
COOPEXMI	1
DEMIKA	1
HARD METAL RWANDA	1
HFE SOCIETY	1
IMPARAGE COMPANY GROUP	1
INVEST COMPANY	1
KODUGA	1
KODUBU	1
KOPAMU	1



	KUAPEGU	1
	KUOMU	1
	MINECA	1
	MODERN MINING COMPANY	1
	PROMINTER	1
	RADEBU	1
	RAS	1
	RWANDA ALLIED PARTNERS LTD	1
	RWANDA TRINITY MINERALS SARL	1
	RWANDA AZ IMPEX	1
	SAE	1
	SADONI	1
	SAFARI LTD	1
	SUGIRA	1
	TRANS AFRICAN SUPER METALS	1
	TRANSLATIQUE	1
	TSL	1
	<b>S/total</b>	<b>67</b>
	<b>TOTAL</b>	<b>92</b>

**Source:** Primary source data (2013)