



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

**The Impact of the Zimbabwean Space Agency's Programme for the Mapping of
Mineral Reserves on Foreign Direct Investment in Zimbabwe**

By

Ruvimbo Samanga

14215552

submitted in partial fulfillment of the requirements for the degree

**MAGISTER LEGUM (LLM) IN INTERNATIONAL TRADE AND INVESTMENT
LAW IN AFRICA**

prepared under the supervision of

Dr. Oyeniya Omogboyega Abe

International Development Law Unit

Faculty of Law

University of Pretoria

September 2019

Declaration

I hereby declare that I submit this mini dissertation in partial fulfillment for the award of Legum Magister (LL.M.) in International Trade and Investment Law in Africa as offered by the International Development Law Unit at the Centre for Human Rights, Faculty of Law, University of Pretoria. I furthermore declare that the work submitted is original and my own and has not been submitted prior to this for the award of any other degree at any other tertiary institution.

University of Pretoria 2019

R Samanga

Dedication

I dedicate this work to my parents without whose sacrifice this research would not be possible. Thank you for allowing me to pursue what fulfills my passions and I hope this work will make you proud one day.

Mr. W.T. Samanga and Mrs. F Samanga I love you both.

Acknowledgments

*“Our doubts are traitors,
and make us lose the good we oft might win,
by fearing to attempt.”* – William Shakespeare

It would not be accurate to state that the journey towards the completion of this mini dissertation was undertaken solely by my own efforts. I have stood advised, guided, and shown great patience by my family, good friends, and my supervisor.

I would firstly like to extend my sincere gratitude to my parents without whose support and continued sacrifices this research would not be possible. To my friends and family circle, you are appreciated for your thoughts, prayers and frequent conversations and encouragement. I would also like to extend my thanks to my supervisor Dr. Niyi for his patience and guidance throughout the brainstorming process of this dissertation. Lastly, I would like to thank God Almighty for the grace to have persevered thus far.

I would also like to extend my thanks, in absentia, the great scholars and sources that have contributed to this research. Being a novel field that I have chosen to engage with, I appreciate the earnest input that these scholars have given in giving insight into the complex fields of Space Law, Mining Law, and International Investment Law. I am undoubtedly increased through the knowledge that has been shared and hope this piece of work will do the same for the next.

It has also been an immense honour to have studies LLM in International Trade and Investment Law in Africa, offered by the Centre for Human Rights at the University of Pretoria. To be offered this intellectual space to broaden my capacities is one I could not have anticipated would expand my horizons to the extent that it has. I believe I was greatly enriched to meet such a diverse group of individuals and believe it has done immensely to broaden my networks both in the classroom and abroad. To the Class of 2019, as I would always say, continue to shoot for the stars!

I lastly acknowledge that any errors in this dissertation are entirely my own.

September 2019

LIST OF ABBREVIATIONS

AfDB	The African Development Bank
BIT	Bilateral Investment Treaty
ESA	European Space Agency
ESN	Emerging Space Nation
FDI	Foreign Direct Investment
ICMM	International Council on Mining and Metals
IOM	The International Organization for Migration
ITSO	Agreement Relating to the International Telecommunications Satellite Organizations 1971
ITU	International Telecommunications Constitution and Convention 1992
GDP	Gross Domestic Product
GIS	Geo-Spatial Information Services
GPST	Global Positioning Satellite Technology
LSZ	Lower Sulphide Zone
MSZ	Main Sulphide Zone
PGM	Platinum Group Metals
SADC	Southern African Development Community
Tcf	Trillion Cubic Feet
UN	United Nations
UNDP	United Nations Development Programme
USGS	United States Geological Survey
WBG	World Bank Group
ZA	Zimbabwe Alloys
ZIA	Zimbabwe Investment Authority
ZimAsset	Zimbabwe Agenda for Sustainable Socio-Economic Transformation

ZIMREF	The Zimbabwe Reconstruction Fund
ZINGSA	Zimbabwe National & Geo-Spatial Space Agency
ZISCO	Zimbabwe Iron and Steel Company
ZGS	Zimbabwe Geological Survey

©COPYRIGHT

All rights reserved no part of this work may be reproduced or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, or stored in any retrieval system of any nature, without the written permission of the copyright holder and or the University of Pretoria.

Abstract

This dissertation will examine Zimbabwe's mining sector as well as its foreign direct investment climate to date, to ascertain what are the most feasible solutions to its mineral mapping challenges. Zimbabwe is well endowed with mineral resources, so much so that much of its Gross Domestic Product (GDP) is hinged on the mineral sector, especially post the economic meltdown that was largely caused by the failed land reform programme.¹ Studies have shown that mineral mapping and exploration are a platform for stimulating economic growth through beneficiation and value addition.² However, for a development strategy based on resources to succeed it is fundamental to comprehend the socio-economic and political dynamics that have hindered the development of mining policy and decision making to date.³ The challenge Zimbabwe is facing currently is that these resources were last mapped in 1980, such that it is unknown what is the full allocation of these resources today. This hinders new and current interest in the mining sector meaning that the country is losing out on potential foreign direct investment. Seeking a solution to this, on the 26th of July of 2018, the Minister of Higher Education & Technology established,⁴ in terms of Section 24(1) read with Section 24(3) of the Research Act [Chapter 10:22],⁵ the Zimbabwean National and Geo-Spatial Space Agency (ZINGSA). ZINGSA was intended to use satellite Geospatial Information Services (GIS) technology to monitor the country's large, untapped mineral reserves, focusing on lithium and graphite.⁶ This process began with an agreement signed between ZINGSA and South Africa's Space Advisory Group to kickstart operations, after which the Minister of Higher And Tertiary Education, Science & Technology Development, Professor Amon Murwira, announced that the government had pledged USD\$1 million towards the agency's pilot programme,⁷ and a further USD\$10 million by the Ministry of Finance.⁸ ZINGSA intends to utilize satellite applications for the advancement of geo-spatial science, satellite communication systems and earth observation.⁹ I will pay particular focus to the Space Agency's Programme for the mapping of mineral reserves and how it is intended to stimulate

¹ B Zikiti 'How can Zimbabwe Leverage its Mineral Resources for Economic Recovery and Sustainable Growth' Master's Thesis, Wits University.

² As above.

³ As above.

⁴ **"Zimbabwe launches space agency to enhance its use of space technology for sustainable development"** *Business Day* (11 July 2018) Available at <https://www.businesslive.co.za/bd/world/africa/2018-07-11-zimbabwe-launches-space-agency-to-enhance-its-use-of-space-technology-for-sustainable-development/> [Accessed 17 May 2019].

⁵ Research Act [10:22] *Acts 5/1986, 2/1988, 18/1989 (s.40, s.43), 11/1991 (s.29), 2/1998, 22/2001 (s. 4).*

⁶ Namely Platinum, Diamonds and Chrome; See also S Munjenjema 'Space Age Dream Takes Shape' *The Zimbabwe Situation* (18 November 2018) Available at <https://www.zimbabwesituation.com/news/space-age-dream-takes-shape/> [Accessed 17 May 2019].

⁷ As above.

⁸ 'Geospatial, Aeronautical and Space Science Capability Programme' *Ministry of Higher & Tertiary Education and Science & Technological Development* Available at <http://www.mhtestd.gov.zw/2018/11/14/geospatial-aeronautical-and-space-science-capability-programme/> [Accessed 17 May 2019].

⁹ C Kuyedzwa 'Zim launches space agency to close tech gap' *Fin24* (10 July 2018) Available at <https://www.fin24.com/Companies/ICT/zim-launches-space-agency-to-close-tech-gap-20180710> [Accessed 31 July 2019].

foreign direct investment within the mining sector through the use of satellite technology and also discuss its viability as compared to other alternatives. My proposal is that the use of satellite technology will map mineral reserves at a more precise scale and is to be preferred. Country specific and sector-specific rules and the way they are formulated, interpreted, applied, and violated must be studied,¹⁰ hence the discussion will address natural resource investment as key to Zimbabwe, and Africa's development. There will also be recommendations on good governance and resource management, possible fiscal regimes for the extraction of natural resources, environmental impacts and finally corporate social responsibility and the extent to which ZINGSA's mineral mapping policy has or can support these pillars to stimulate investment in Zimbabwe's mining sector. Where the programme is deficient or yet to be implemented, this dissertation serves as a policy guide on the most economically viable and sustainable frameworks applicable to the Zimbabwean mining and foreign direct investment context.

¹⁰ R Bhala *International trade law: Interdisciplinary theory and practice* (2007) ix.

TABLE OF CONTENTS

DECLARATION	2
DEDICATION	3
ACKNOWLEDGMENTS	4
ABBREVIATIONS	6
ABSTRACT	7
CHAPTER 1: INTRODUCTION	
1. Background.....	13
1.1 Scene setting: The Zimbabwean National Space Agency & its programme for the mapping of mineral reserves.....	14
1.1.1 <i>Problem Statement</i>	16
1.1.2 <i>Hypothesis</i>	17
1.1.3 <i>Research Objectives</i>	17
1.1.4 <i>Research Questions</i>	18
1.2. Research Methodology.....	18
1.2.2 <i>Historical approach</i>	19
1.2.3 <i>Descriptive approach</i>	20
1.3.3 <i>Analytical approach</i>	20
1.3.4 <i>Comparative approach</i>	20
1.4 Literature Review.....	20
1.5 Delineation and Limitations.....	23
1.6 Referencing technique and key terms.....	23
1.7 Overview of Chapters.....	23
CHAPTER 2: SYNOPSIS OF THE MINING SECTOR IN ZIMBABWE	
2. Introduction.....	26
2.1 History of Mining in Zimbabwe.....	26
2.2 Challenges Facing the Mining Sector in Zimbabwe.....	32
2.3 Mining Reform in Zimbabwe.....	38
2.4 Minerals of Zimbabwe.....	38
2.4.1 <i>Gold</i>	38
2.4.2 <i>Platinum Group Metals (PGM)</i>	39
2.4.3 <i>Diamonds</i>	39
2.4.4 <i>Chrome</i>	40
2.4.5 <i>Coal</i>	40
2.4.6 <i>Nickel</i>	41
2.4.7 <i>Asbestos</i>	41
2.4.8 <i>Coal Bed Methane</i>	42
2.4.9 <i>Copper</i>	42

2.4.10	<i>Iron</i>	43
2.4.11	<i>Pegmatite Minerals</i>	43
2.4.12	<i>Dimension Stones</i>	43
2.4.13	<i>Graphite</i>	44
2.4.14	<i>Lithium</i>	44
2.5	Conclusion.....	44

CHAPTER 3: SYNOPSIS OF FOREIGN DIRECT INVESTMENT IN ZIMBABWE

3.	Introduction.....	46
3.1	Applicable Theories in Foreign Direct Investment.....	46
3.2	History of Foreign Direct Investment in Zimbabwe.....	47
3.3	Challenges Hindering Foreign Direct Investment in Zimbabwe.....	48
3.4	Examining the Link between Mining and Foreign Direct Investment.....	50
3.5	Conclusion.....	50

CHAPTER 4: PROSPECTS OF MINERAL MAPPING IN ZIMBABWE

4.	Introduction.....	53
4.1	Zimbabwean National Space Agency’s Programme for the Mapping of Mineral Reserves.....	53
4.2	Satellite Technology and the 4 th Industrial Revolution.....	57
4.3	Benefits of Satellites for Mapping Mineral Reserves.....	59
4.4	Drawbacks of Satellites for Mapping Mineral Reserves.....	61
4.5	Conclusion.....	62

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.	Introduction.....	64
5.1	Good Governance, Natural Resource Investment, and Africa’s Development.....	67
5.2	Conclusion.....	71

BIBLIOGRAPHY.....	74
--------------------------	-----------

CHAPTER 1: INTRODUCTION

1. Background

Presently more than 100 minerals have been discovered in Zimbabwe.¹¹ With most discoveries occurring along ‘The Great Dyke’ which appears to be entirely unique to Zimbabwe.¹² This phenomenon is a 4-mile wide, 320-mile-long channel of minerals running along the same fracture line as that of the Great Rift Valley of Africa and is considered to contain the highest grades of chrome and asbestos in the world. However, Zimbabwe’s vast mineral wealth can truly be seen in its output of Platinum Group Metals, of which it is the second-largest producer of platinum rivaled only by South Africa. Even though Zimbabwe’s platinum capacity falls behind that of its neighboring country, it still can boast of producing a higher quality output of Platinum, that is, one which contains up to 14 mineral by-products as opposed to the South African ‘stone’ which will usually average around 6 to 7 mineral by-products.¹³ These platinum reserves are expected to last for at least another 400 years.¹⁴

In addition to this Zimbabwe is also home to the greenstone belts also known as the ‘gold belts’, the metamorphic belts as well as the Precambrian and Karoo basins.¹⁵ Yet despite all this data there is no accurate or reliable quantification of Zimbabwe’s vast mineral resources. This information, if it were to be publicly known, would have the capacity to attract potential foreign investors. These studies attract interest because foreign investors are continuously searching for investment opportunities of which the extent of Zimbabwe’s mineral capacity is still unknown and does not provide certainty to potential investors. Mineral mapping is thus a challenge facing Zimbabwe and in turn, hinders Foreign Direct Investment (FDI).

1.1 Scene setting: Zimbabwe’s Mining and Investment Climate

Zimbabwe has abundant mineral resource reserves,¹⁶ and like most other countries on the African continent, it is mainly dependent on primary productions which it relies on for exports as well as economic growth.¹⁷ While artisanal mining in gold has been prevalent throughout the years, vast mineral reserves are yet to be quantified and exploited due to a lack of capital and infrastructure.¹⁸ It is unfortunate that as a result of the “lost decade” (1998-2009), Zimbabwe has lagged behind in mineral exploration and development, barring it from the so-

¹¹ C Chakamwe ‘Zimbabwe the richest country in the world’ *The Patriot* (31 October 2013) Available at https://www.thepatriot.co.zw/old_posts/zimbabwe-the-richest-country-in-the-world/ [Accessed 4 October 2019].

¹² As above.

¹³ As above.

¹⁴ As above.

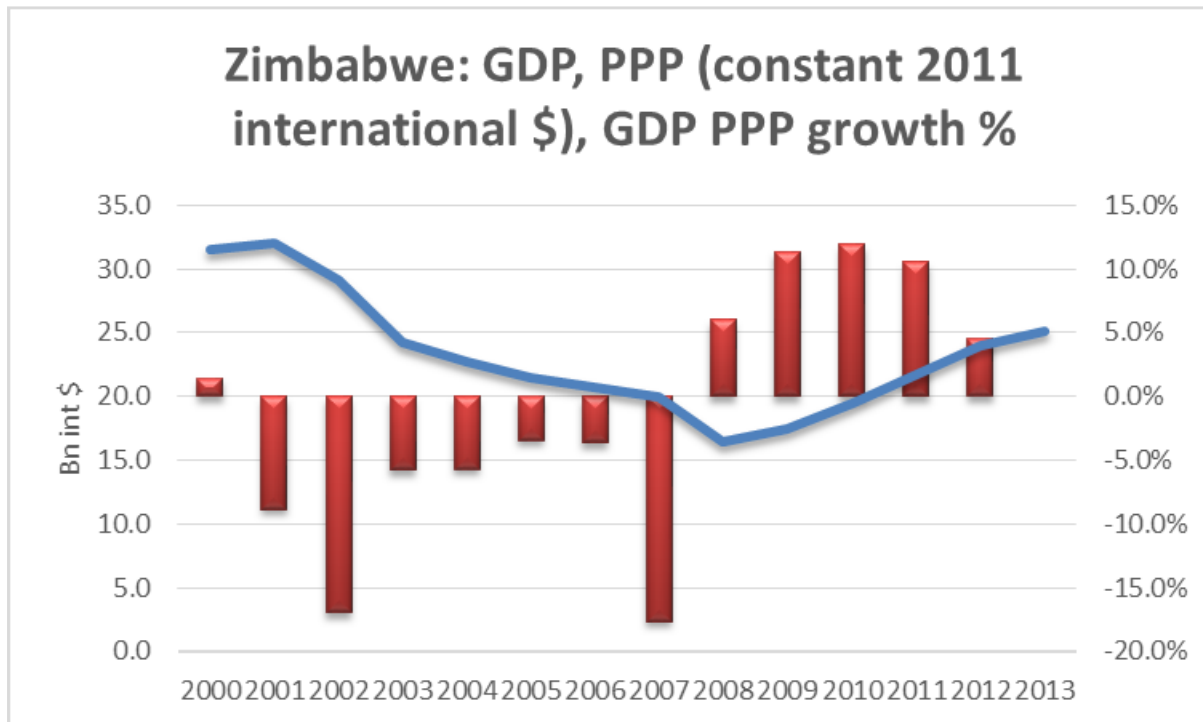
¹⁵ As above.

¹⁶ African Development Bank ‘Africa’s Natural Resources: The paradox of plenty’ (2007) 1.

¹⁷ Chamber of Mines “Mining in Zimbabwe’ (2009) Available at <http://chamberofminesofzimbabwe.com/2019/01/29/zimbabwes-gold-production/> [Accessed 2 October 2019].

¹⁸ As above

called ‘commodity boom’ experienced by developing and developed countries elsewhere on the globe.¹⁹



Source: WB data online 2015.

This study will look at how the mining sector can be the magic bullet to Zimbabwe’s economic woes by providing a stimulant for foreign direct investment.

To address what has now become a technological gap in mineral mapping, the Minister of Higher Education & Technology, Professor Amon Murwira, established,²⁰ in terms of Section 24(1) read with Section 24(3), 25 and 26 of the Research Act [Chapter 10:22],²¹ the Zimbabwean National and Geo-Spatial Space Agency (ZINGSA) in July of 2018. ZINGSA was intended to use satellite Geospatial Information Services (GIS) technology to monitor the country’s large, untapped mineral reserves, focusing on lithium and graphite.²² Through the above, ZINGSA is expected to promote, in addition to mineral exploration, wildlife

¹⁹ B Matsika ‘A closer look at Zimbabwe’s mining sector’ 10 September 2010 Available at <https://www.howwemadeitinafrica.com/a-closer-look-at-zimbabwes-mining-sector/3769/> [Accessed 2 October 2019].

²⁰ “Zimbabwe launches space agency to enhance its use of space technology for sustainable development” *Business Day* (11 July 2018) Available at <https://www.businesslive.co.za/bd/world/africa/2018-07-11-zimbabwe-launches-space-agency-to-enhance-its-use-of-space-technology-for-sustainable-development/> [Accessed 17 May 2019].

²¹ Research Act [10:22] *Acts 5/1986, 2/1988, 18/1989 (s.40, s.43), 11/1991 (s.29), 2/1998, 22/2001 (s. 4)*.

²² Namely Platinum, Diamonds and Chrome; See also S Munjenjema ‘Space Age Dream Takes Shape’ *The Zimbabwe Situation* (18 November 2018) Available at <https://www.zimbabwesituation.com/news/space-age-dream-takes-shape/> [Accessed 17 May 2019].

conservation, disease surveillance, agriculture as well as infrastructure management and mapping.²³

As with most policy documents developed by Governments, the aim was to stimulate economic diversification, particularly in the mining, health, agriculture, and tourism sectors. Commenting on this development H.E. Emmerson Mnangagwa noted how vital the project was and the extent to which it would serve as a catalyst for competitiveness and growth.²⁴ This is a pertinent development because Zimbabwe has lagged its regional counterparts and the world at large in terms of technological development even though the country's economy is predicated on mining and agriculture.

Commenting on the need for technological transfer as a developmental tool in Zimbabwe, the President further mentioned that the space agency would be instrumental in building the necessary technical expertise and institutional capacities in key sectors such as weather, climate services, wildlife management, and tourism, life sciences, agriculture, and most importantly for this present discourse, mineral mapping, and quantification.²⁵ By tapping into these technological advancements, the country's industrial agenda would be strengthened in line with the country's strive towards 'Vision 2030', which is to attain a middle-income economy by 2030.²⁶

The World Bank (WBG) group has commented on the challenges that have contributed to the adoption of this agenda citing that the country's economy had reached a crossroad and was facing various challenges relating, *inter alia*, stimulating investment and growth to increase revenue collection as well as foreign exchange generation.²⁷

The WBG, however, announced recently that the government had plans to attract foreign direct investment through the Transitional Stabilization Programme 2018-2020, to be discussed below, which also contains provisions that will promote financial stabilization as well as stemming liquidity challenges which have prompted exchange rates to skyrocket and have unfortunately contributed to Zimbabwe's current inflation woes.²⁸

I believe that given the technological advancements of the last decade, financing and investing in space technologies is no longer expensive nor does it pose an impediment but will rather have run-on effects in the mining industry which will in turn positively affect foreign direct investment. I hope to comprehensively explore these complexities in greater detail below.

1.1.1 Problem Statement

While Zimbabwe is endowed with vast mineral resources, the location, variety, and quantities are unknown and must be addressed. These mineral resources were last mapped accurately at the time of independence in 1980, such that today it is unknown what is the full allocation of

²³ As above.

²⁴ As above.

²⁵ As above.

²⁶ As above.

²⁷ The World Bank Group 'The World Bank in Zimbabwe) 31 October 2018 Available at <https://www.worldbank.org/en/country/zimbabwe/overview> [Accessed 21 September 2019].

²⁸ As above.

the country's mineral reserves. This, in turn, hinders new and current interest in the mining sector meaning that the country is losing out on potential foreign direct investment.

1.1.2 Hypothesis

If mineral mapping information were to be collected and made public it would attract foreign direct investment. Such studies attract investment by providing certainty to potential foreign investors. Satellite technology can be used to map mineral resources at a more precise scale than conventional mapping techniques.

1.1.3 Research Objectives

This dissertation will discuss the challenges facing the Zimbabwean mining sector and how this, in turn, hinders foreign direct investment. It will examine the costly or old-fashioned techniques that have hampered the mining sector from recording accurate and reliable quantification of mineral reserves. It will also map the mineral explorations that have been conducted over the years tracing the last known quantification.

An evaluation will then be made on whether the mapping of mineral reserves will indeed have a positive impact on the mining sector and whether mineral quantification can stimulate foreign direct investment in the mining sector.

Finally, the manner in which minerals will be mapped will be discussed to ascertain what is Zimbabwe's most feasible option in addressing the technological and infrastructural gap in mapping minerals. This will be done by examining space applications namely satellite technology, particularly how this technology can reduce the information gap hampering the Zimbabwean mining sector.

On the question of why such research is relevant in the present age can be justified by the fact that Zimbabwe is a mineral-rich country that has failed to capitalize on its primary production modes because of a failing economy. Even though studies have shown that mineral-rich countries often show a slower rate of growth than resource-poor countries as a result of mineral-dependency,²⁹ studies have further debunked this by showing that mineral-dependency can be a tool for economic growth through the strategic use of linkages,³⁰ namely for this present discourse, the link between the mining sector and FDI.

Furthermore, at this juncture, the world is on the cusp of the 4th Industrial Revolution and must seriously meditate on the necessities of technology, data and digitization as provided via satellite technology, and that this will, in turn, help Zimbabwe usher itself into the technological age. I propose the following research aims and objectives:

- To examine Zimbabwe's mining sector and identify challenges faced by the industry
- To examine Zimbabwe's current FDI climate and hindrances thus far
- To provide novel and feasible recommendations for boosting Zimbabwe's mining and FDI policies using 4th industrial revolution drivers

²⁹ Zikiti (n 1 above) p2.

³⁰ As above.

1.1.4 *Research Questions*

1. What is the state of the mining sector in Zimbabwe?
2. Whether mineral resources are an attractive source of Foreign direct investment in Zimbabwe
3. What are the options available for Zimbabwe in mapping mineral resources?

1.2. Research Methodology

A comparative, historical and descriptive methodology will be utilized to examine ZINGSA's functions and progress, comparing its present form to regional and international models before finally detailing and expanding on pitfalls, promises and progress of trade, investment, and development in the context of Zimbabwe's. The mining sector and FDI.

I will be relying on literature, that is library research as well as comprehensive desk research to supplement, I believe these will be sufficient in forming a critical analysis of the primary as well as secondary sources that will be pertinent for this study. I will also rely on online sources such as websites and online newspapers where the above is deficient and to provide contextual examples.

With regards to primary sources, I will rely on the enabling legislative and policy frameworks in Zimbabwe, including but not limited to statutes, published policy documents and any other applicable legal instruments as gazette by the government of the Republic of Zimbabwe.

Secondary sources of information will comprise industry reports on space technologies in the mining sector, journal articles that address the use of space technologies as a tool for investment as well as the opinions of notable scholars, academics and researchers who have published papers relevant in this regard. As a subsidiary secondary source, I may also frequently refer to speeches and other addresses made in different media ranging from tv and radio interviews to state newspapers and public forums as well.

There has been scant research on the use of GIS technology as a tool for attracting investment in the mining sector in Zimbabwe, let alone in Africa. Thus, I hope this research will be groundbreaking, novel, analytical and comprehensive.

The discussion will follow a historical, descriptive, analytical, as well as comparative approach.

1.2.2 *Historical approach*

While considering the historical development of international investment law, not only in a global but national context, as well as considering the growth of the mining sector and the constitution of ZINGSA, it is undoubted that a historical approach will be utilized. While the excitement surrounding Africa's resource endowment is multifaceted, what is primary is Africa's history of resource exploitation, such as the indigenous communities from Western Africa who used highly advanced panning and sluicing for gold,³¹ or additionally the fact that in the Mashonaland region (located in what is now known as Zimbabwe) there was once a mine in the 17th century belonging to a Portuguese traveler that at one point was producing over

³¹ A Boahen 'Topics in West Africa history' (1996) *Tiyambe Zeleza, A modern economic history of Africa* (1) p 30.

400 000 ounces of gold for its patron! From these facts, one can gather that there is a need to study the development of natural resource management in Africa over the years.

1.2.3 *Descriptive approach*

In addition to describing the progression of resource management in Africa the dissertation will also touch on the applicable theories to not only natural resource management but also theories on foreign direct investment, as well as existing principles and regulations in the mining sector and in space law and policy.

1.3.3 *Analytical approach*

After discussing the different theories and models above, a critical analysis will ensue to determine the most appropriate investment, fiscal, mining and space regulations to bring about the intended benefits of ZINGSA's programme on mineral mapping.

1.3.4 *Comparative approach*

The investment and mining regulation system in Zimbabwe is informed by the Constitution which is considered the supreme law of the land.³² This echoes Section 2 as found in the South African Constitution which also submits that all laws, conduct and even custom found to be inconsistent with the Constitution are to be struck down or amended to meet constitutional muster.³³ Zimbabwe's regulatory regime will thus be tested against other jurisdictions that are informed by Roman Law and English Law such as Botswana and Namibia. There will be case study analysis with regards to all sectors mentioned hereto.

1.4 Literature Review

There is no shortage on academic works pertaining to international investment law across the globe. A number of these address the specific developmental context of African economies and businesses with varying success rates depending on the methodology utilized. As it pertains to broad theories on international law I will rely primarily on "M Sornarajah *the International Law on Foreign Investment* (2010)" as prescribed during our investment law module, which provides a fundamental introduction to Investment law theories. It focuses, along with other scholarly materials, on provisions contained within modern investment treaties and practices of States looking to boost collapsed investment climates like Zimbabwe. I believe that it will give the best practice guidance on model laws around the world.

In other papers, it has also been noted that the vast regulatory challenges surrounding mining regulation not only in Zimbabwe but other African countries frequently involves a challenge in good governance in natural resource management.³⁴ To highlight the different aspects of democracy, the rule of law, accountability and transparency as well as issues of corporate social responsibility I will rely as well on the *Natural Resource Investment and Africa's Development*

³² Section 2 of the Zimbabwean Constitution Amendment Number 20 (Act 2013).

³³ Section 2 of the Constitution of the Republic of South Africa (1996).

³⁴ R Ako & N Uddin 'Good governance and resource management in Africa' (2011) *New Horizons in Environmental and Energy Law* 1 p22.

edition of the New Horizons in Environmental and Energy Law journey, which is a conglomeration of different African scholars. Their studies find that foreign direct investment is dampened where there is improper regulation. The discourse will thus also examine the risk to Zimbabwe's mining sector if management is compromised because of bad governance especially on the political front.

Other literary sources have expressed the necessity of the drafting of policy frameworks that not only woo foreign investors but also have a commitment towards enriching the task force through technological transfer and this will involve an investigative discussion on the role that the 4th Industrial Revolution will also play in ushering Zimbabwe towards a sustainable development model that addresses not only the technology but also the economic and poverty gap in the country. Because the jurisprudence is still being developed in this regard, I will have to rely much on online sources particularly the *Space in Africa* resource which describes itself as "the premier source of space-related news from Africa," and frequently addresses current news on how African states are using space technologies in innovative ways to drive sustainable development on the continent.

According to Colin McCarthy, the growth and development of the African Space Industry Space agencies and accordingly ZINGSA fall under the greater international law regulatory framework known as space law, governed by the five main space treaties namely the "Outer Space Treaty", the "Moon Agreement", the "Liability Convention", the "Rescue Agreement" and the "Registration Convention" and these are commonly known as the "5 United Nations treaties on outer space".³⁵ Zimbabwe has yet to sign or ratify either one of these treaties.³⁶

Of at least 10 other regulatory regimes governing satellite applications, Zimbabwe has only signed the 1971 Agreement Relating to the International Telecommunications Satellite Organizations (ITSO) and the 1992 International Telecommunications Constitution and (ITU).³⁷ ZINGSA hopes to eventually extend satellite applications in their Land Demarcation Programme,³⁸ mapping of Afro-Ecological Zones, quantifying the country's biomass and solar capabilities, wildlife tracking, and anti-poaching measures and finally identifying malaria-prone areas and other health concerns.³⁹ At present only Global Positioning Satellite Technology (GPST) is used for telecommunications and broadcasting.⁴⁰ However lamentably at this stage, Zimbabwe still shares a payload with South Africa's SABC satellite systems

³⁵ 'Space Law Treaties & Principles' *United Nations Office for Outer Space Affairs* (2019) Available at <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html> [Accessed 17 May 2019].

³⁶ GA Resolution A/AC.105/C.2/2018/CRP.3 "Status and application of the five United Nations treaties on outer space" "Committee on the Peaceful Uses of Outer Space Legal Subcommittee Fifty-seventh session Vienna, 9–20 April 2018 Item 6 of the provisional agenda.

³⁷ As above.

³⁸ For the issuance of 99-year leases. Land is demarcated using satellite and drone technology; See reference above.

³⁹ As above.

⁴⁰ J Cochran 'Zimbabwe Telecommunications' (26 May 2016) Available at <https://dlca.logcluster.org/plugins/servlet/mobile?contentId=10130664#content/view/10130664> [Accessed 17 May 2019].

which compromises the broadcasting strength, quality and sovereignty of Zimbabwe's telecommunications systems.

As it stands at present, the multilateral trade agenda has been redefined by the introduction of the concept of Nanosatellites which effectively fulfill the same tasks as conventional satellites, save for the fact that they are smaller and considered more economically efficient. To address the space regulatory frameworks, I will rely as well on the publications of Carl Christol *the Modern International Law of Outer Space* (2012) – sometimes referred to as the grandfather of space law. Carl Christol discusses fundamental principles and enabling legislation of space law. He will be supplemented by Frans Von Der Dunk's *Handbook on Space Law* (2015) – which addressed the interpretation of space treaties especially in the light of technological advances such as Space Applications.

1.5 Delineation and Limitations

- a) This research will focus on the regulatory gaps within Zimbabwe's Mining Policy and not its broader Trade Policy.
- b) Investment theories discussed will pertain to foreign direct investment as opposed to domestic investment approaches.
- c) The applicable space law is restricted to that pertaining to satellite technology.
- d) The recommendations herein are not intended to be an absolute and unitary strategy but must be used in conjunction with other developmental measures.

1.6 Referencing technique and key terms

This dissertation is consistent with the University of Pretoria's Pulp Referencing Style Guide. The following terms are pertinent through this research: foreign direct investment, sustainable development, the 4th industrial revolution, good governance, mineral mapping, resource management.

1.7 Overview of Chapters

Chapter 1 is characterized as the research chapter which gives a synopsis of the origins of the Zimbabwean mining sector. It gives the background on why the mining sector has performed poorly and how this has further had a negative effect not only on FDI but foreign currency generation in Zimbabwe, leading to an economic downturn. Chapter 1 also explains how the Zimbabwean government established and intends to use the Zimbabwean National and Geospatial Space Agency to leverage space capabilities in the mining sector. This programme, using satellite technology, is expected to promote FDI in Zimbabwe's mining sector. The chapter also addresses the problem statement and hypothesis before explaining the research objectives and pursuant methodology. The delineations and limitations of the study will also be stated as well as the style guide used for referencing and final this brief overview of chapters.

Chapter 2 will be a conceptual one giving further information on Zimbabwe's mining sector. This chapter tracks the industry from its infancy up until the last mineral mapping that was conducted in 1980.

Chapter 3 will commence by first giving the theoretical frameworks surrounding international investment in Africa. It will give a short description of the different micro and macroeconomic theories within which the law of investment, mining and space law operates as well as the specific instruments used to achieve these policies in the context of sustainable development. The chapter will continue with an examination on the progression of FDI data in Zimbabwe and show why foreign investment is important in stimulating growth and mitigating the current currency deficit and cash crisis issues. This chapter will consider how sound mineral mapping policy will be instrumental in providing certainty, stability, and security to foreign investors.

Chapter 4 will address specifically the Zimbabwean Space Agency, its Constitution, functions as well as country-specific frameworks. I believe this is the prescriptive part of the dissertation and focuses on the authorities that are tasked with implementing the use of space applications in mineral mapping. It gives outlines of different space agency models ranging from the global context to local African contexts as well as the way that certain frameworks are categorized, and the risk involved with their different models. It will discuss how these policies are complementary in driving development in Zimbabwe's mining sector by analyzing different interaction models and drawing recommendations as far as possible where the policies detract. A brief note will be made on some of the types of investment contracts that different space agencies have signed, such as Bilateral Investment Treaties (BITs) and using an analytical framework, will use this chapter to describe how the selection and use of either of these models will present certain benefits and disadvantages. This is done also considering the developmental contexts of emerging space economies in Africa. This chapter rounds of the debate by considering future implications of space applications for mineral mapping to boost FDI, by looking at the role that the fourth industrial revolution, namely space law, digitization, and artificial intelligence may one day play in investment policy and mining specifically, but also socio-economic rights and sustainable development in general. The chapter will conclude by reemphasizing the satellite component of this research, further highlighting Zimbabwe's developmental capacity needs in this industry and the necessary infrastructure development that will also be required to this extent.

Chapter 5 is a relatively short chapter that gives a final overview of the research piece. It will address the discussions contained in chapters one to four before giving concluding remarks and a summation of the research. Given all the challenges espoused above it is hoped that the recommendations made in this dissertation will help inform government on the socio-economic as well as political benefits that the use of space applications, namely satellite technology, hold in the African context.

CHAPTER 2: SYNOPSIS OF THE MINING SECTOR IN ZIMBABWE

2. Introduction

At present Zimbabwe's mining sector is characterized by both small to medium mining operations, the most important minerals being produced being gold, asbestos, coal, chromite and base metals.⁴¹ The mining sector currently contributes towards 8% of Zimbabwe's total GDP.⁴² The sector is regulated by the Zimbabwean Mines & Minerals Act [21:05],⁴³ with exploration to date being deemed to have only scratched the surface of Zimbabwe's full potential which is known to lie in two main areas namely the Great Dyke as well as the Greenstone Belts.⁴⁴ This chapter will examine the inception of the sector and its development and progress thus far.

The Great Dyke is described by the Mineral Potential Booklet as "a layered igneous complex" which stretches from North to South along a 550km plane.⁴⁵ It is considered the largest base for chromite deposits and also houses the largest platinum reserves as well as considerable copper and nickel deposits.⁴⁶ Zimbabwe's geological environment can be categorized as heterogeneous and has rock ages that span for a period of more than 3 billion years.⁴⁷ Below will be an overview of Zimbabwe's mining history as well as a brief breakdown of the various mineral resources found within Zimbabwe's rich mining sector.

2.1 History of Mining in Zimbabwe

Mining in Zimbabwe can be traced all the way back to the 1890s in Mashonaland East, where artisanal gold mining was considered a 'great antiquity' and various mining sites were producing high-grade gold for export.⁴⁸ In fact, one small mine, owned by a Portuguese explorer, was recorded to have produced over 400 000 ounces of gold in the 17th century,⁴⁹

The earliest forms of modern mining were recorded in 1892 and by the year 1990 over 40 minerals were being exploited.⁵⁰ Over the first century of mining in Zimbabwe, the two most popular minerals were undoubtedly gold and asbestos, but this began to change with the

⁴¹ 'Mining in Zimbabwe' *Ministry of Mines & Mining Development* Available at <http://www.mines.gov.zw/> [Accessed 17 May 2019].

⁴² As above.

⁴³ Mines & Minerals Act [21:05] Acts 38/1961, 24/1962 (s. 2), 18/1963 (s. 24), 19/1963 (s. 12).

⁴⁴ *Ministry of Mines & Mining Development* (n 14 above).

⁴⁵ Mining Potential Booklet "Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)" January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 1.

⁴⁶ As above.

⁴⁷ As above.

⁴⁸ A Boahen 'Topics in West Africa history' (1996) *Tiyambe Zeleza, A modern economic history of Africa* (1) p 30.

⁴⁹ As above.

⁵⁰ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p 1.

⁵⁰ United Nations Conference on Trade and Development 'World Investment Report' (2008) p 3.

upsurge in nickel and ferrochrome as valuable exports and more recently with the exploitation of platinum group metals, that is platinum, palladium, and rhodium.⁵¹

During that same period in the 1890s, it was discovered by the Chamber of Mines that much of the information relating to mineral reserves was going missing especially those mines that had been established during the occupation of the British South Africa company.⁵² To combat this the Zimbabwe Geological Survey (ZGS) was instituted in Bulawayo in 1910 and later relocated to the capital city Harare in 1918.⁵³

The ZGS were tasked with mapping regional reserves and identifying the most important economic minerals by creating a geological map that detailed the geology of the area as well as a description of the mine sites and mineral deposits.⁵⁴ The first general geological map was published at a 1:1 000 000 scale in 1921 by synthesizing geological information gathered through mapping.⁵⁵ As more data was collected these maps were being published more frequently with editions being released during the years 1928, 1936, 1946, 1961, 1971 and 1977.⁵⁶

The ZGS is charged with generating, storing, and distributing geoscientific information across different sectors,⁵⁷ namely geoscientific data compilation, mapping, studying mineral resources, mineral exploration monitoring, technical services, as well as being the custodian of all national geoscientific information.⁵⁸

The ZGS has identified more than 500 deposits of base metal and other industrial minerals all over Zimbabwe. It characterizes Zimbabwe as a major producer of gold, lithium, chrome, asbestos, and caesium as well as certain high-quality emeralds.⁵⁹ Most of these mining operations are focused on the Archaean core of the country where a vast majority of deposits are concentrated along with the greenstone belts which have been found to contain minerals ranging from gold copper, tungsten, antimony, and even arsenic. Nickel has also been discovered in these belts along with its by-products copper and cobalt, while deposits of

⁵¹ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series “Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery” (2009) p 1.

⁵¹ United Nations Conference on Trade and Development “World Investment Report” (2008) p 3.

⁵² Ministry of Mines and Mining Development ‘Zimbabwe Geological Survey’ Available at <https://www.mines.gov.co.za> [Accessed 2 October 2019].

⁵³ As above.

⁵⁴ As above.

⁵⁵ As above.

⁵⁶ As above.

⁵⁷ ‘Mining in Zimbabwe’ *Ministry of Mines & Mining Development* Available at <http://www.mines.gov.zw/> [Accessed 17 May 2019].

⁵⁸ As above.

⁵⁹ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series “Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery” (2009) p 1.

⁵⁹ United Nations Conference on Trade and Development “World Investment Report” (2008) p 3.

asbestos have been discovered in the serpentinized ultramafic intrusions. Furthermore, the Great Dyke which runs through the centre of the country from North-East to Southwest is known to contain vast resources of chromite and platinum.⁶⁰

Mining began simply with the exploration and exploitation of gold as a primary resource, during which time most deposits were still known because of ancient workings. Shortly after, chromite deposits were discovered, and chrysotile asbestos was developed along with coal from the Hwange region. In addition to this, the Zimbabwe Iron and Steel Company (ZISCO) was established to begin production of iron, steel as well as coke, and meanwhile, two other major operations were being developed by Zimbabwe Alloys (ZA) to produce low carbon ferrochrome and as well Zimasco which manufactured high carbon ferrochrome.⁶¹ Subsequent to this, an ammonium nitrate plant was also opened at Zisco to develop oxygen-refined steel, while simultaneously a coking plant was also developed at Hwange for steam coal to fire the newly established Hwange Thermal Power Station.⁶²

Copper deposits were mined by MTD Mangula, and the Empress nickel deposit, which was found in 1956, also began producing other nickel properties during the 1960s and late 1970s. This was supplemented by two other nickel deposits at Hunters Road and Damba-Silwane which unfortunately to date remain dormant. Presently Empress Nickel mine has shut down its refinery operations for toll treatment of matte from the BCL mine located in Botswana. In Buchwa and Ripple Creek, iron ore continued to be exploited via small open cast mines, and the same was replicated at Dorowa for phosphate, in addition to a few other open cast goldmines which were extracting minerals via heap-leaching.⁶³

From the year 2000 however, some mines began to shut down their operations including Mangula who had been known as the leading copper producers, and they were in turn followed by Alaska and Sanyati and the Epoch and Madziwa nickel mines.⁶⁴ To date, the Gaika, Motapa and Royal Family gold mines have since closed, in addition to the Railway Block high-grade chromite mine.⁶⁵

⁶⁰ As above.

⁶¹ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 3.

⁶² As above.

⁶³ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 3.

⁶⁴ As above.

⁶⁵ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 3.

A few disinvestments also occurred most notably that of the original BHP Platinum mine located at Selous, which was established in the 1990s but shut down operations when the Australian mining company that had initially invested in it decided to take its investments elsewhere.⁶⁶ The plant was reconfigured to cater for the open cast mining that took over at Ngezi while in recent years diamond pipes located at Murowa (which is a part of the Rio Tinto group) as well as River Ranch, continue to be exploited on a small scale along with alluvia diamonds in Marange.⁶⁷

Only permanent residents of Zimbabwe who are above the age of 18 are permitted to apply for a prospecting license from any Provincial Mining Director, for the purposes of prospecting and registering mining claims.⁶⁸ Such licenses subsist for a maximum of two years and the holder thereto automatically acquires the rights to prospect as well as peg mining claims in Zimbabwe.⁶⁹

To date, all mining projects operate under certain limitations, those most pertinent being the buoyant exchange rate, which has nearly obliterated gold production, in addition to shortages of power, skills, ore and low Sulphur coal which is a requisite for the ferrochrome sector.⁷⁰ Meanwhile, there is a major capacity for the development of platinum mines still with the development of the new underground mines located at Unki, owned by Anglo-American, as well as Ngesi which is owned by Impala Platinum and finally Mimosa.⁷¹

The ZGS has created a list from 1990 that contains 66 base and industrial mineral deposits mapped across Zimbabwe however in recent years production has begun to concentrate to the point whereas of 2006, only 7 products were accounting for about 98% of total export value. This trend reflects the price fluctuations as well as the increase in gold and platinum prices, in addition to a change in the composition of mineral outputs from higher value and value-added minerals such as ferrochrome and PGMs.⁷²

⁶⁶ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 3.

⁶⁷ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 4.

⁶⁸ As above.

⁶⁹ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 9.

⁷⁰ As above.

⁷¹ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 4.

⁷² Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at

Upon identifying a potential mineral deposit, a prospecting license holder may request for the appointment of an agent or other Approved Prospector to peg the site on his/her behalf, should they have interest in exploring that deposit. The Agent will then go on to demarcate the area physically by marking the deposit with a Discovery Peg. As is prescribed by the procedure, the agent should also give notices of the Prospecting, Discovery, and Registration by way of physical marking on the ground as well. These notices must be clearly visible for other prospectors to identify and take note of.⁷³

Before these notices are to be posted, the Agent must give written notice to the owner of the land highlighting the requisite intention to prospect. There are certain areas such as dip tanks, dams and cultivated lands etc. that are classified as not being open to prospecting and pegging and are reserved from such actions.⁷⁴

A registration application should be submitted to the Ministry of Mines and Mining Development, at the Provincial Mining Director's offices, and should be accompanied with the following supporting documents:

- (a) Prospecting licenses;
- (b) Prospecting Notice;
- (c) Discovery Notice (Base Minerals);
- (d) Notification of intention to prospect to the landowner;
- (e) A map in triplicate to the scale of 1:25000.⁷⁵

Only when the Provincial Mining Director is satisfied that the procedures have all been complied with shall they be required to issue a certificate of registration, but only upon payment of the gazetted fee. This gives the holder the authorization to commence mining projects subject, of course, to comply with the other subsidiary obligations such as those pertaining to environmental management.⁷⁶

Three months from the registration date the miner is expected to erect certain permanent beacons on the ground. After this has been done a renewal of title for precious minerals can only be renewed if the site is continuously worked on, which claims have a 12-month tenure. Whenever a mining title is transferred or sold, a Certificate of Registration After Transfer will have to be provided for by the Ministry of Mines and Mining Development.⁷⁷ If for any reason the title is not renewed this will result in the Prospector forfeiting their mining claim and a further loss of title can also occur in the event that the Prospector has failed to comply with

<http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf>
[Accessed 4 October 2019] p 5.

⁷³ As above.

⁷⁴ As above.

⁷⁵ As above.

⁷⁶ As above.

⁷⁷ As above.

other minimum requirements resulting in the claim automatically being cancelled.⁷⁸ Abandonment is also grounds for cancellation of a mining title.⁷⁹

2.2 Challenges Facing the Mining Sector in Zimbabwe

Zimbabwe is not typically considered a mineral economy like the DRC, Zambia or even Botswana, however, since the 2000 crisis period it has become increasingly dependent on foreign revenues stemming from a very narrow range of mineral exports.⁸⁰ Despite the output levels falling, the mining export shares doubled from 27% in 2000 to about 53% in 2008, and in addition to this export concentration also increased.

During the year 2000, the top five mineral exports in terms of revenues were PGMs, nickel, gold, asbestos, and ferrochrome, which in conjunction have accounted for about 24% of total exports. However, by the year 2008, the total share had doubled to 49% for the four main products (asbestos was no longer considered as its export volumes had fallen).⁸¹

The concentration of export ratios has risen in recent years for quite several resource-based African countries, particularly oil producers, but not only limited to them. Exports across the board have grown to 80% during the years 1995-2006 according to the UNCTAD report for 2008. The rising primary commodity prices during the years 2006 to 2008 are the likely causes that further boosted this concentration⁸².

Zimbabwe's experience is relatively different from the mining sectors in DRC, Zambia, and Botswana which are considered mineral-rich in that unlike these three countries, Zimbabwe had been able to build a successful commercial and manufacturing sector in tandem to that of mining, however, these have since deteriorated.⁸³

The increasing export concentrations can be attributed to three main factors namely:

- a) The sharp fall in both commercial agriculture as well as manufacturing which both held a combined export share of 72% in the year 2000 which later fell to 43% by the time 8 years had elapsed,
- b) The commodity price boom that was felt globally,
- c) The growth of platinum as Zimbabwe's key export, taking over the position previously held by Tobacco.⁸⁴

These changes, though temporary, shifted Zimbabwe from a diversified export market (reliant on mining, manufacturing, agriculture, and tourism), to one that was solely reliant on mining

⁷⁸ As above.

⁷⁹ As above.

⁸⁰ As above.

⁸¹ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p 1.

⁸² United Nations Conference on Trade and Development 'World Investment Report' (2008) p 40.

⁸³ As above.

⁸⁴ As above.

exports for its foreign currency earnings.⁸⁵ These issues should be the focal point for policymakers going forward.

From a policy perspective there are 3 complementary effects which stand out in this case namely:

1. The Resource Curse
2. Dutch Disease
3. Wealth depletion efforts

Theorists on the Resource Curse advance that while some countries have experienced growth and diversification based on their rich mineral wealth (countries such as Norway, Indonesia, Malaysia, and Norway), post 1970 history illustrates that many mineral-based developing countries have performed below average on a consistent basis when it comes to growth performance, governance as well as income equality. This theory posits that those natural resource sectors that are export-driven such as precious metals, gemstones, oil, and gas, have the capacity to generate considerable revenues for both the government as well as foreign-owned entities, however, these do not automatically translate into economic growth that benefits all members of the population particularly the poor.⁸⁶

This contradiction can be accounted for by the inability of states in mobilizing non-renewable natural resource revenues (otherwise known as resource rents) and reinvesting them appropriately in both human and physical capital, diversification of the economy and putting it towards poverty reduction. It is further posited that countries that have rich natural resource sectors are a catalyst for Dutch-Disease i.e. over-valuation of the exchange rate, which swivels the terms of trades contra other sectors of the economy (the affected sectors in Zimbabwe being agriculture, manufacturing as well as tourism. This, unfortunately, erodes the economic diversification and export growth of the economy.⁸⁷

The evidence is scant on the effects that the Resource Curse or so-called Dutch Disease have had on the Zimbabwean economy pre- and post-independence, as well as prior to the crisis of 1997. The currency that was eventually overhauled was a result of conscious policy choices and not specifically the Dutch Disease, which was also coupled by the country's uninspiring growth performance which can also similarly be attributed to the lack of adequate policy formation and implementation.⁸⁸ However, the heavy reliance on revenues from mining especially during the years 2003 to 2008 (also known as the commodity boom) gives rise to a number of issues that will have to be addressed over at least the next decade.

The degree to which Zimbabwe is now in danger of experiencing the Resource Curse and the effects of Dutch Disease must be considered. When evaluating a diversified economy, there is

⁸⁵ As above.

⁸⁶ As above.

⁸⁷ As above.

⁸⁸ As above.

the real danger that Dutch Disease, fomented by high prices for minerals and worsened by aid inflows, will limit the growth of other sectors such as agriculture, tourism, and manufacturing and particularly their ability to generate rather than expend foreign currency.⁸⁹

Furthermore, with the introduction of the dollar system post-2008, the negative impact of Dutch Disease has turned from a buoyant exchange rate for the Zimbabwean dollar to increased cost and price systems that impair competitiveness. This means that the real effective exchange rate- substituted by either the US dollar or the rand or whichever selected currency- will tend to be overvalued. As a result of the fact that the nominal exchange rate cannot be devalued other than by abandoning the dollarization system, certain adjustments must be made such as bringing costs and prices down, that is, by optimizing productivity and competitiveness. Undoubtedly this is seen as a deflationary measure because it is commonly linked to recession in which output, employment as well as incomes are negatively affected.⁹⁰

Larger export concentration has already raised the country's vulnerability to adverse commodity price fluctuations, and this is best illustrated in the temporary closure, during the years 2008-2009, of some mining operations, especially the impact was seen with regards to human capital as well as infrastructure coupled with a reduction in production capacity across the sector affecting all minerals.⁹¹

A persisting oscillation in the economy's growth path from one based on labor-intensive agriculture, a bit of manufacturing and tourism, to that of capital and skills intensive mining would up the game in terms of employment generation as well as poverty reduction unless other more express countermeasures are to be adopted.⁹² Future governments will especially need to advance an explicit portfolio management growth strategy which will require a portion of mineral rents (and maybe even tourism and forestry as well) to be ring-fenced for reinvestment purposes in produced assets, particularly in human capital and infrastructure. This is vital in ensuring that the exhaustion of mineral resources is set off by the creation of human capital and produced assets.⁹³

Mineral exhaustion considerations should be at the forefront of the tax regime for the industry. To this end, a certain proportion of mineral tax should be put aside in a Sovereign Wealth Fund,

⁸⁹ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p 1.

⁸⁹ United Nations Conference on Trade and Development 'World Investment Report' (2008) p 2.

⁹⁰ As above.

⁹¹ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p 1.

⁹¹ United Nations Conference on Trade and Development 'World Investment Report' (2008) para 3.

⁹² United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p 1.

⁹² United Nations Conference on Trade and Development 'World Investment Report' (2008) para 4.

⁹³ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p 1.

⁹³ United Nations Conference on Trade and Development 'World Investment Report' (2008) para 5.

and managers must be appointed to ensure that revenues generated are rechanneled into the local economy rather than being utilized to fund general government expenditure.⁹⁴

It must also be noted that with the reemergence of so-called resource nationalism, both within the borders of Zimbabwe and without, the ownership and exploitation of natural resources may likely stay a controversial economic policy and political issue, underlining the need for transparent and competitive industry investment and fiscal regimes.⁹⁵

Between the sharp falling of the economy (especially in the years 2007 and 2008) and the disastrous effects of hyperinflation as well as the dollarization period, local savings in households, corporations and governments were completely ravaged.⁹⁶ For recovery to occur this would take decades and a concerted effort by the government to voluntarily do away with pre-existing commitments to work indigenization, which has the intended or unintended result of depressing investment levels, further undermining economic growth and poverty reduction.⁹⁷

What official statistics show is that Zimbabwe is active in 10 out of a possible 60 minerals in the mining sector, however, the country's last full-scale mineral exploration was conducted in 1980 during Zimbabwe's Independence.⁹⁸

The decline of the mining sector's capacity coincided with that of the agriculture sector which at present remains the primary contributor to the country's GDP from independence to the year 2000.⁹⁹ Proceeding these years the mining sector was hindered as a result of the persistent political unpredictability as well as policy uncertainty in Zimbabwe which hampered the creation of any viable economic linkages.¹⁰⁰ The political instability can be linked to the failed land reform program which commenced in 2000 which had the effect of weakening legal and institutional frameworks as well as resulting in various political inconsistencies. This reduced investor's confidence in the mining sector.¹⁰¹ With the pursuant imposition of so-called "smart sanctions," the country was unable to trade or borrow from the West in particular and this exacerbated the economic and political problems not only in the mining sector but the country

⁹⁴ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p 1.

⁹⁴ United Nations Conference on Trade and Development "World Investment Report" (2008) para 6.

⁹⁵ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p 1.

⁹⁵ United Nations Conference on Trade and Development "World Investment Report" (2008) para 7.

⁹⁶ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) para 7.

⁹⁶ United Nations Conference on Trade and Development "World Investment Report" (2008) para 8.

⁹⁷ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p 1.

⁹⁷ United Nations Conference on Trade and Development "World Investment Report" (2008) para 8.

⁹⁸ As above.

⁹⁹ Zikiti (n 1 above) p 3.

¹⁰⁰ As above.

¹⁰¹ As above.

as a whole.¹⁰² The fields of data science and most importantly in this regard mineral exploration data are not only vital for mapping reserves but also assist in ascertaining the number of resources that are required to bring the project to fruition.¹⁰³ Through the establishment of the Space Agency, it can be said that Zimbabwe has, through the United Nations, joined the ranks of Ethiopian, South Africa and Nigeria in being categorized as an Emerging Space Nation.¹⁰⁴

2.3 Mining Reform in Zimbabwe

While the policy reforms have been met with open arms in the local context, it has received mixed reactions from abroad as a viable development instrument. Principally, the policy aims to address the injustices that have historically empowered foreign investors while disenfranchising local investors in participating in the economy.¹⁰⁵ This new policy thinking has been addressed in the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZimAsset) which was developed in 2013 to emphasize the government's ideals of beneficiation and value addition in the mining sector.¹⁰⁶

2.4 Minerals in Zimbabwe

2.4.1 Gold

To date, there have been over 4000 gold deposits recorded within Zimbabwe, almost all of which have been located on ancient workings.¹⁰⁷ These deposits remain under-exploited and have not been explored in recent years to unearth new deposits neither have existing deposit's potential been fully realized.¹⁰⁸ About 90% of the gold deposits have been linked to the greenstone belts whose gold quality has been compared to countries such as South Africa, Canada, and Australia which comparably have some of the richest deposits in the world.¹⁰⁹ Other known deposits include those in the northwest part of the country located outside of the Zimbabwe craton, known as the Proterozoic Piriwiri rocks, as well as deposits along the Limpopo Mobile Belt in the Southern part.¹¹⁰

2.4.2 Diamonds

Diamonds are one of the gemstones in Zimbabwe that have massive potential. Kimberlites bearing diamonds have historically been located in ancient cratons in countries such as Siberia

¹⁰² As above.

¹⁰³ R Bhala (n 6 above).

¹⁰⁴ Zikti (n 1 above) p4.

¹⁰⁵ As above.

¹⁰⁶ As above.

¹⁰⁷ Mining Potential Booklet "Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)" January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 2.

¹⁰⁸ As above.

¹⁰⁹ As above.

¹¹⁰ As above.

and Congo and regions such as the Kaapvaal.¹¹¹ Having similar geological terrain to these regions, the Zimbabwean cratons provide immense and vast opportunity for kimberlitic diamond discovery.¹¹² Roughly 160 kimberlites have been discovered in areas such as Murowa Mine located in Zvishavane, the Midlands Province as well as River Ranch Mine located in the Matabeleland South provincial town of Beitbridge.¹¹³ Most recently there was a discovery of significant placer diamonds in the Chimanimani and Marange areas of the Manicaland province and these point to a significant potential across many ancient deposits if these are to be fully explored and mined.¹¹⁴ If this is done extensively it is believed that Zimbabwe will become a key player in global diamond production.¹¹⁵

2.4.3 Platinum Group Metals (PGM)

Zimbabwe is host to the 2nd largest resource for Platinum Group Metals (PGM) after South Africa.¹¹⁶ 2.8 billion tonnes of PGMs ore at 4g/t 4e is located within the Great Dyke Belt alone.¹¹⁷ The grade as well as the thickness of the ore specimens are varied and persist over vast areas, however, the Great Dyke has two primary PGM-bearing zones, which is the Main Sulphide Zone (MSZ) and the Lower Sulphide Zone (LSZ).¹¹⁸ Mining operations are currently operational at the MSZ while the LSZ is still to be explored in detail in order to avail further opportunities for investors.¹¹⁹

2.4.4 Chrome

Zimbabwe is host to the second-largest high-grade chromium reserves in the world, coming after South Africa, with reserves estimated at a whopping 10 billion tonnes.¹²⁰ The chrome is mined mainly along the Great Dyke belt of Zimbabwe which occur as strati of deposits along its strait.¹²¹ It is also found along with the Greenstone belts found off of the Dyke and it occurs in serpentinite form as podiform structures, some locations for example being the Zimasco

¹¹¹ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 2.

¹¹² As above.

¹¹³ As above.

¹¹⁴ As above.

¹¹⁵ As above.

¹¹⁶ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 3.

¹¹⁷ As above.

¹¹⁸ As above.

¹¹⁹ As above.

¹²⁰ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 4.

¹²¹ B Zikiti ‘How can Zimbabwe Leverage its Mineral Resources for Economic Recovery and Sustainable Growth’ Master’s Thesis, Wits University p 2.

mine on Shurugwi Mashava. Some giant crystals measuring up to 1.5m have even been discovered along the Dyke. In the Mashava region chrome is found in remnants of greenstone towards the Limpopo belt which is south of Mberengwa. It also occurs as eluvial deposits in the Greenstone belt as well.¹²² This mineral is mainly used for stainless steel manufacture, also as a metal coating as well as for metallurgical processes and in the chemical industry.¹²³

2.4.5 Coal

Once more Zimbabwe is host to vast reserves of coal located in the mid-Zambezi basin, the Save-Limpopo basin as well as in the rocks of the Lower Karoo. These coal-rich areas are estimated to contain over 26 billion tonnes of coal spread across 29 known coal localities. Production of coal had been limited to the coalfields in the Zambezi Valley however more recently some production operations had been kickstarted at the Sengwa coalfield located near Gokwe, as well as Kwasine coalfield located just outside of Chiredzi and finally the Tuli coalfield close to Beitbridge. As with most minerals the Zimbabwe coalfields are yet to be fully explored and exploited despite the fact that the grade of coal is considered of superior quality and has been found to be both suitable for thermal power generation as well as coking purposes in metallurgical applications amongst others.¹²⁴

2.4.6 Nickel

As with most other minerals in this chapter, Zimbabwe's geological environment is highly favourable for the occurrence of nickel. Zimbabwe's nickel-sulfide endowments include a vast amount of komatiite and mafic intrusion-hosted deposits. Over 30 sites have been uncovered to date. There are other resource basins that contain large amounts of laterite nickel deposits located on the northern tip of the Great Dyke as well as oxide nickel deposits in several serpentinite areas across the greenstone belts, also igneous complexes dotted all around the country.¹²⁵

2.4.7 Asbestos

This mineral occurs as chrysotile and it is commonly found in ultramafic complexes e.g., in the Mashava Igneous Complex, also common in large serpentinites and other slip fiber zones wherein which shears are filled with matted fibers in the Great Dyke. An example of a well-known asbestos site is Ethel mine. Currently, however, there are more than 60 deposits spread across Masvingo, Insiza, Gwanda as well as Mberengwa and Shurugwi which are currently being explored for chrysotile. At some point Zimbabwe was even considered the 3rd largest producer of asbestos in the world before global demand began to decline.¹²⁶ Also before the production of gold took root in Zimbabwe asbestos was considered the sector's largest income generator. Unfortunately, production came to a halt after the closures of the Gaths Mine and Shabanie mine.¹²⁷

¹²² As above.

¹²³ As above.

¹²⁴ As above.

¹²⁵ As above.

¹²⁶ As above.

¹²⁷ As above.

2.4.8 Coal Bed Methane gas

Exploration for Coal Bed Methane gas (CBM) began in the early 1990s and follow-up studies have shown that coal basins located within Zimbabwe have the physical characteristics, such as the requisite coal seam thickness, concomitant coal rank as well as the depth of the coal seam which are ideal for occurrences of CBM.¹²⁸ In light of these findings, various companies have assumed CBM operations across the countries various coal fields, which operations have shown that the coal basins, particularly in the western region have great potential for CBM with a local estimate of 40 trillion cubic feet (tcf) with a purity of over 95%.¹²⁹ These figures have the capacity to lure unique investment opportunities and the potential for CBM exploitation is competitive.

2.4.9 Copper

Copper deposits span over 70 known sites which produce the mineral either as a primary or a secondary product. The Magondi Basin, which is in the Karoi area in Mashonaland West Province, is considered the main area of copper production within Zimbabwe, which area covers a span of 150km. Like copper, sites have been discovered in the southeast part of Zimbabwe, namely in Manicaland, in the Umkondo Basin. Prospects for copper have also been found in the greenstone belts.¹³⁰

2.4.10 Iron

Also located in the Greenstone belts are large quantities of iron ore related to banded ironstone formations.¹³¹ The deposits have been quantified to exceed over 30 billion tons of reserves. A few of the high-grade sites are located at Buchwa as well as Ripple Creek, both of which are situated in the Midlands Province. Other notable ironstone deposits include the large Mwanesi deposit located West of Chivhu and Nyuni which is near Masvingo. Similar sites are also located in Manyoka and Mongula which are considered portions of the Limpopo Mobile Belt and have also been estimated to house great iron ore potential.¹³²

2.4.11 Pegmatite Minerals

Pegmatite minerals, which are found in several geological landscapes across Zimbabwe, especially along the peripheries of the greenstone and metamorphic belts, are a wellspring for various other key minerals such as tin, beryl, wolframite, mica, feldspar as well as gemstones such as euclase, alexandrite, chrysoberyl, aquamarine and emerald to name a few. Generally,

¹²⁸ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 3.

¹²⁹ As above.

¹³⁰ As above.

¹³¹ As above.

¹³² As above.

pegmatite minerals are found in the eastern, northeastern and western parts of the country with several other sites dotted around the different regions.¹³³

2.4.12 Dimension Stones

Dimension stones are a group of stones including but not limited to marbles, quartzites, gneisses, granites, migmatites, gabbro-norites, and dolerites, and these are rocks typically found within Zimbabwe's geological landscape. The most popular dimension stone in Zimbabwe is the black granite rock which is commonly found in the Northeast of the country and has attracted considerable foreign interest in investment to date.¹³⁴

2.4.13 Lithium

When it comes to Lithium production, Zimbabwe was ranked as the 4th largest producer in 1984.¹³⁵ Almost all the graphite production is localized at the Bikita pegmatite of Archaean age, which is considered one of the biggest lithium-bearing pegmatites in the entire world. While some lithium has been drawn from the pegmatites located in the Proterozoic Zambezi Metamorphic belt near Kamativi, most of the Lithium is retrieved from Archaean pegmatites. The minerals found at these sites include spodumene, petalite, lepidolite, amblygonite, and eucryptite. There are a few investment projects that have undertaken to exploit these minerals so far including at the Arcadia Mine in Arcturus which is currently being explored by Prospect Resources (Pvt) Ltd and Zulu Lithium which is engaging in an exploration project in Fort Rixon.¹³⁶

2.4.14 Graphite

The Proterozoic Piriwiri Group gneisses, located in the Karoi district of Hurungwe, have already been mentioned above however they are also the resource base for graphite deposits.¹³⁷ At these sites, high-grade graphite has been formed through the metamorphosis of rocks that contain carbonaceous materials. With an increase in the metamorphic grade the quality of the graphite also improves and increases. The Proterozoic Dett Intelier located in the Hwange area is another well-known deposit however main production of graphite has mostly occurred at the Lynx mine in the Karoi.¹³⁸

2.5 Conclusion

This chapter did not, however, give details into some of the lesser-known mineral and gas exploits such as natural gas and uranium. As already stated, Zimbabwe currently operates in only 10 out of a possible 60 mineral resources. It is believed that if Zimbabwe can diversify its

¹³³ As above.

¹³⁴ As above.

¹³⁵ Mining Potential Booklet "Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)" January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 7.

¹³⁶ As above.

¹³⁷ As above.

¹³⁸ As above.

mineral sector this would be more economically viable than relying solely on a single commodity to generate export earnings, provided that the market is still quite unstable and is the only source of capital generation.¹³⁹ Hence this study will focus on how Zimbabwe can diversify its market through mineral mapping to create economic linkages. As already mentioned, Zimbabwe's mining sector is vast and diversified, including over forty known minerals.¹⁴⁰ Mineral resources comprise a major share of the country's GDP owing to the increased demand in primary mineral commodities in the global economy.¹⁴¹ In explaining the conduct of foreign investors in the mining industry various scholars have developed theories that focus on how investment policies are not only applied but also how they are used. It is important to engage in a critical examination of these to ensure that such theories are viable and applicable within the economy to promote the value chain and enhance competitive globalization.¹⁴² This is because FDI is considered a tool for economic viability in a global economy and is considered to boost domestic economies.¹⁴³

¹³⁹ As above.

¹⁴⁰ Zikiti (n 1 above) p 3.

¹⁴¹ As above.

¹⁴² J Weiss *Economic Policy in Developing Countries: The reform agenda* (1995) 185.

¹⁴³ UNCTAD 'World Investment Report: Transnational Corporations, Market Structure and Competition Policy (1997).

CHAPTER 3: SYNOPSIS OF FOREIGN DIRECT INVESTMENT IN ZIMBABWE

3. Introduction

Defined narrowly, foreign investment is the act of acquiring assets outside one's home country. These assets may be financial, such as bonds, bank deposits and equity shares or they may be so-called direct investment and involve the ownership of means of production such as factories and land.¹⁴⁴

According to a report by the OECD, a fair, transparent, clear, and predictable legal and regulatory framework for investment is a key determinant in investment decisions and will undoubtedly influence their development.¹⁴⁵ FDI is defined as any investment, either via portfolio investment or direct investment, by a company outside of its country of origin¹⁴⁶

It has been supposed by Robert E. Lipsey the investment that the kind of investment that is to be distinguished and preferred by the majority of multinational companies is one in which internationalized production arises.¹⁴⁷ It is a model that emphasizes a higher degree of control over the firm, which is either acquired or created, which is located in another country that is not the country of origin of the investing company.¹⁴⁸ This is the distinguishing feature between FDI and portfolio investment, the former which has a bigger contribution towards overall economic growth as opposed to the later.¹⁴⁹

3.1 Applicable Theories to Foreign Direct Investment

One theory often favoured by scholars is the capital market theory which suggests that FDI would not exist if it were not for the market irregularities present within the economy, which include but are not limited to economies of scale, goods, and factor markets, as well as government regulation in the form of various fiscal regimes and the different trade obstacles.¹⁵⁰

The significance of FDI and its uniqueness from other forms of investment must be noted, particularly as it involves a comprehensive transfer of a package that may consist of but not limited to technology, managerial skills and access to international markets through finished products to less-developed host states. Most investors also seek to retain control of their investment and thereby internalize the market; arguably, this is the best approach as foreign investors must overcome several hurdles such as information cost, institutional, social and political frameworks that may burden their investments when setting up foreign investments.

¹⁴⁴ Foreign Direct Investment and Poverty in the ASEAN Region, Hossein Jalilian and John Weiss, ASEAN Economic Bulletin, Vol. 19, No. 3 (December 2002), pp. 231-253, ISEAS - Yusof Ishak Institute, <https://www.jstor.org/stable/25773736>, Accessed: 15-08-2019 08:30 UTC

¹⁴⁵ OECD 'Enhancing the legal framework for sustainable investment: Lessons from Jordan' Available at <https://www.oecd.org> [Accessed 23 September 2019].

¹⁴⁶ S Adewumi 'The impact of FDI on growth in developing countries: An African experience' Master's Thesis, Jonkoping International Business School, 2006 at p 2 (on file with the author).

¹⁴⁷ R.E. Lipsey 'The role of foreign direct investment in international capital flows' (1999) *International Capital Flows* 308.

¹⁴⁸ Lipsey (n 65 above) 309.

¹⁴⁹ As above.

¹⁵⁰ T Qu and MB Green 'Chinese Foreign Direct Investment: A subnational perspective on location' (1997) p 6.

3.2 History of Foreign Direct Investment in Zimbabwe

Previously, foreign investors were permitted to own a 100% stake in mining operations for all minerals except for the PGM and diamonds, which required a foreign investor to own the operations jointly with the government at a ratio of 51%/49%.¹⁵¹ When making an investment, investors are required to register a company within Zimbabwe and then acquire what is known as an investment certificate which is issued by the Zimbabwe Investment Authority (ZIA) before they can commence with operations.¹⁵² After this certificate has been received the company can then apply for mineral rights, to be obtained from the Ministry of Mines and Mining Development.¹⁵³

In an attempt to address the above challenges the government submitted an application for support from the African Development Bank (AfDB), the United Nations (UN) as well as the WBG amongst other parties to make an assessment of the scale of its challenges, which organizations subsequently instituted a Joint Assessment Phase, which collated data and analyzed existing information sources in 24 different sectors across different thematic areas in Zimbabwe.¹⁵⁴ Approved in May of 2014, The Zimbabwe Reconstruction Fund (ZIMREF) was described as a multiple donor, country-specific trust fund, as approved by the Board of Executive Directors, and will be expected to subsist until December 2019.¹⁵⁵

ZIMREF was considered instrumental in implementing the World Bank Third Interim Strategy Note for Zimbabwe and was expected to contribute to strengthening Zimbabwe's reconstruction and systems development with the aim of promoting stabilization and reform through the development and the alleviation of poverty.¹⁵⁶ However, due to economic constraints this programme was abandoned while Zimbabwe attempts to clear its US\$2 million dollar debt to ZIMREF within the next 12 months.¹⁵⁷ Since then Zimbabwe has been barred from accessing international credit and has struggled to tackle the causes of the grave political and economic crisis which has stifled the country's development since 1997.¹⁵⁸

Determined to increase revenue flow especially to attract foreign mining investors, the new administration made an announcement in March to the effect that the 49% foreign equity cap on businesses or projects would be scrapped, and that this would also extend to the diamond

¹⁵¹ Mining Potential Booklet "Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)" January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 9.

¹⁵² As above.

¹⁵³ As above.

¹⁵⁴ As above.

¹⁵⁵ The World Bank 'The Zimbabwe Reconstruction Fund' Available at <https://www.worldbank.org/en/programs/zimbabwe-reconstruction-fund#2> [Accessed 22 September 2019].

¹⁵⁶ As above.

¹⁵⁷ N Banya 'Zimbabwe aims to clear World Bank arrears in 12 months' *IOL* (Harare) 22 October 2018 Available at <https://www.iol.co.za/news/africa/zimbabwe-aims-to-clear-world-bank-arrears-in-12-months-17581563> [Accessed 22 September 2019].

¹⁵⁸ OECD 'Report on Zimbabwe' Available at <https://www.oecd.org> [Accessed 22 September 2019].

and platinum mining sectors as well.¹⁵⁹ The fact that the post-Mugabe regime seems to be placing emphasis on the mining sector as a tool to attract foreign investors is a no-brainer: Zimbabwe has for many years been considered a treasure trove.¹⁶⁰ Apart from having the world's second-largest platinum group metals (PGMs), second only to South Africa, it also hosts large deposits of diamonds, lithium, nickel, graphite, copper, cobalt, coal, chromite, and gold, amongst others.¹⁶¹

3.3 Challenges Hindering Foreign Direct Investment in Zimbabwe

Assessments by the ZGS illustrates that the relative underinvestment in exploration and production, and not necessarily the potential of the minerals, have been the major factors in the constraints seen in the development of Zimbabwe's mining sector to date. This is hardly a novel occurrence and foreshadowed the coming on of the economic and political crises witnessed during the 1990s. As far back as 1992 the World Bank ear-marked Zimbabwe along with other countries such as the DRC and Namibia as so-called 'Category A' countries, deeming these countries as primary listings for exploration investment amongst the different African states, with total investment potential being pegged at a whopping \$US100 million over a five-year period, at a rate of \$20 million annually.¹⁶²

All the countries mentioned above exhibited the same trend of constrained mining operations which were a direct result of the prevailing economic and political instabilities, which invariably had an impact on the way mining houses invested in the sector. Their reluctance was well-founded as the political climates in these countries made the policy considerations rather unpredictable especially in so far as they related to property rights as well as exchange rate management.¹⁶³ Nevertheless, certain mining houses and prospectors continued to operate in Zimbabwe's mining sector.

The assumption is made that "Zimbabwe is open for business". This is despite the fact that after a brief period during which the Zimbabwean economy recovered (that is during the years 2010-2014), a downward trend became evident at the turn of 2015 which had a resultant impact on the Gross Domestic Product (GDP).¹⁶⁴ The decline in growth was exacerbated by a

¹⁵⁹ M Zhuwakinyu 'Foreign mining investors responding to Zimbabwe's come hither mantra' *Creamer Media's Engineering News* (Harare) 6 September 2019 Available at <https://m.engineeringnews.co.za/article/foreign-mining-investors-responding-to-zimbabwes-come-hither-mantra-2019-09-06> [Accessed 22 September 2019].

¹⁶⁰ As above.

¹⁶¹ As above.

¹⁶² Mining Potential Booklet "Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)" January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 3.

¹⁶³ Mining Potential Booklet "Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)" January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 4.

¹⁶⁴ The World Bank Group 'The World Bank in Zimbabwe) 31 October 2018 Available at <https://www.worldbank.org/en/country/zimbabwe/overview> [Accessed 21 September 2019].

multiplicity of factors including a severe shortage in foreign currency, resulting in dampened supply and demand; the impact caused by El Nino, which drought also brought about a drop in commodity price; A widening fiscal deficit that was the result of expansionary and deficient fiscal policy and lastly the rise in poverty levels and citizen vulnerability due to poor disaster management and financial instability respectively.¹⁶⁵ Thus the question to be asked throughout this discourse is whether the current space agency programme, investment, fiscal and mining regime is indeed sufficient to attract foreign direct investment in Zimbabwe.

3.4 Examining the Link between Mining and Foreign Direct Investment

The main criterion which influences mining investment is the resource potential as well as the infrastructure development according to a survey conducted by the World Bank in 1992.¹⁶⁶ The survey conducted a study of 40 internationally recognized mining houses from several countries all over the world (the likes of Europe, South Africa, Japan, and America) and it was discovered that one of the essential prerequisites to investment in the mining sector was the issuance of and guarantee of mining rights before exploration could commence.¹⁶⁷

Other important criteria were, of course, a mining code that was well-established, a certain degree of contractual stability, the opportunity for profit repatriation and finally a guaranteed fiscal code and access to foreign currency exchange. Some subsidiary factors also included accelerated depreciation and authorization as well as realistic exchange rates which were considered relevant but decidedly less vital than those mentioned above.¹⁶⁸

To curb this a 10% depreciation factor has been used, though conservatively, and this is in light of the 10-year long period between 1983-1993 in which net investment was recorded negatively and during which there was a backlog in replacement investment.¹⁶⁹ Post-1997 data has been scant however it has been uncovered that outside of the diamond and platinum sectors, investment in potential capacity and exploration have been low.¹⁷⁰ Addressing this, the President of the Chamber of Mines at the Annual Congress in 2007 posited that no exploration licenses had been issued since 2003, regardless of the fact that mining houses had applied for exclusive prospecting orders. He commented further stating:

“The boom in exploration witnessed prior to 1996 before reaching its peak in that same year has quickly dwindled and declined since that time and Zimbabwe has unfortunately failed to lure exploration dollars from international investments since 1999.”¹⁷¹

¹⁶⁵ As above.

¹⁶⁶ The World Bank Group ‘The World Bank in Zimbabwe) (1992) Available at <https://www.worldbank.org/en/country/zimbabwe/overview>.

¹⁶⁷ As above.

¹⁶⁸ As above.

¹⁶⁹ The World Bank Group ‘The World Bank in Zimbabwe) (1992) Available at <https://www.worldbank.org/en/country/zimbabwe/overview>.

¹⁷⁰ As above.

¹⁷¹ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at

Though anecdotal, this speech shows that there is a substantial backlog in investment in the mining sector and that the capital stock is not only reduced but due to low investment levels prevailing over the past 20 years equipment, has also depreciated due to age and has resultantly become obsolete.¹⁷²

In summation, production and investment have witnessed a proportional rate of decline, and due to the fact that the industry is still considered to be in its infancy means that more than average levels of exploration and investment will be required to restore previous production capacity before the crisis period.¹⁷³

The earth science data collected and distributed from commercial small-satellite constellations will supplement observations from space agency and mining sector programmes. There will in future be a greater need for regional integration even with strategic partners abroad who can provide space agencies like ZINGSA with the necessary technical assistance to push the development of the African Space Industry which as of June 2019 was valued at a whopping \$7 billion dollars.¹⁷⁴

The strategic advantage that can be gained when African countries take the initiative to add value to their factors of production namely land and capital cannot be understated and it is my assertion that satellite technology will be indispensable in this regard. Furthermore, satellite usage whether in the global or African context is extensive.¹⁷⁵ There are satellites for more common purposes of which we already make use of on the continent for example telecommunications, broadcasting, agriculture, navigation systems and even reconnaissance.¹⁷⁶ But in addition to this governments and organizations have begun to use satellites for mining, energy, oil and gas, pipeline and transmission, engineering and construction, defence and security, environmental management, media and entertainment, natural resources and tourism.¹⁷⁷

Regrettably, the country has not invested in exploration in the last 20 years with modern methods showing bias and reliance on 60 known mineral deposits uncovered by ancient workings.¹⁷⁸ Zimbabwe thus lags several years behind in comparison to other countries like

<http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf>
[Accessed 4 October 2019] p 4.

¹⁷² B Dhar “Mining Policy Initiatives” (2001) p 41.

¹⁷³ C Prahalad & G Hamel “Strategy as a field of study: Why search for a new paradigm?” (1994) *Strategic Management Journal* 15 p 15.

¹⁷⁴ T Oniosun “African Space Industry generating \$7 billion annually, to exceed \$10 billion by 2024” *Space in Africa* (7 June 2019) Available at <https://africanews.space/african-space-industry-now-generating-over-usd-7-billion-annually-to-exceed-usd-10-billion-by-2024/> [Accessed 14 June 2019].

¹⁷⁵ As above.

¹⁷⁶ H Soffar ‘What are the importance and uses of satellites in our life?’ *Online Sciences* (5 June 2015) Available at <https://www.online-sciences.com/technology/what-are-the-importance-and-uses-of-satellites-in-our-life/> [Accessed 10 June 2019].

¹⁷⁷ As above.

¹⁷⁸ As above.

Canada that have a similar terrain but have been able to adequately map the geographical and mineral environment.¹⁷⁹

¹⁷⁹ As above.

CHAPTER 4: PROSPECTS OF MINERAL MAPPING IN ZIMBABWE

4. Introduction

Has the Zimbabwean Space Agency been successful in its mandate of promoting Foreign Direct Investment (FDI) in the mining sector through mapping of mineral reserves using Geographic Information Services (GIS) technology and if not, what measures need to be enforced?

It is forecast that by the year 2040, the global space industry will be worth upwards of \$1 trillion.¹⁸⁰ For this reason, my dissertation will focus particularly on the mining sector namely how satellite technology can be used to advance socio-economic aims but furthermore how this development can help Zimbabwe by transforming it into a tech hub for trade in services through space applications and the attraction for foreign direct investment. The space agency will thus be used to map, monitor, and identify areas where the prevalence of minerals is high.¹⁸¹

4.1 Zimbabwean National Space Agency's Programme for the Mapping of Mineral Reserves
The Minister of Technology, speaking to national radio station Star FM on the 1st of October, during a segment called "*The Minister's Desk*", also succinctly addressed the aim of the established agency citing:

"ZINGSA's core mandate will be to design and promote research and innovation in geospatial science, as well as to regulate any other related activities which would be constructed in a series of phases."¹⁸²

The Minister made it known that despite the costs involved with the establishment of the agency, the benefits would far outweigh any doubts in the investment of the space agency's initiatives.¹⁸³ In fact, he further commented that the government was expected to invest US\$3million in the agency's activities, which will rely heavily on the satellite industry that will, in the Minister's words "enable us to discover resources, construct early warning systems and create immense business for the country."¹⁸⁴ In his words, satellite technology cannot be considered luxury given that it is a multi-trillion dollar industry worldwide and a billion-dollar industry on the continent at present.¹⁸⁵

Murwira added that in order for ZINGSA to be operational, the government would have to set up a series of coordinated innovation hubs at state universities and that this would be fulfilled within the first 100 days in office.¹⁸⁶ This was followed up by a concomitant promise that the hubs would assist in generating employment by stimulating research, and would be supported

¹⁸⁰ T Oniosun "African Space Industry generating \$7 billion annually, to exceed \$10 billion by 2024" *Space in Africa* (7 June 2019) Available at <https://africanews.space/african-space-industry-now-generating-over-usd-7-billion-annually-to-exceed-usd-10-billion-by-2024/> [Accessed 14 June 2019].

¹⁸¹ As above.

¹⁸² K Mashinininga & T Mukeredzi 'Minister unveils ambitious plans for higher education' *University World News* (Harare) 5 October 2018.

¹⁸³ As above.

¹⁸⁴ As above.

¹⁸⁵ As above.

¹⁸⁶ As above.

by establishing industrial parks in the country's 10 provinces.¹⁸⁷ At least six state universities have received a total allocation of US\$15 million in government funds to support the above mandates by ensuring the innovation hubs are established but also that higher education institutions have the funding they need to contribute meaningful solutions to the current technological and economic challenges currently facing the country.

Through this, it is hoped that Zimbabwe will also be able to coordinate national and international collaborations to attract global investment. It is also hoped that several businesses with specialized space-related capability in research, engineering, manufacture, and design will be attracted by Zimbabwe's FDI potential.. Such renowned companies would include Lockheed Martin, Boeing, Thales, and BAE Systems. What the above discourse shows is that Zimbabwe has a keen export interest in engaging in Outer Space activities for the following reasons, according to President Emmerson Mnangagwa:

“It is expected that this initiative will enhance Zimbabwe's capacity to engage in global policy discourses on generation, access, use and regulation of the application of space technologies and innovations for sustainable development.”¹⁸⁸

Space technologies for mineral mapping will also assist in generating employment opportunities for Zimbabweans, both at home and abroad, according to the Minister, and will encourage Zimbabweans living in the diaspora to return to the country and assist in building the industry.¹⁸⁹ It is estimated that there are at least 5 million Zimbabweans currently residing overseas as a result of a decade of both economic and political turmoil.¹⁹⁰ The International Organization for Migration (IOM) office which is located in the capital city Harare has said that there may be anywhere from 500 000 to four million Zimbabweans living in the diaspora,¹⁹¹ however, clarified that these statistics were not reliable and has compounded the organizations ability to accurately catalogue how many Zimbabweans are actually living abroad.¹⁹² Commenting on this the IOM states that:

“Despite there being an immense potential for the diaspora to contribute to the national development of the country, there was indeed a lack of credible and updated statistics on the true extent and nature of the Zimbabwean diaspora, and this would, in turn, hamper any evidence-based initiatives,”¹⁹³ such as the space agency's space application initiative above. What Nongovernmental Organizations have come to tacitly agree on however is that the Zimbabwean diaspora is widespread across nations such as the United

¹⁸⁷ As above.

¹⁸⁸ M Xuequan 'Zimbabwe Launches Space Agency ZINGSA' *Xihuanet* (Xinhua) (11 July 2019) Available at http://www.xinhuanet.com/english/2018-07/11/c_137315340.htm [Accessed 21 September 2019].

¹⁸⁹ M Xuequan 'Zimbabwe Launches Space Agency ZINGSA' *Xihuanet* (Xinhua) (11 July 2019) Available at http://www.xinhuanet.com/english/2018-07/11/c_137315340.htm [Accessed 21 September 2019].

¹⁹⁰ R Ndlovu 'Rough Estimates: Millions of Zimbabweans Abroad' *Mal & Guardian* (Harare) 19 April 2013 Available at <https://mg.co.za/article/2013-04-19-millions-of-zimbabweans-abroad> [Accessed 22 September 2019].

¹⁹¹ As above.

¹⁹² As above.

¹⁹³ As above.

Kingdom, Botswana, and South Africa mainly (which is estimated to cost two million to three million Zimbabweans), as well as Canada, United States, New Zealand, and Australia.¹⁹⁴

A venture towards investing in space systems is thus one of national pride as stated by the South African Space Advisory Company Official Turcia Busakwe, who has praised the recent establishment of ZINGSA's programme on mineral mapping, as a development that her company was willing to support to one day see Zimbabwe launching its own satellite.¹⁹⁵

The above however is still a clear commitment by the Zimbabwean government to explore technological alternatives in the hopes that keeping abreast with the 4th industrial revolution will attract foreign investors and new trading partners to help revive Zimbabwe's ailing economy. On the verge of collapse, it is posited that a technological upgrade may be Zimbabwe's breath of fresh air and an opportunity beyond the frontier to the realm of developed country status.

Zimbabwe is not alone on this frontier as 14 Other African States have established some form of Space Centre, the most prominent being South Africa's National Space Agency, Nigeria's National Space Research and Development Agency and the Ethiopian Space Science & Technology Institute as well as new actors like Ghana and Kenya.¹⁹⁶ Ever since Egypt launched NILESAT in 1998 the African Space Industry has spent over USD\$3billion on Space projects,¹⁹⁷ making it a viable investment sector with the potential to boost investment in other sectors as well namely mining where remote-sensing technology collects data on mineral reserves.

What is even more pertinent is the extent to which the African Union through the various space agencies has promoted regionalism and integration through the call for a joint African Space Agency, deemed AfriSpace which is expected to combine the capacities of all participating African signatories in the hopes that this will more efficiently channel our resources towards integrating ourselves into the 4th industrial revolution which amongst Space Law will also involve the digital and artificial intelligence age.¹⁹⁸ However, my dissertation will delineate to the extent that I will only focus on the space aspect of this age.

What must be noted is that globalization is an equally important ideal that will inevitably influence the trajectory of African discourse especially in the Space Industry which to date is already worth USD\$7 billion. This discussion would thus not be complete without mention of the role of international law, particularly international investment law, mining regulation, and space law as well as any other accompanying regulations.

4.2 Satellite Technology and the 4th Industrial Revolution

¹⁹⁴ As above.

¹⁹⁵ M Xuequan 'Zimbabwe Launches Space Agency ZINGSA' *Xihuanet* (Xinhua) (11 July 2019) Available at http://www.xinhuanet.com/english/2018-07/11/c_137315340.htm [Accessed 21 September 2019].

¹⁹⁶ "List of Space Agencies in Africa" *Space in Africa* (22 June 2018) Available at <https://africanews.space/list-of-space-agencies-in-africa/> [Accessed 17 May 2019].

¹⁹⁷ As above.

¹⁹⁸ R Bhala (n 6 above) p 6.

So, what is a satellite? To put it simply, NASA defines it as a moon, planet or machine that orbits a planet or star.¹⁹⁹ Satellites can thus either be natural or artificial which is the focus of this present discourse.²⁰⁰ There are different kinds of artificial satellites,²⁰¹ for this discussion we will focus on satellites used for communications, navigations, and remote sensing. Satellites use what is referred to as a transponder to receive and send signals containing data to other satellites.²⁰² Satellites are launched into outer space to fulfil a particular function for example communications, oceanography, astronomy and even surveillance.²⁰³ In a nutshell, satellites help many scientists get a better perspective of a variety of objects located anywhere in the world!²⁰⁴

Satellite applications are the most extensive, commercialized and applications-oriented sector of outer space activities yet despite prolific satellite technology reliance there is no single comprehensive legal regime even at the international level.²⁰⁵ It cannot be understated the import of sound policy on satellite usage if such is to proliferate especially in a developmental context for emerging and developing space economies.

At present up to 10 different legal regimes may find application in the use of satellite technology however this discussion will focus primarily on the generic body of international space law, the regime developed in the context of the International Telecommunication Union (ITU), and the trade regime applied in the context of the World Trade Organization (WTO).²⁰⁶

The three most important parameters for successful satellite communication operations are, respectively, the availability of and legitimate entitlement to use ‘geographical’ locations in outer space for the satellites used, the availability of and lack of interference with radio frequencies for the communication activities, and access to the international markets for the services to be offered for commercial purposes.²⁰⁷

It is clear from the foregoing that satellite technology will have an impact on trade and investment in the provision of services and improving not only the economy but the quality of life for the ordinary Zimbabwean citizen. What is saddening is that despite this Zimbabwe has yet to launch a single satellite into outer space and frequently relies on neighboring countries, most notably South Africa, for its telecommunications and broadcasting.

¹⁹⁹ S May ‘What is a Satellite’ NASA Available at <https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-a-satellite-58.html> [Accessed 11 May 2019].

²⁰⁰ As above.

²⁰¹ These range from but are not limited to satellites for atmospheric studies, navigations, communications, reconnaissance, remote-sensing, search and rescue, space exploration and weather.

²⁰² As above.

²⁰³ H Soffar ‘What are the importance and uses of satellites in our life?’ *Online Sciences* (5 June 2015) Available at <https://www.online-sciences.com/technology/what-are-the-importance-and-uses-of-satellites-in-our-life/> [Accessed 10 June 2019].

²⁰⁴ As above.

²⁰⁵ FG Von Der Dunk ‘Legal Aspects of Satellite Communications–A Mini Handbook’ (2015) 4 *Journal of Telecommunication and Broadcasting Law* 1.

²⁰⁶ Von Der Dunk (n 1 above) 1.

²⁰⁷ Von Der Dunk (n 1 above) 1.

Firstly, satellites provide geologists and field crews the location of tracks, roads, fences and inhabited areas.²⁰⁸ This is important for mapping out potential access corridors for exploration areas and considering the environmental impact of large projects. The satellite map data is also useful for mapping outcrops and regolith systematics as well as vegetation cover across exploration blocks and over regional areas.²⁰⁹ Given Africa's rich mineral wealth the inability to adequately map and monitor mineral reserves impedes African states from developing that particular sector and expanding their export and manufacturing industries.

Furthermore, from 1988, 32 Satellites were launched into orbit by 8 African countries, 15 of which were launched in the last 4 years showing the proliferation or rather a necessity in engaging in space commercialization for the social-economic development of the continent.²¹⁰ This diverse satellite network includes 14 Earth Observation Satellites, 10 communications satellites, 8 technology demonstration satellites, a satellite for scientific experiments, an educational project satellite and lastly a military radar satellite.²¹¹ In fact 14 of these satellites were built by African engineers and more than 8500 people are currently employed in the African Space Industry,²¹² showing Africa's competency and ability to engage in international fora in matters of space technology and I believe could be the silver bullet to some of Africa's developmental challenges as they pertain specifically to human rights. I reiterate again that Space Law and Human Rights are not mutually exclusive.

I will close with a quote from Professor Carl Christol, a notable jurist in the space law community who summarizes my stance aptly when he declared,

“That the United Nations have been moving simultaneously in the field of space law and the international law of dignity is vastly to its credit. The concurrence of these efforts in time should not be regarded as purely coincidental. They are interrelated aspects of a common plane.”²¹³

4.3 Benefits of Satellites for Mapping Mineral Reserves

The use of advanced satellite image processing, colour balancing techniques and the correct band combinations, satellites can process imagery per client requirements, optimized for the identification of specific terrain in conjunction with geological features.²¹⁴ These features are identified with high-resolution 3D terrain visualization acquired by stereo satellite imagery or LiDAR and viewed in 3D terrain visualization environments.²¹⁵

²⁰⁸ As above.

²⁰⁹ As above.

²¹⁰ As above.

²¹¹ As above.

²¹² As above.

²¹³ C Christol “Human Rights in Outer Space” (American Institute of Aeronautics and Astronautics (AIAA)) Paper No 68-980 1968.

²¹⁴ As above.

²¹⁵ As above.

Take for instance high resolution <1m satellite map mosaics and 2m-5m Digital Elevation Model (DEMS) provide operators with the appropriate tools to plan for the layout of 2D and 3D seismic surveys and they do this by selecting good source offset locations.²¹⁶ When the seismic data quality improves in the manner above it improves and reduces risk by selecting good seismic lines.²¹⁷

Powerful interpretation tools for mapping and GIS projects that show the bigger picture. During the planning survey, data-filled maps are invaluable to plotting the pipeline course using submersibles or semi-submersibles, identifying potential problem areas as well as determining a strategy for laying pipelines through rural, mountainous or environmentally harsh areas.²¹⁸

What is evident from the foregoing is that satellite images are invaluable for the detection of leakage, which regular control systems may unfortunately not be able to detect.²¹⁹ As a case study the Satellite Imaging Corporation acquires high-resolution satellite imagery from 30 centimetres to 1-meter resolution which can detect a spill early and saves time and costs on clean-up procedures and makes it a sustainable and viable option in the African context in light of the African Union's commitment to the Agenda 2063 goals.

When it comes to offshore oil and gas, satellite communications seem almost made to order. According to Robert G. Burke, a semisubmersible equipped for satellite communications operated by Diamond Offshore Drilling company used drills for British Petroleum in the US Gulf of Mexico. This is understandable because, for offshore oil and gas, satellite communications are efficient because they are fast, easy to use and capable of transferring huge amounts of voice, fax and data from one place to another, from anywhere on the globe within a fraction of a minute.²²⁰ With this technology nearly everybody benefits in one way or another from drillers, loggers and seismic contractors and of course the clients and producers.

4.6 Cons of Satellites for Mapping Mineral Reserves

Although of late there has been an unhappy trade-off with regards to costs that have escalated this is fast changing as service providers slash their prices by 10-15% in order to lure more oil and gas customers within their fold.²²¹ Further price reductions will come when new compression methods offering the promise of a more economical method of sending an entire 3D seismic survey to shore practically as it happens on the open sea.²²² More often than not savvy established clients push for volume discounts in addition to consolidated billing.

²¹⁶ As above.

²¹⁷ As above.

²¹⁸ As above.

²¹⁹ As above.

²²⁰ RG Burke "Satellite communications and how the petroleum industry is using satellite services" *Offshore* (1 May 1996) Available at <https://www.offshore-mag.com/business-briefs/article/16759406/satellite-communications-how-the-petroleum-industry-is-using-satellite-services> [Accessed 20th May 2019].

²²¹ As above.

²²² As above.

So how then do producers and service companies adapt and how do they manage under such conditions? You would be surprised how easily they converted and changed their operations to fit new and fast-emerging technology.

The African Union Commission has since noted however that only a tiny minority of countries control space technologies in Africa, most notably South Africa, Nigeria, Ethiopia that has established space programmes, as well as Kenya, Ghana, and Zimbabwe that have in recent years begun to promulgate space legislation and initiatives.²²³ This is because establishing space programmes remains astronomically expensive, even more so for those developing countries. However national budgets bear the burdens of other development and growth initiatives that some have argued may be more pertinent in the African context as opposed to space travel, for the advancement of for instance human rights.

A common continental approach will allow the sharing of risks and costs and ensure the availability of skilled and sufficient Human Resources.²²⁴ As well it would ensure a critical size of geographical area and population required in terms of the plan of action for some space applications.²²⁵

The African Space Agency, tentatively named 'AfriSpace', will bring a much-needed regulatory framework and implement a long-term African Space Policy, recommend space objectives to member states as well as coordinate space traffic management through the allocation of orbital slots and other space resources.²²⁶

There is immense literature on Space Law and Human Rights which can be found, however, literature linking the two is still in limited quantity.²²⁷ It is my proposition however that these two fields are connected, are constantly changing, and adapting and one must take cognizance of the impact they will both have in the coming years.²²⁸

More so the impact that Space Applications will have on the African continent. Africa's Space journey began in 1988 and since then has already surpassed USD\$7 billion of annual revenues and is expected to exceed \$10 billion by 2024.²²⁹ Regional and national programmes are becoming quite extensive with 19 African countries setting up space agencies to further the implementation of the continental space policy stipulated under the African Union Agenda 2063 as will the joint African Space Agency.²³⁰

4.6 Conclusion

²²³ Ian Timberlake 'Africa eyes joint space agency' 4 September 2012 Available at <https://phys.org/news/2012-09-ministers-african-space-agency.html> (Accessed 14 February 2019).

²²⁴ As above.

²²⁵ As above.

²²⁶ As above.

²²⁷ Potter (n 2 above) 60.

²²⁸ As above.

²²⁹ T Oniosun "African Space Industry generating \$7 billion annually, to exceed \$10 billion by 2024" *Space in Africa* (7 June 2019) Available at <https://africanews.space/african-space-industry-now-generating-over-usd-7-billion-annually-to-exceed-usd-10-billion-by-2024/> [Accessed 14 June 2019].

²³⁰ As above.

It is hoped that the recommendations made in this paper will help inform the government on the obvious socio-economic benefits that the use of space applications holds in the African context especially the use of satellite technology. The earth science data collected and distributed from commercial small-satellite constellations will supplement observations from space agency programmes.

There will in future be a greater need for regional integration even with strategic partners abroad who can provide the necessary technical assistance to push the development of the African Space Industry which as of June 2019 was valued at a whopping \$7 billion dollars.²³¹ For example, Ethiopia recently signed a further agreement to jointly build a communications and broadcast satellite.²³² This satellite will be built by experts from both countries and will be the second satellite by the Ethiopian Space Science and Technology Institute.²³³ In November of 2018, the country announced its plan to launch its first satellite in 2019, the Ethiopian Multi-Spectral Remote-Sensing Satellite ETRSS-1 which will now be launched in November 2019 according to the Director.²³⁴ The design, development and manufacturing of the satellite are being conducted in collaboration with the Chinese at a cost of \$8 million for which China has provided training and \$6 million for the project.²³⁵ As of the 15th of November 2019, Zimbabwe announced the implementation of a Research & Development budget, one which would include the launch of a space satellite. It's clear to see the strategic advantage that can be gained when African countries take the initiative to add value to their factors of production namely land and capital. Africa at this juncture, at the frontier of the 4th Industrial Revolution, must seriously meditate on the necessities of satellite applications which I believe are the magic bullet to Africa's problems. Africa has no choice but to shoot for the stars!

²³¹ As above.

²³² As above.

²³³ Christol (n 177 above).

²³⁴ As above

²³⁵ Space in Africa "Zimbabwe Space Agency is launching tomorrow-all you need to Know" (9 July 2018) Available at <https://africanews.space/zimbabwe-space-agency-is-launching-tomorrow-all-you-need-to-know/> [Accessed 5 June 2019].

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5. Introduction

During the period 1980 to 2003 global policies surrounding the mining sector were influenced by falling real prices for minerals and metals.²³⁶ This was a result of a phenomenon known as resource nationalization finally retreating and giving way to a new wave of privatization.²³⁷ This occurred due to the government seeking new ways to source foreign currency to finance development in the mining sector.²³⁸

Coupled with this was the fact that global demand for minerals and metals fell during the early 1990s and only regained traction after 1997.²³⁹ Before the disastrous global recession which occurred towards the end of 2008, there was a reason to believe that the mining sector would be at the forefront of Zimbabwe's path to recovery post-crisis as capacity would be revived and investor confidence reignited giving rise to investment opportunities.²⁴⁰ The aspirations did not, however, come to pass in the wake of the 2003 to 2008 commodity price boom which downcast estimates for both demand in metals and minerals and global economic growth.²⁴¹

Zimbabwe is at a further disadvantage owing to the fact that mineral mapping and explorations have been at a standstill since early 2000 and further compounded by nearly a decade of hyperinflation and the general disintegration of infrastructure especially those used to generate and provide power, water, and transport, and this has only served to undermine the cost-competitiveness right across the economy's different sectors.²⁴² Zimbabwe has also lacked the necessary technical and professional know-how not just from the unprecedented migration of skills but also the relative decline in the country's education sector, coupled with the system's inability to retain and regenerate skills at a local level.²⁴³ According to the United Nations Development Programme (UNDP) mining has the potential to lead the growth sector especially in a post-crisis economy such as Zimbabwe, though this will be largely dependent on the global commodity market conditions as well as other macroeconomic, industry governance and fiscal strategies employed by the higher authorities regulating the sector.²⁴⁴ Compared to other

²³⁶ C Prahalad & G Hamel "Strategy as a field of study: Why search for a new paradigm?" (1994) *Strategic Management Journal* 15.

²³⁷ As above.

²³⁸ As above.

²³⁹ F Cawood & O Oshokoya "Resource nationalism in the South African Mineral Sector: Sanity through stability" (2013) *Journal of the Southern African Institute of Mining and Metallurgy* 113 p26.

²⁴⁰ F Cawood & O Oshokoya "Resource nationalism in the South African Mineral Sector: Sanity through stability" (2013) *Journal of the Southern African Institute of Mining and Metallurgy* 113 p26: see also Cambou and Smis "Permanent sovereignty over natural resources from a human rights perspective: Natural resources exploitation and indigenous peoples rights in the Arctic (2013) *Michigan State International Law Review* 22 p 349.

²⁴¹ G Davis & L Arturo Vasquez Cordano "Trade in mineral resources (2009) *Colorado School of Mines* p 10.

²⁴² P Zhuwawo "Frameworks, procedures and guidelines for the implementation of Indigenization Economic Empowerment Act (4 January 2016) Presented by the Minister of Indigenization and Economic Empowerment, Zimbabwe.

²⁴³ As above.

²⁴⁴ United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009) p vii.

countries globally, Zimbabwe may not be considered a mineral-rich economy, however it does have considerable mineral reserves, especially gold, diamonds, methane gas, asbestos, nickel, platinum, coal and chromite to sufficiently generate export earnings of up to US\$2 billion annually over the medium term, and a further US\$5 billion a year within the first 15 year period, ensuring that the mining sector remains Zimbabwe's largest country exporter and which investment potential deserves further investigation.²⁴⁵

However the challenge still remains that the mining sector accounts for less than 5% of Zimbabwe's Gross Domestic Product and formal sector employment, which is still the mining sectors main contributor to poverty reduction and growth, is likely to be impacted only indirectly.²⁴⁶ Growth is instead expected to take the form of gross capital formation via the construction industry during what is called the post-crisis expansion period, while over the longer term it is expected that contributions to tax revenues as well as foreign currency earnings as output are expected to increase. Because of the high and ever-increasing levels of capital intensity, especially when it comes to major mining projects, it will result in there not being a truly significant direct contribution to employment growth.²⁴⁷

For about 25 years leading up to the commodity boom of 2002-2008, mining projects around the world disintegrated rather than being a means of creating value.²⁴⁸ This is since the rate of return in base metal mining fell slightly below the yield on the then US government bonds. Basically, this meant that global mining was not sustainable owing to industries such as the Zimbabwean mining industry failing to cover the opportunity cost of capital.²⁴⁹

The growth of the sector has not been entirely negative however, during the years 2002-2008 there were two major developments that occurred that altered the industry. Firstly, metal prices doubled during the prolonged commodity price boom thereby breathing new life into the industry's fortunes while on the other hand, resource nationalism saw a resurgence in leading governments, especially those considered low and middle-income economies like Zimbabwe. This nationalism was characterized by a rising in mining taxes as well as increased demand in-state participation in the ownership and especially the development of mining operations in Zimbabwe.²⁵⁰

Despite the progress in this regard globally Zimbabwe still experienced the brunt of the mining industry decline as it experienced falling production volumes and further failed to take advantage of the commodities boom.²⁵¹ Like other countries in the world, Zimbabwe tried too to take advantage of so-called resource nationalism, with calls rising for majority 'indigenous' ownership of all mining ventures, which also included a 25% 'free carry' stake for the

²⁴⁵ As above.

²⁴⁶ As above.

²⁴⁷ As above.

²⁴⁸ As above.

²⁴⁹ As above.

²⁵⁰ As above.

²⁵¹ As above.

government.²⁵² The conglomeration of a failing macroeconomic situation, the migration of skills, the lack of infrastructural development and the relative policy instability and uncertainty in the Zimbabwean mining industry all served to ensure that investment, exploration, and development in the mining sector would be minimal.²⁵³

Against this backdrop, in a post-crisis situation such as the one facing Zimbabwe currently, the government will have to diligently craft a balanced policy framework landscape that encourages investment, both domestic and especially foreign while ensuring that ‘mineral rents’ are not only captured but invested appropriately by the state. A few of the policy considerations will be discussed below to supplement the findings made in this dissertation and give final recommendations on how the mining sector can be boosted to in turn FDI in Zimbabwe.

5.1 Good Governance, Natural Resource Investment, and Africa’s Development

Today the viability of the Resource curse has waned while recent studies are beginning to instead show a positive correlation between the abundance of natural resources and the growth of GDP.²⁵⁴ The statistics collected from the SADC region are stark particularly the growth differentials between countries like Botswana and Zambia as compared to those of the DRC. What the research shows is the management of resources rather than their general prevalence is vital to promoting growth within a countries mining sector.²⁵⁵ Botswana is the most pertinent case study in this regard as sound management policies resulted in the country having the longest-running growth track record in the Southern African region, whereas the general maladministration in Zambia and the DRC had negative socio-economic consequences despite the fact that these countries are considered to be well endowed with mineral reserves.²⁵⁶

It cannot be understated the impact that political and institutional reforms have on the development of the mining sector. For instance, DRC was ravaged by years of mis governance due to rapacious rent-seeking elites which eventually resulted in nearly a decade of civil unrest, while Zambia’s developmental growth was compounded for the last 25 years of the century due to the country’s general shoddy economic performance and a substantial inflow of foreign aid.²⁵⁷

But what was different in Botswana’s approach that Zimbabwe can possibly draw from? Robinson (2008) attempts to surmise this by highlighting the institutional reforms that were

²⁵² As above.

²⁵³ As above.

²⁵⁴ F Cawood & O Oshokoya “Resource nationalism in the South African Mineral Sector: Sanity through stability” (2013) *Journal of the Southern African Institute of Mining and Metallurgy* 113 p26.

²⁵⁵ P Zhuwawo “Frameworks, procedures and guidelines for the implementation of Indigenization Economic Empowerment Act (4 January 2016) Presented by the Minister of Indigenization and Economic Empowerment, Zimbabwe.

²⁵⁶ As above.

²⁵⁷ Natural Resource Governance Institute “State participation and state-owned enterprises: The benefits and challenges, (March 2015).

drawn from the native ‘Tswana states’ as well as leadership that was both strong and pragmatic on the part of the Botswana government.²⁵⁸ It must be noted that the parliamentary reforms that were instituted during the colonial period largely subsisted even post-independence in contrast to countries like Zimbabwe which rolled out presidential institutions after independence.²⁵⁹

The country was successful in avoiding the so-called Resource Curse not through dependence on heterodox policies that have often been promoted by critics of market-driven economies, but rather through the simple reliance and efficient adoption and implementation of strategies considered to be more orthodox.²⁶⁰ In Robinson’s words:

“The issue is not trying to identify the connecting market failure, but rather it is in trying to achieve a political and institutional environment that is conducive to making choices that are socially desirable.”²⁶¹

But Botswana’s success can be described as multifaceted, including complexities, histories and institutional interests that are historically different from those experienced by countries like the DRC, Kenya, Zambia or in this case Zimbabwe.²⁶² What can be taken away from this particular case study however is the fact that the resource curse has a greater opportunity to subsist in economies that have weak institutional reforms.²⁶³ This is further exacerbated where there are tribal tensions, and a strong political elites put private interests ahead of the prevailing social interest.²⁶⁴

The mining sector has the capacity to contribute positively to poverty reduction in several ways but the most vital is through the forming of linkages in the job and income sectors along with opportunities for lateral or downstream businesses to grow.²⁶⁵

Given this information the mining sector will have to take into consideration 5 key factors for rebooting the mining sector namely:

²⁵⁸Natural Resource Governance Institute “State participation and state-owned enterprises: The benefits and challenges, (March 2015).

²⁵⁹ As above.

²⁶⁰ R Freeman “The politics of stakeholder theory: Some future directions’ (1994) *Business Ethics Quarterly* (40) p 410.

²⁶¹ Natural Resource Governance Institute “State participation and state-owned enterprises: The benefits and challenges, (March 2015).

²⁶² G Bridge “Contested Terrain: Mining and the Environment.” (2004) *Annual Review of Environmental Resources* (29) 59.

²⁶³ S Mawowa “The Political Economy of Artisanal and Small-Scale Gold Mining in Central Zimbabwe.” (2013) *Journal of Southern African Studies* 39 (4): 921.

²⁶⁴ K Kuwaza, Mugabe Interview Confirms Chiadzwa Diamond Looting, *The Zimbabwe Standard*, 11 March 2016.

²⁶⁵ The World Bank Group ‘The World Bank in Zimbabwe) 31 October 2018 Available at <https://www.worldbank.org/en/country/zimbabwe/overview>.

- a) How to promote investment both domestic and foreign
- b) How to foster investment in value-added operations that will raise the export revenues and mineral rents
- c) How to ensure that mining rents recollected and reinvested by the state in produced assets and intangible capital thereby ensuring that the wealth per capita deteriorates neither is it affected by the resource curse.
- d) Giving priority to the welfare of workers and ensuring corporate social responsibility through the provision of health care and safety mechanisms.
- e) Lastly ensuring environmental protection.

This strategy is commonly seen in mining scenarios such as the one Zimbabwe is currently experiencing, which is often seen as a trade-off situation where the policy mechanisms that are adopted to promote investment usually then limit the extent to which these measures maximize mineral rent.²⁶⁶

In the same vein, social and environmental considerations have the probable effect of eroding the return on capital invested thereby dissuading investment in the first place which again will have an adverse effect on the mineral rent.²⁶⁷ But if Zimbabwe manages to create a transparent and comprehensive mining policy strategy it would be in a position to leverage investment and thereby reduce the risk premium and returns required by the mining companies, the investors as well as the lenders at large.²⁶⁸

One of the areas that will need urgent attention is the fiscal regime namely the taxation system. The Council on Mining and Metals (ICMM) and The Commonwealth Secretariat have identified five focus areas that developing fiscal regimes must consider.

Zimbabwe will have to develop a tax system that is both neutral and effective, as well as being progressive to the extent that it will maximize revenues from the mining sector over a long period of time, and will involve creating sustainable timescales of even up to 50 year long periods to ensure this.²⁶⁹ It would also be effective if the tax system were made much simpler making it easier for the government to calculate the requisite deductions.²⁷⁰ These measures, coupled with fiscal decentralization and transparency will be fundamental in ensuring that

²⁶⁶ Zimbabwe Investment Authority, Metals and Minerals, accessed from http://www.investzim.com/index.php?option=com_content&view=article&id=314&Itemid=716 (01 June 2016).

²⁶⁷ As above.

²⁶⁸ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 4.

²⁶⁹ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 5.

²⁷⁰ OECD ‘Enhancing the legal framework for sustainable investment: Lessons from Jordan’ Available at <https://www.oecd.org>

governance processes and structures are efficient, making the effects of Resource Curse and Dutch Disease more manageable. The government of Zimbabwe will just lastly have to decide whether it would prefer the taxation based on the mineral wealth approach as opposed to the taxation system based on net revenue depending on which one will be more applicable.²⁷¹

Scholars have developed a newfound interest in the way in which corporations impact the economy, society, and environment at large. Prevailing principles in this regard include green concepts such as green design, green procurement and most importantly waste management.²⁷² The most attractive reform when it comes to the mining sector will be the relative paucity of environmental regulations that place emphasis on the corporate social responsibility of the mining house to not only avoid causing irreversible damage to the environment but also further requiring that the site and community are developed sustainably through provision of amenities (water, electricity, education and job opportunities).²⁷³ This factor is frequently overlooked in analyses for policy reformation and reduction, especially to the extent that mining operations have negative repercussions on the environment.²⁷⁴

While countries are pursuing rapid income growth and development of the mining sector it is often overlooked the damage that can actually be caused to the resource base as the natural resources run the increased risk of damage due to accelerated developmental processes, and in light of the fact that natural resources are considered a gift as opposed to something that is produced, it must always be borne in mind that activities such as mining, though having the capacity for growth, are in essence a consumption of a finite resource which must be managed appropriately and in a sustainable manner to ensure the country can benefit for generations to come.²⁷⁵

Exhaustible resources have no other choice but to face depletion and the inevitable result is that in the chase for rapid poverty reduction a country will enrich its citizens by consuming the mineral wealth but at the same time the mineral rents must be well re-invested to ensure that countries like Zimbabwe can create sustainable economies that do not just simply drain the

²⁷¹ OECD ‘Enhancing the legal framework for sustainable investment: Lessons from Jordan’ Available at <https://www.oecd.org>.

²⁷² W Muchaendepi, C Mbowa, J Kanyepe & M Mutingi ‘Challenges faced by the mining sector in implementing sustainable supply chain management in Zimbabwe’ Available at www.sciencedirect.com [Accessed at 2 October 2019].

²⁷³ Natural Resource Governance Institute “State participation and state-owned enterprises: The benefits and challenges, (March 2015).

²⁷⁴ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 6.

²⁷⁵ Mining Potential Booklet “Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)” January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 5.

resource base as is the current situation persisting at the moment.²⁷⁶ Zimbabwe must have an asset accumulation mindset and if revenues generated from mineral rents are to be best applied it is proposed that they adopt the model that distinguishes resource-rich countries, which is divesting capital back into technological change in the form of satellite technology as has been posited above, and this will, in turn, curb informal mining operations which are the main causes of environmental damage.²⁷⁷

Studies have shown that the operation of SMEs with low technology has far-reaching consequences on the environment, and though government departments such as the Department of Geological Survey is overstretched, it too will have to take an active role in addressing this cumbersome environmental bureaucracy by empowering SME's with the technical assistance and technological know-how to allow them to integrate into this new model.²⁷⁸ This will require even the most smallest of mining operations also being required to undertake environmental impact assessments prior to the commencement of any operations.²⁷⁹

Satellite mapping for mineral resources presents the least environmentally degrading option and for me this is the most critical linkage which I have attempted to address in this dissertation, towards strengthening Zimbabwe's foreign direct investment in the mining sector. Conclusively linkages will have to be quantified according to three main factors that are economic, socio-political, and environmental.²⁸⁰

5.5 Conclusion

In closing the surrounding geological evidence has shown that Zimbabwe may probably not become a resource-driven economy in the same manner as witnessed in Botswana, Zambia or even the DRC. However, given efficient business-friendly policies which are well placed and coordinated Zimbabwe can redo the mistakes of the last 2 decades.²⁸¹

I believe as we are on the cusp of the 4th industrial revolution, Zimbabwe has a real opportunity to restore the ailing mining industry using ingenious means such as satellite technology, to assist in bridging the infrastructural and technological gap that has so adversely affected

²⁷⁶ Mining Potential Booklet "Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)" January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 5.

²⁷⁷ As above.

²⁷⁸ As above.

²⁷⁹ As above.

²⁸⁰ Mining Potential Booklet "Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)" January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf> [Accessed 4 October 2019] p 5.

²⁸¹ Natural Resource Governance Institute "State participation and state-owned enterprises: The benefits and challenges, (March 2015).

mineral exploration in the region.²⁸² Not only does satellite technology provide a more efficient and precise way of mapping mineral reserves it also generally considered more sustainable to the extent that no actual environmental degradation will occur owing to the fact that much of the process will be conducted remotely from outer space.²⁸³

It is also considered more efficient as processes such as pegging and marking of potential mineral sites will be conducted digitally and can be stored on a cloud or database making use of sophisticated blockchain technology that will allow real-time data to be readily accessible to all potential investors and prospectors alike.²⁸⁴ This would bring much-needed certainty to a system that for the most part has been impaired and undermined by the failure, even of bodies such as the ZGS, to reliably and adequately collate and store information pertaining to Zimbabwe's vast mineral reserves.

It is my assertion that satellite technology is a feasible option for Zimbabwe given the commitments already made by the government in establishing the much needed Space Agency to be the driver of these operations, and given the work done by the agency through my capacity as National Point of Contact of the Space Generation Advisory Council the positive steps that the Ministry of Technology is taking in ensuring that the Programme for the Mapping of Mineral Reserves does not merely become another rubber stamp have duly been noted.²⁸⁵

It is once again and finally restated that the mapping of mineral reserves is vital in any conception of the revival of Zimbabwe's ailing mining industry and must be leveraged if foreign investment is to be attracted.²⁸⁶ Given the information that has been submitted above, foreign investors would be highly interested in diverting their funds towards Zimbabwe's mining sector based on what is presently known about its rich geographical landscape alone. What more then if Zimbabwe's full mineral capacity was recorded and certain.²⁸⁷

Satellite technology will thus be one of the magic bullets for stimulating foreign direct investment in Zimbabwe's mining sector. As explained in Chapter 1, Zimbabwe has performed poorly in its mining industry owing to untapped mineral reserves and poor natural resource

²⁸² Natural Resource Governance Institute "State participation and state-owned enterprises: The benefits and challenges, (March 2015).

²⁸³ T Oniosun "African Space Industry generating \$7 billion annually, to exceed \$10 billion by 2024" *Space in Africa* (7 June 2019) Available at <https://africanews.space/african-space-industry-now-generating-over-usd-7-billion-annually-to-exceed-usd-10-billion-by-2024/>

²⁸⁴ C Christol "Human Rights in Outer Space" (American Institute of Aeronautics and Astronautics (AIAA)) Paper No 68-980 1968.

²⁸⁵ Space in Africa "Zimbabwe Space Agency is launching tomorrow-all you need to Know" (9 July 2018) Available at <https://africanews.space/zimbabwe-space-agency-is-launching-tomorrow-all-you-need-to-know/>

²⁸⁶ Natural Resource Governance Institute "State participation and state-owned enterprises: The benefits and challenges, (March 2015).

²⁸⁷ G Bridge "Contested Terrain: Mining and the Environment." (2004) Annual Review of Environmental Resources (29) 59.

management, and this has further had a negative effect not only on FDI but foreign currency generation in Zimbabwe, leading to an economic downturn. To curb this the government established and intends to use the Zimbabwean National and Geospatial Space Agency to leverage space capabilities in the mining sector.

In mapping the progression of FDI data in Zimbabwe it was shown the importance of FDI in stimulating growth and mitigating the current currency deficit and cash crisis issues. This chapter considered how sound mineral mapping policy would be instrumental in providing certainty, stability, and security to foreign investors.

The future implications of space applications for mineral mapping to boost FDI must be considered on the backdrop of the fourth industrial revolution and the extent to which technological advancement in the form of space applications will play an integral role in advancing the socio-economic goals of Zimbabwe as a nation.

BIBLIOGRAPHY

Articles

1. Cochran J, 'Zimbabwe Telecommunications' (26 May 2016) Available at <https://dlca.logcluster.org/plugins/servlet/mobile?contentId=10130664#content/view/10130664>
2. J Chu 'Satellites in the developing world' *MIT News* (4 August 2011) Available at <http://news.mit.edu/2011/developing-satellites-0804>
3. C Baldwin "Satellite communications and how the petroleum industry is using satellite services" *Offshore* (1 May 1996) Available at <https://www.offshore-mag.com/business-briefs/article/16759406/satellite-communications-how-the-petroleum-industry-is-using-satellite-services>
4. Dave Baiocchi and William Wesley IV 'the Democratization of Space' Available at <https://www.foreignaffairs.com/Articles/Space/2015-04-20/Democratization-Space>
5. Ian Timberlake 'Africa eyes joint space agency' 4 September 2012 Available at <https://phys.org/news/2012-09-ministers-african-Space-Agency.html>
6. R Woodruff "Satellite communications and how the petroleum industry is using satellite services" *Offshore* (1 May 1996) Available at <https://www.offshore-mag.com/business-briefs/article/16759406/satellite-communications-how-the-petroleum-industry-is-using-satellite-services>
7. RG Burke "Satellite communications and how the petroleum industry is using satellite services" *Offshore* (1 May 1996) Available at <https://www.offshore-mag.com/business-briefs/article/16759406/satellite-communications-how-the-petroleum-industry-is-using-satellite-services>
8. T Oniosun "African Space Industry generating \$7 billion annually, to exceed \$10 billion by 2024" *Space in Africa* (7 June 2019) Available at <https://africanews.space/african-space-industry-now-generating-over-usd-7-billion-annually-to-exceed-usd-10-billion-by-2024/>
9. Space in Africa "Zimbabwe Space Agency is launching tomorrow-all you Need to Know" (9 July 2018) Available at <https://africanews.space/zimbabwe-space-agency-is-launching-tomorrow-all-you-need-to-know/>
10. A Boahen 'Topics in West Africa history' (1996) *Tiyambe Zeleza, A modern economic history of Africa* (1) p 30.
11. R Ako & N Uddin 'Good governance and resource management in Africa' (2011) *New Horizons in Environmental and Energy Law* 1.
12. R.E. Lipsey 'The role of foreign direct investment in international capital flows' (1999) *International Capital Flows*.
13. C Prahalad & G Hamel "Strategy as a field of study: Why search for a new paradigm?" (1994) *Strategic Management Journal* 15.
14. F Cawood & O Oshokoya "Resource nationalism in the South African Mineral Sector: Sanity through stability" (2013) *Journal of the Southern African Institute of Mining and Metallurgy* 113 p26.

15. Cambou and Smis “Permanent sovereignty over natural resources from a human rights perspective: Natural resources exploitation and indigenous people’s rights in the Arctic (2013) *Michigan State International Law Review* 22 p 349.
16. G Davis & L Arturo Vasquez Cordano “Trade in mineral resources (2009) *Colorado School of Mines*.
17. R Freeman “The politics of stakeholder theory: Some future directions’ (1994) *Business Ethics Quarterly* (40).
18. S Mawowa “The Political Economy of Artisanal and Small-Scale Gold Mining in Central Zimbabwe.” (2013) *Journal of Southern African Studies* 39 (4): 921.
19. G Bridge “Contested Terrain: Mining and the Environment.” (2004) *Annual Review of Environmental Resources* (29) 59.

Books

1. C Christol “Human Rights in Outer Space” (American Institute of Aeronautics and Astronautics (AIAA)) Paper No 68-980 1968.
2. D Woods ‘University Partnerships as a model for Capability Building in Emerging Space Nations’ *Acta Astronautica* 97, pages 1-184.
3. I Kouskouvelis Space law and human rights: a complementary relationship through the right to development (1991) 350.
4. MA Potter Human rights and outer space: an overview of the international legal and political context (1989) 382.
5. R Bhala *International trade law: Interdisciplinary theory and practice* (2007) ix.
6. J Weiss *Economic Policy in Developing Countries: The reform agenda* (1995).
7. T Qu and MB Green ‘Chinese Foreign Direct Investment: A subnational perspective on location (1997).
8. African Development Bank ‘Africa’s Natural Resources: The paradox of plenty’ (2007).
9. B Dhar “Mining Policy Initiatives” (2001).
10. A Bebbington “Extractive Industries and the Stunted States: Conflict, Responsibility and Institutional Change in the Andes.” (2008).

Case Law

1. Centre for Minority Rights Development (Kenya) and Minority Rights Group International on behalf of Endorois Welfare Council v. Kenya 276/2003 African Commission on Human and Peoples’ Rights 4 February 2010 Available at <https://www.refworld.org/cases,ACHPR,4b8275a12.html>

Dissertations & Theses

1. SA Do you Kanga ‘The right to development in the African human rights system: The Endorois case’ Master’s Thesis, Centre for Human Rights, University of Pretoria, 2011 at 382.

2. S Adewumi 'The impact of FDI on growth in developing countries: An African experience' Master's Thesis, Jonkoping International Business School, 2006 at p 2 (on file with the author).
3. B Zikiti 'How can Zimbabwe Leverage its Mineral Resources for Economic Recovery and Sustainable Growth' Master's Thesis, Wits University.
4. Simbarashe Mangwende, Effects of Gold Panning in Communities: A Case of Shurugwi District, A Thesis submitted in partial fulfilment of a Bachelor of Arts (Hons), Midlands State University, 2014.
5. Desmond Munemo, Assessing the effectiveness of the Kimberley Process in Zimbabwe and the Democratic Republic of Congo, A Thesis submitted in partial fulfilment of a Master of Arts, Witwatersrand University, 2013.

International Agreements

1. African Charter on Human and Peoples Rights.
2. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies of 1967.
3. Universal Declaration of Human Rights of 10 December 1948
4. Article 17 of the International Covenant on Civil and Political Rights of 16 December 1966.
5. The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979.
6. Preamble, Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects of 1968.

Zimbabwe Legislation

1. Mines & Minerals Act [21:05] Acts 38/1961, 24/1962 (s. 2), 18/1963 (s. 24)
2. The Research Act [10:22] Acts 5/1986, 2/1988, 18/1989 (s.40, s.43), 11/1991 (s.29), 2/1998, 22/2001 (s. 4).
3. The Zimbabwean Constitution Amendment Number 20 (Act 2013).

Newspapers

1. Investing in Space "China increases investment in emerging private space industry" *CNBC Markets* (10 October 2018) www.cnbc.com [Accessed 29th of August 2019].
2. K Mashinininga & T Mukeredzi's Minister unveils ambitious plans for higher education' *University World News* (Harare) 5 October 2018.
3. South Africa Launches Advanced Nanosatellite' *The Central (Johannesburg)* 28 December 2018 Available at <https://techcentral.co.za/South-Africa-launches-advanced-nanosatellite/86229/>
4. Space in Africa "Zimbabwe Space Agency is launching tomorrow-all you Need to Know" (9 July 2018) Available at <https://africanews.space/zimbabwe-space-agency-is-launching-tomorrow-all-you-need-to-know/> [Accessed 5 June 2019].

5. “Zimbabwe launches space agency to enhance its use of space technology for sustainable development” *Business Day* (11 July 2018) Available at <https://www.businesslive.co.za/bd/world/africa/2018-07-11-zimbabwe-launches-space-agency-to-enhance-its-use--of-space-technology-for-sustainable-development/>
6. “Big data, satellites and climate change” *OECD The Observer*
7. M Xuequan ‘Zimbabwe Launches Space Agency ZINGSA’ *Xinhuanet* (Xinhua) (11 July 2019) Available at http://www.xinhuanet.com/english/2018-07/11/c_137315340.htm [Accessed 21 September 2019].
8. R Ndlovu ‘Rough Estimates: Millions of Zimbabweans Abroad’ *Mal & Guardian* (Harare) 19 April 2013 Available at <https://mg.co.za/article/2013-04-19-millions-of-zimbabweans-abroad>.
9. N Banya ‘Zimbabwe aims to clear World Bank arrears in 12 months’ *IOL* (Harare) 22 October 2018 Available at <https://www.iol.co.za/news/africa/zimbabwe-aims-to-clear-world-bank-arrears-in-12-months-17581563>.
10. M Zhuwakinyu ‘Foreign mining investors responding to Zimbabwe’s come hither mantra’ *Creamer Media’s Engineering News* (Harare) 6 September 2019 Available at <https://m.engineeringnews.co.za/article/foreign-mining-investors-responding-to-zimbabwes-come-hither-mantra-2019-09-06>
11. C Chakamwe ‘Zimbabwe the richest country in the world’ *The Patriot* (31 October 2013) Available at https://www.thepatriot.co.zw/old_posts/zimbabwe-the-richest-country-in-the-world/.

Online Sources

1. Mining & Exploration’ *Satellite Imaging Corporation* Available at <https://www.satimagingcorp.com/applications/energy/mining/>
2. KC Kuyedzwa ‘Zim launches space agency to close tech gap’ *Fin24* (10 July 2018) Available at <https://www.fin24.com/Companies/ICT/zim-launches-space-agency-to-close-tech-gap-20180710>
3. Earth Institute Columbia University “Pictures Worth a Thousand Words: How Satellite Imagery is Improving Agriculture in Developing Countries” (18 July 2018) Available at <https://blogs.ei.columbia.edu/2018/07/18/afsis-agriculture-africa-remote-sensing/>.
4. ‘Geospatial, Aeronautical and Space Science Capability Programme’ *Ministry of Higher & Tertiary Education and Science & Technological Development* Available at <http://www.mhtestd.gov.zw/2018/11/14/geospatial-aeronautical-and-space-science-capability-programme/>.
5. S Munjenjema ‘Space Age Dream Takes Shape’ *The Zimbabwe Situation* (18 November 2018) Available at <https://www.zimbabwesituation.com/news/space-age-dream-takes-shape/>.
6. ‘Space Law Treaties & Principles’ *United Nations Office for Outer Space Affairs* (2019) Available at <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html>.
7. The World Bank Group ‘The World Bank in Zimbabwe’ 31 October 2018 Available at <https://www.worldbank.org/en/country/zimbabwe/overview>.

8. The World Bank ‘The Zimbabwe Reconstruction Fund’ Available at <https://www.worldbank.org/en/programs/zimbabwe-reconstruction-fund#2>.
9. NASA “Prospecting from Orbit” (3 June 2014) Available at <https://www.nasa.gov/vision/earth/lookingatearth/prospecting.html> {Accessed 24 September 2019}.
10. M Altaweel “Mapping minerals with satellite imagery” 11 April 2018 Available at <https://www.gislounge.com/mapping-minerals-satellite-imagery/> [Accessed 24 September 2019].
11. B Matsika ‘A closer look at Zimbabwe’s mining sector’ 10 September 2010 Available at <https://www.howwemadeitinafrica.com/a-closer-look-at-zimbabwes-mining-sector/3769/>
12. The World Bank Group ‘The World Bank in Zimbabwe) (1992) Available at <https://www.worldbank.org/en/country/zimbabwe/overview>.

Reports

1. African Union, Second Ordinary Session for the Specialized Technical Committee Meeting on Education, Science and Technology (STC-EST) 21 October to 23 October 2017, Cairo, Egypt.
2. ClimDev-Africa ‘Project: Satellite and Weather Information Project for Disaster Resilience in West Africa (SAWIDRA-WA) p iv.
3. ‘Monitoring Climate Change From Space’ *European Space Agency* (4th December 2018) Available at https://www.esa.int/Our_Activities/Observing_the_Earth/Space_for_our_climate/Monitoring_climate_change_from_space2
4. The World Bank ‘Stepping Up Climate Adaptation and Resilience in Africa’ (11 March 2019) Available at <https://www.worldbank.org/en/news/feature/2019/03/11/stepping-up-climate-adaptation-and-resilience-in-africa>
5. UNCTAD ‘World Investment Report: Transnational Corporations, Market Structure and Competition Policy (1997).
6. GA/SPD/323 19 October 2005.
7. GA Resolution A/AC.105/C.2/2018/CRP.3 “Status and application of the five United Nations treaties on outer space “Committee on the Peaceful Uses of Outer Space Legal Subcommittee Fifty-seventh session Vienna, 9–20 April 2018 Item 6 of the provisional agenda.
8. G James “Space-based resources for disaster management in Africa” *United Nations Conference on Space-Based Technologies for Disaster Risk Management* 7-9 November 2012, Beijing, China
9. “List of Space Agencies in Africa’ *Space in Africa* (22 June 2018) Available at <https://africanews.space/list-of-space-agencies-in-africa/>.
10. Mining in Zimbabwe’ *Ministry of Mines & Mining Development* Available at <http://www.mines.gov.zw/>.

11. OECD 'Report on Zimbabwe' Available at <https://www.oecd.org>
12. OECD 'Enhancing the legal framework for sustainable investment: Lessons from Jordan' Available at <https://www.oecd.org>
13. W Muchaendepi, C Mbowa, J Kanyepe & M Mutingi 'Challenges faced by the mining sector in implementing sustainable supply chain management in Zimbabwe' Available at www.sciencedirect.com
14. Mining Potential Booklet "Procedures & Requirements Of Acquiring Licenses And Permits In Terms Of The Mines And Minerals Act (Chapter 21:05)" January 2018 Available at <http://www.mines.gov.zw/sites/default/files/Downloads/Zimbabwe%20Mineral%20Potential%20Booklet.pdf>.
15. United Nations Development Programme: Comprehensive Economic Recovery in Zimbabwe working paper series "Working Paper 1: The mining sector in Zimbabwe and its potential contribution to recovery" (2009).
16. United Nations Conference on Trade and Development 'World Investment Report' (2008).
17. P Zhuwawo "Frameworks, procedures and guidelines for the implementation of Indigenization Economic Empowerment Act (4 January 2016) Presented by the Minister of Indigenization and Economic Empowerment, Zimbabwe.
18. Natural Resource Governance Institute "State participation and state-owned enterprises: The benefits and challenges, (March 2015).
19. Xinhua, Zimbabwe pushes to amend mining law to attract investors, Available at http://www.china.org.cn/world/Off_the_Wire/2016-03/14/content_38024489.htm (01 June 2016).
20. Zimbabwe Investment Authority, Metals and Minerals, accessed from http://www.investzim.com/index.php?option=com_content_view=article&id=314&Itemid=716 (01 June 2016).
21. Kudzai Kuwaza, Mugabe Interview Confirms Chiadzwa Diamond Looting, The Zimbabwe Standard, 11 March 2016.
22. P Mhlanga "Zimbabwe's Economic Crisis." (2016) Financial Gazette, March 24. Available at www.financialgazette.co.zw/zimbabwes-economic-crisis-deepens/.

Other Legislation

1. Section 2 of the Constitution of the Republic of South Africa (1996).