Facilitating trade in mineral resources: policy implications for trade between Africa, South Africa and East Asia

Shinechole Moon / MNXSHI002

A minor dissertation submitted in *partial fulfillment* of the requirements for the award of the degree of Master of Arts in Political Studies

Faculty of the Humanities

University of Cape Town

2014

COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature: Date:

ACKNOWLEDGEMENTS

As a believer remaining in God's love, I want to attribute thanks to Him who has always arranged for a positive environment to make it possible for me to study and finish this dissertation without difficulty. Sincerely, I can do nothing without the wisdom and logic that have been given to me in every chapter through Him, for I know Christ is the power of God and the wisdom of God as recorded in 1 Corinthians chapter 1:24.

In the human realm, to my source and helper - my country (Korea), parents (father: Byung yun Moon, mother: Myungyong Eum), and wife (Eunkyung Lee) - I want to express deep appreciation because they all encouraged me to finish this thesis by providing financial and affectionate support that makes what I have achieved until now possible.

In addition, it was a pleasure for me to meet my supervisor, Dr. Vinothan Naidoo, Department of Political Studies in University of Cape Town (UCT), who possesses both broad knowledge and considerateness. My dissertation composed of five chapters was refined through his acute and meticulous advice based on his professionalism from a poor to an acceptable state. Whenever I faced difficulties, his valuable advice and suggestions give me opportunities to learn how to organize every chapter and to arrange the contents of my thesis. Without his thoughtful support, it would not have been possible to finish this dissertation.

Lastly, Ms Joanne Polzin working in UCT as an administrative assistant deserves my gratitude, along with Jason Gray who is a considerate editor. I must confess that their caring and help were a significant factor to enable me to adapt to life in UCT and finish this thesis.

ABSTRACT

This thesis aims to carry out a comparative research to analyse the policies and countermeasures taken by various countries related to the trade in Rare Earth Elements (REEs). The similarity of the approaches of East Asian countries – China, Korea, and Japan – towards the African continent, and South Africa's mineral policies with the goal of national development provides the basis for the formulation of a SWOT Matrix analytical tool. As mineral resources, particularly REEs, have increased in significance with the advancement of modern technology, it will be valuable from an academic, business and political perspective to undertake such research in order to consider the optimal policy instruments that can benefit resource poor countries, such as Korea in particular, and resource rich countries such as South Africa. In Chapter 3, a number of proposals for Korea to establish rational policy systems to secure a stable REE supply chain will be put forward, followed in Chapter 4 by a SWOT Matrix analysis to provide some recommendations to South Africa for a number of policy instruments to meet its requirements of generating inclusive economic growth through establishing cooperative models.

The implications of the diverse counterstrategies against China's restrictive policies on REEs are particularly enlightening to illustrate the future value of REEs as well as the direction mineral policies have progressed and will tend to develop on the global stage, both to secure mineral assets and to achieve sustainable development from a domestic and a global perspective. It was clear in the research that, from a domestic point of view, resource poor countries hoping to organize their own mineral policies for securing mineral resources and national development must implement policies which target the vitalization of domestic mining, the enhancement of R&D activities, and the building of a flexible stockpiling system.

By comparing S (strengths) and W (weaknesses) from South Africa and O (opportunities) and T (threats) from the three Asian countries, we observe that a cooperative model requires three ingredients – competitiveness, comparison, and choice – operating organically on the basis of mutual cooperation between importers and exporters.

LIST OF ABBREVIATIONS

BEE	Black Economic Empowerment
CNOOC	China National Offshore Oil Corporation
CRM	Critical Raw Materials
DME	Department of Minerals and Energy
DOE	Department of Energy
DSB	Dispute Settlement Body
EC	European Commission
FDI	Foreign Direct Investment
FOCAC	Forum on China-African Cooperation
GM	General Motors
HDSA	Historically Disadvantaged South Africans
HREEs	Heavier Rare Earth Elements
JBIC	Japan Bank for International Cooperation
JOGMEC	Japan Oil, Gas and Metal National Corporation
KAF	Korea-African Forum
KIAD	Korea Initiative for Africa's Development
KIGAM	Korean Institute of Geoscience and Mineral Resources
KIRAM	Korea Institute for Rare Metals
KORES	Korea Resources Corporation
LREEs	Light Rare Earth Elements
MDGs	Millennium Development Goals
ME	Ministry of Environment
MEP	Ministry of Environmental Protection
METI	Ministry of Economy, Trade and Industry
MKE	Ministry of Knowledge Economy
MOC	Ministry of Commerce
MOU	Memorandums of Understanding
MPRDA	Mineral and Petroleum Resources Development Act
NAC	National Assembly Committee
NDS	National Defense Stockpile

NEXI	Nippon Export and Investment Insurance
NIMS	National Institute for Materials Science
NK	North Korea
ODA	Official Development Assistance
PGMs	Platinum Group Metals
PPS	Korean Public Procurement Service
PRC	People's Republic of China
R&D	Research and Development
REEs	Rare Earth Elements
REOs	Rare Earth Oxides
RMI	Raw Materials Initiative
RN	Resource Nationalism
ROW	Rest of The World
SA	South Africa
SMEs	Small and Medium-sized Enterprises
TICAD	Tokyo International Conference for Africa's Development
UNSC	UN Security Council
USGS	U.S Geological Survey
WTO	World Trade Organization

TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

INTRODUCTION

Due to their increasing importance for green and high-tech industries, the demand for Rare Earth Elements (REEs) has greatly intensified in recent years. The heightened pressure for control of REEs due to the enlargement of their spheres of industrial application has caused problems of scarcity, with many parties vying for control of limited natural resources. The implications of this supply and demand constraint have led to greater competition between nations to secure REE production and resources on the global stage.

As the world's biggest REE producer, China's production of REEs reached 97% of the world's total in 2010. Nevertheless, China is faced with a number of severe problems related to REEs, caused by disorderly development and poor management of their mines. A large amount of environmental pollution near China's mines occurred as a result of a failure by the government to properly manage the mines and to curb the severe, destructive rivalry among small businesses.

These recently raised environmental concerns are also very closely connected with a number of consecutive regulations from Chinese administration to control export quotas on REEs in the global market. A series of assertive measures by the Chinese government enlarging the scope of export restrictions caused a substantial burden to the raw materials market. As a result, many countries relying on the export of high-tech products were forced to endure a period of drastically soaring raw materials prices. For that reason, major REE importing nations have become acutely focused on the task of preparing countermeasures to secure REEs. They are not only investing huge sums of money on Research and Development (R&D) and restructuring their own domestic stockpiling policies with a long-term perspective, but also investigating overseas nations in possession of large, untapped mineral resources in order to build cooperative relationships.

It is hoped that this thesis will provide an easily understandable perspective on the significance of REEs and the rationale behind a number of countermeasures instituted by importer nations against China's REEs policy, particularly for the purpose of countries whose economy demands the consumption of large volumes of mineral resources for their industrial or military goals, to buttress themselves against unexpected supply shocks resulting in a shortage of mineral resources globally, and to provide some direction on how they can use

REEs to enable their sustainable economic development.

In addition, this thesis will explore a cooperative model to ensure that both the consumer and the provider nations of mineral resources are mutually benefited in the exchange. This will take the form of an investigation of the resource diplomacy of import-dependent countries located in Northeast Asia – namely, China, Japan, and Korea – towards the African continent, as well as an analysis of the strengths of weaknesses of South Africa's mineral policy.

The sequential order of the chapters of this thesis will be the following:

- Definition of REEs -- Chapter 1
- China's Rare-Earth Policy --------------------------------------- Chapter 2
- Counterstrategies of Importer Nations ------------------------- Chapter 3
- South Africa and Cooperative model --------------------------- Chapter 4
- Conclusion -- Chapter 5

To elaborate on this brief outline, Chapter 1 will provide an overview of the characteristics of REEs in order to facilitate an overall understanding and definition. Chapter 2 will make the argument that mineral resources could be used as a political and economic weapon in relation to China's Rare-Earth policy around resource nationalism (RN). Chapter 3 will explore the diverse countermeasures devised by countries heavily depending on China's REEs, to provide resource poor nations with practical measures to prepare for emergencies related to a scarcity of mineral resources, both from a short and long-term perspective.

Chapter 4 will explore a cooperative model through the framework of a SWOT analysis, by comparing the diplomatic strategies currently being employed by resource import-dependent countries such as China, Japan, and Korea in order to extract external elements such as O (opportunities) and T (threats), as well as South Africa's S (strengths) and W (weaknesses) in its own mineral policy. On the basis of the SWOT analysis, chapter 5 will consider the implications for how South Africa could reform on how it could reform its own policy instruments to produce a cooperative model for creating win-win situations between trading partners.

CHAPTER 1

DEFINITION OF REES

1.1. The properties and field of application of REEs

According to the definition by the U.S Geological Survey (USGS), there are seventeen REEs comprising yttrium, scandium, and 15 elements of the lanthanides chemical group – lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium – in the periodic table. REEs are divided into two categories: Light Rare Earth Elements (LREEs) and Heavier Rare Earth Elements (HREEs), according to the electron configuration of each rare-earth element.

- **LREEs (7 elements):**
  - Lanthanum
  - Cerium
  - Praseodymium
  - Neodymium
  - Samarium
  - Europium
  - Scandium

- **HREEs (9 elements):**
  - Yttrium
  - Gadolinium
  - Terbium
  - Dysprosium
  - Holmium
  - Erbium
  - Thulium
  - Ytterbium
  - Lutetium

The term ’Rare Earth’ should not be understood as referring to their scarcity in the earth’s crust, but from the difficulty of exploitation. In other words, while some REEs are even more plentiful than normal ores such as copper, lead, gold, and platinum, their diffuse structure makes them highly problematic to extract. This means that REE elements cannot be obtained as easily as common ores, which are extracted through relatively uncomplicated production processes (Humphries, M. 2012: 2).

As REEs have unique chemical, physical, electronic and luminescent properties, they have crucial utility in a diversity of high-technology industries; particularly in the spheres of commercial, military, and green technologies. Firstly, in commercial industries related to the metallurgical, optical and medical sciences, they are used mainly for their advanced properties in electricity conduction, electron manipulation, automobile, machinery, petro chemistry, glass and ceramic manufacturing, and as a catalyst. Secondly, in military technologies they are also adopted as crucial elements to produce a range of high-tech strategic arms, including precision-guided missiles, smart bombs, unmanned aerial vehicles, and radar. Lastly, in green technology industry, REEs have grown vastly in their areas of interest and applicability to meet consumer demand and government environmental initiatives (Hoatson, M et al. 2011:20). For example, vehicles with permanent magnets and pure or hybrid electric-powered engines are gradually achieving greater consumer interest than traditional vehicles operated by fossil fuels, since they are able to reduce their spending on petrol; and international governments are encouraging their manufacturing industries to make their products as eco-friendly as possible to reduce the problem of global warming. These newer manufacturing techniques, and the emergence of clean, energy efficient consumer products, almost without exception require the advanced application of REEs for their production.

Table 1: Major applications of the REEs in emerging high-technology industries

REEs and Application Fields
(1) Catalysts: La, Ce, Nd, Pr, Lu, Y, Sm · Automotive catalysts · Petroleum refining, fuel catalytic cracking, ethane polymerization · Fuel and hybrids, diesel fuel additive · Air pollution controls, water filtration, hydrogen storage, flints
(2) Permanent and ceramic magnets: Nd, Pr, Sm, Dy, Tb, Tm, La, Ce · Cars—hybrids-plug-in and electric vehicles, window motors, screen wipers, starter motors, hybrid batteries, alternators, brakes · Electronics—computer disc drives, data storage, iPods, DVDs, CDs, video recorders, consoles, video cameras, mobile phones · Speakers, headphones, microphones, ceramic capacitors · Wind-, hydro-, and tidal-power turbines · Electrical motors, refrigeration, generators, cordless power tools · Medical imaging · Handheld wireless devices
(3) Phosphors: Y, Eu, Tb, Gd, Ce, La, Dy, Pr, Sc · LCD televisions and monitors, plasma televisions and displays, mobile phone displays · Energy efficient fluorescent lights, high-intensity lighting, LEDs, mercury-vapour lamps · Phosphors—red (Eu), blue (Eu), and green (Tb)
(4) Polishing powders: Ce, La, Pr · Television and computer screens—plasma, CRT · Precision optical lenses and electronic components · Silica wafers and chips, catalyst for self-cleaning ovens
(5) Glass additives: Ce, Er, Gd, Tb, La, Nd, Yb, Pm · CRT screens to stabilize glass from cathode ray · Glass—optical lenses, glass for digital cameras, tinted glass, UV-resistant glass, high-refractive index glass, fiber optics
(6) Ceramics: Dy, Er, Ce, Pr, Nd, Gd, Ho, La · Colors in ceramics and glass —yellow (Ce), green (Pr), and violet (Nd)
(7) Energy storage: La, Ce, Pr, Nd, Pm · Rechargeable NiMH batteries, battery electrodes, nuclear batteries
(8) Medical equipment: various REEs · MRI machines, X-ray imaging · Surgical drills and tools, surgical lasers · Electron beam tubes, computed tomography, neutron capture
(9) Other applications: · Lasers—Yb, Y, Dy, Tb, Eu, Sm, Nd, Pr, Gd, Ho, Er · Superconductors—Gd, Y · Nuclear—Ce, Er · Fertilizers—various REEs · High-technology alloys—Yb, Lu, Er, Tb, Gd, Eu, Sm, Nd, Pr, Ho, Sc
Ce = cerium, Dy = dysprosium, Er = erbium, Eu = europium, Gd = gadolinium, Ho = holmium, La = lanthanum, Lu = lutetium, Nd = neodymium, Pm = promethium, Pr = praseodymium, Sc = scandium, Sm = samarium, Tb = terbium, Tm = thulium, Y = yttrium, Yb = ytterbium.

Source: Hoatson, M. et al. 2011.p20

1.2. Global reserves and production

According to the data estimates by the USGS in 2013, REEs are not evenly distributed internationally, but limited to a small set of countries such as China, U.S, India, and Australia, and other countries described in table 2. China still maintains a near-monopoly power in the world market as the world's largest REE resource, holding 50% of the world's reserves, followed by the U.S which holds about 13%; whereas the other countries – India (3.1%), Australia (1.6%), Brazil (0.032%), and Malaysia (0.32%) – hold conspicuously minor quantities of REEs compared with these two major nations. Furthermore, in observing the production figures of REEs provided by the USGS in the same year, we see that the production ranking of those elements corresponds very closely to the countries' reserve quantities, with the exception of Australia and India.

The world's largest nation, China, produced 86.4% of the world's total (rounded), whereas the production ratio of the remaining countries totaled 13.6%: 6.4 % from the U.S, 3.6% from Australia, 2.5% from India, and 1.1% from the other countries (USGS.2013:129). This figure illustrates dramatically the scale of inequality that exists with regard to the reserves and production of REEs between countries. This ultimately implies that the future REE minerals market could become very unstable due to the drastically fluctuating prices that occur because of this situation where a single nation holds a monopoly reserve power.

Table 2: World mine production and reserves (metric tons)

Country	Mine production		Reserves
	2011	2012	
United States	**-**	**7,000**	**13,000,000**
Australia	**2,200**	**4,000**	**1,600,000**
Brazil	**250**	**300**	**36,000**
China	**105,000**	**95,000**	**55,000,000**
India	**2,800**	**2,800**	**3,100,000**
Malaysia	**280**	**350**	**30,000**
Other countries	**NA**	**NA**	**41,000,000**
World total (rounded)	**111,000**	**110,000**	**110,000,000**

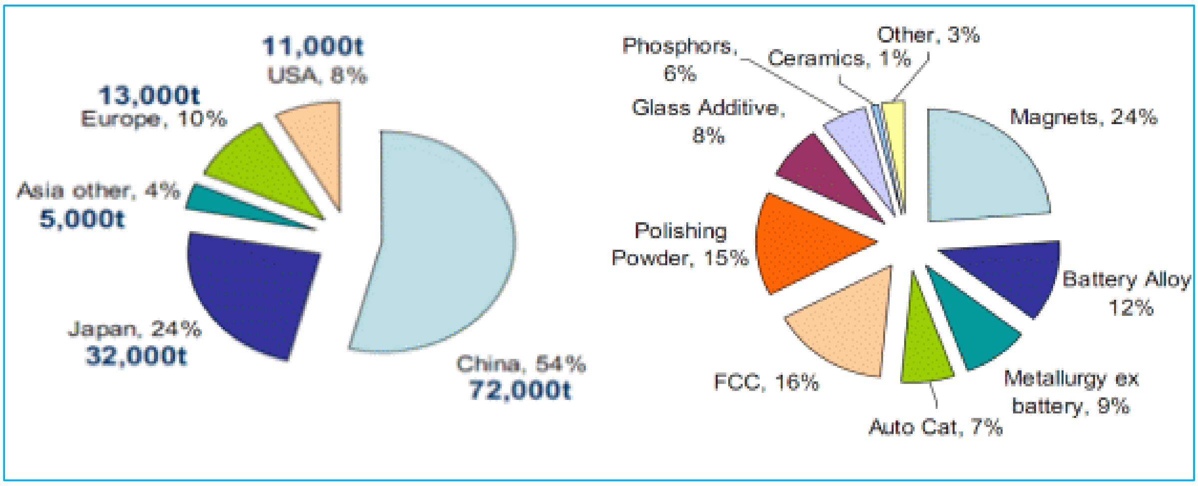
Source: USGS.2013.p129

1.3. Demand and supply

According to the Lynas Corporation, China – whose economic growth over the past decade has been nothing short of remarkable – emerged as the largest consumer nation of REEs, in accordance with its own growth and expansion in manufacturing capacity. As seen in graph 1 China constituted 54% of the entire global consumption of REEs, followed by Japan at 24% and Europe at 10% (Lynas.2010:10).

Graph 1: Estimated world consumption and application in 2010

(Total: 134,000tons)



Source: Lynas Corporation Ltd. 2010. p10

The increasing consumer appetite for high-tech products has also enlarged the fields of application of REEs, resulting in a constraint on their supply. Almost all of the most exciting and cutting edge commodities such as smartphones, hybrid cars, and wind turbine generators utilize permanent magnets as a crucial component in order to operate. As table 3 illustrates, for those strong magnetic substances to be produced the magnet makers require neodymium, praseodymium, dysprosium, and terbium. Therefore, given the increasing demand, many REE experts predict that supply of the four elements will begin to fall behind the quantities demanded by industry in 2014 (Seaman, J. 2010:10).

Table 3: Forecast of demand-supply of REEs in 2014 (metric tons)

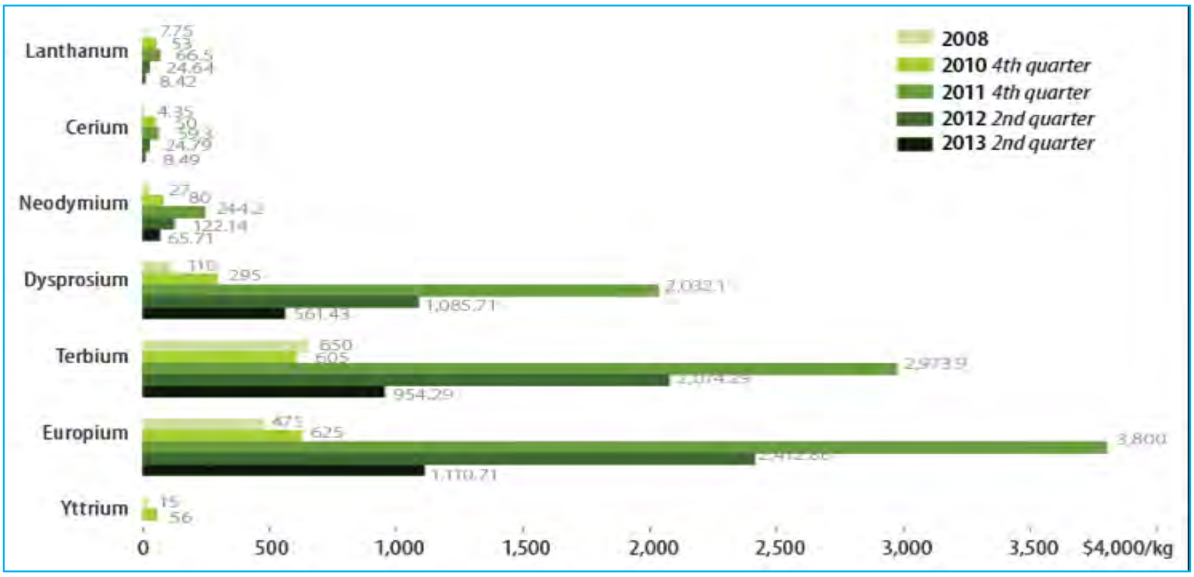
Element	Demand	Supply	Balance	Balance as % of Demand
Lanthanum	**51,050**	**54,750**	**3,700**	**7.25**
Cerium	**65,750**	**81,750**	**16,000**	**24.33**
Praseodymium	**7,900**	**10,000**	**2,100**	**26.58**
Neodymium	**34,900**	**33,000**	**-1,900**	**-5.44**
Samarium	**1,390**	**4,000**	**2,610**	**187.77**
Europium	**840**	**850**	**10**	**1.19**
Gadolinium	**2,300**	**3,000**	**700**	**30.43**
Terbium	**590**	**350**	**-240**	**-40.68**
Dysprosium	**2,040**	**1,750**	**-290**	**-14.22**
Erbium	**940**	**1,000**	**60**	**6.38**
Yttrium	**12,100**	**11,750**	**-350**	**-2.89**
Ho-Tm-Yb-Lu	**200**	**1,300**	**1,100**	**550**
Total	**180,000**	**203,500**	**23,500**	**13.06**

Source: Modified from the' Kara, H. et al. 2010. P39' by author

1.4. The trend of prices

Before 2009 the overall price of REEs remained at stable levels without any great occurrences disrupting the balance between supply and demand. However, once the Chinese government began from September 2009 to strongly regulate its illegal mining industries and announced a range of policies related to REE export restrictions, many industrial nations experienced an unprecedented soaring of prices in the global market from 2008 to 2011(Seaman, J. 2010:18; Humphries, M. 2013:5).

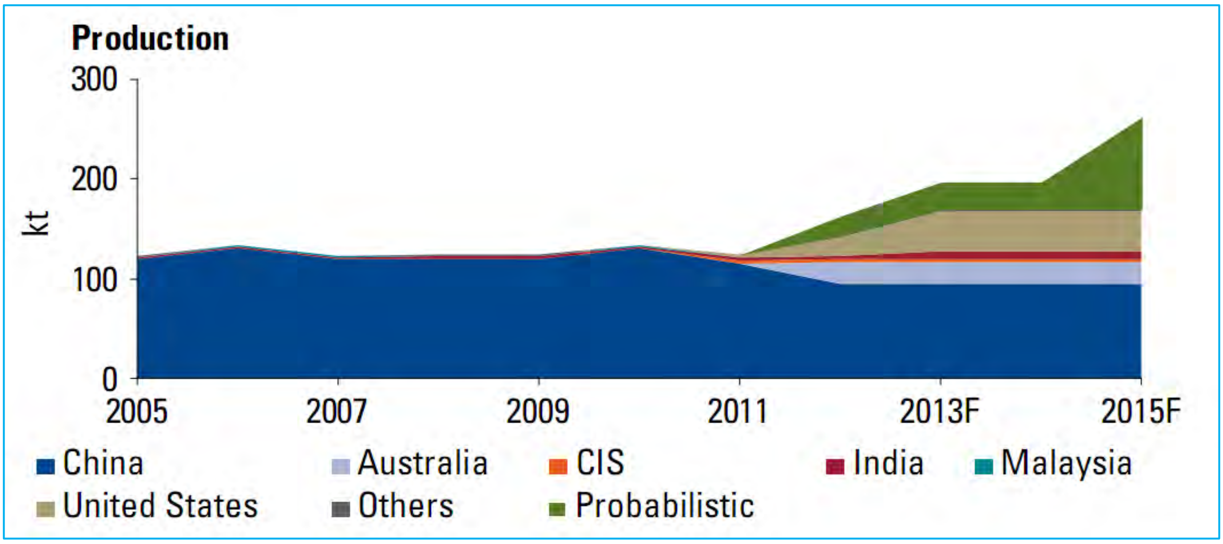
Graph 2: Selected Rare Earth Oxide prices, 2008-2013 (US $/kg)



Source: Humphries, M. 2013. P7

As we can see from graph 2, between 2008 and 2011 the prices of some REEs – four in particular – skyrocketed drastically; from three times even to as much as 10 times the prices seen in 2008. Those four elements (neodymium, dysprosium, europium and terbium) prove that the forecasted inflationary pricing seen in table 3 was remarkably precise. As we see in figure 1, these soaring prices began to stabilize and decrease after 2011 as a result of increased production by other countries outside of China; and as a result of a reduction in demand due to the global economic recession and improvements in technologies, which enabled REEs to be substituted by alternative materials. Nevertheless, there are still a number of potential risk factors that threaten the possibility of stable market prices in the long-term unless China's aggressive policies are somehow curtailed, increased demand for particular elements is offset, and sufficient alternative materials become available for current REE fields of application.

Figure 1: Global estimated production of Rare Earth Oxides, 2005-2015F



Source: Piedra, J.2012. p2

1.5. Environmental Problem and REEs

In order to extract REEs from raw materials, a number of crucial manufacturing steps must occur, such as the following:

① Mining: extracting rough ores out of deposits in the earth's crust

② Milling: crushing and grounding mined ores to be fine powders

③ Flotation: separating valuable metals from mixed ores by both physical and chemical methods

④ Refining process

Passing from mining to milling, crude ores will be changed to low concentration REOs (0-10% elements), and after passing flotation, the low concentration elements will be refined to a higher degree of purity (30-70%). Those processes are quite effective for producing high-purity REOs. Although manufacturers can obtain high quality REEs through these methods, the processes have an unfortunate side effect – environmentally damaging toxic wastes are also produced such as fluorides, sulphides, acids and heavy metals containing a lot of radioactive substances.

Although mining companies have impoundment facilities to contain these toxic wastes and prevent them from seeping into the neighboring groundwater and soil, there have been occasions where the possibility of spillover due to improper maintenance and heavy rainfall has been raised (Schüler, D et al., 2011:42-45). For that reason, China and the other major countries involved in producing REEs have strengthened environmental regulations in order to safeguard the health of inhabitants living in around mining industrial areas and to conserve the natural environment.

1.6. Implications

It seems to be an unavoidable fact that the future market value of REEs will only continue to grow, particularly in light of the past trends and forecasted data we have already looked at. On one hand, they have some very apparent advantages compared with common ores, as the other mineral elements cannot provide an adequate and comprehensive substitute for the unique properties of REEs, particularly in very niche areas of application. Their usefulness in the most progressive and valuable consumer technologies is indispensable. For instance, a smartphone – now considered a necessity in modern society – is composed of a broad range of cutting-edge materials: a semiconductor, a permanent magnet, and a liquid crystal display (LCD) or light emitting diode (LED) display. As we can see in table 1, every one of those components utilizes REEs in an indispensable way.

On the other hand, the disproportionality between global REE reserves and production has already resulted in national tensions, and has the potential to be the cause of political and economic problems, in a situation where a single nation with abundant natural resources can leverage its position to become a monopoly power. For that reason, many resource poor countries have expressed concern about this eventuality where a single nation can wield so much control, as they have already seen the negative economic impacts of soaring mineral prices. To summarize, while the benefits of REEs for the developed world are manifold and undeniable, the difficulty of extraction and their global scarcity is the cause of quite serious international problems. While they have enabled a wealth of technological advancement, resulting in products which have enriched the lives of the public, the last several years have seen nations engaging in aggressive acquisition and hoarding strategies, resulting in monopoly power and a destabilizing of global mineral prices. The significance of REEs can be confirmed in the next chapter by reviewing not only the directions of China's REE policy but also the connection between China's policy and Resource Nationalism (RN).

CHAPTER 2

CHINA'S RARE-EARTH POLICY

2.1. Discovery, development and meaning

The relationship between China and REEs started in 1927, when China's scientists discovered their existence in Bayan Obo. Although China only began actively to produce REEs from 1957, its minerals industry has grown more noticeably than any other country in the world, to the extent that today they have 21 production sites outputting a high quantity of REEs (Pui-Kwan, T, 2011:1).

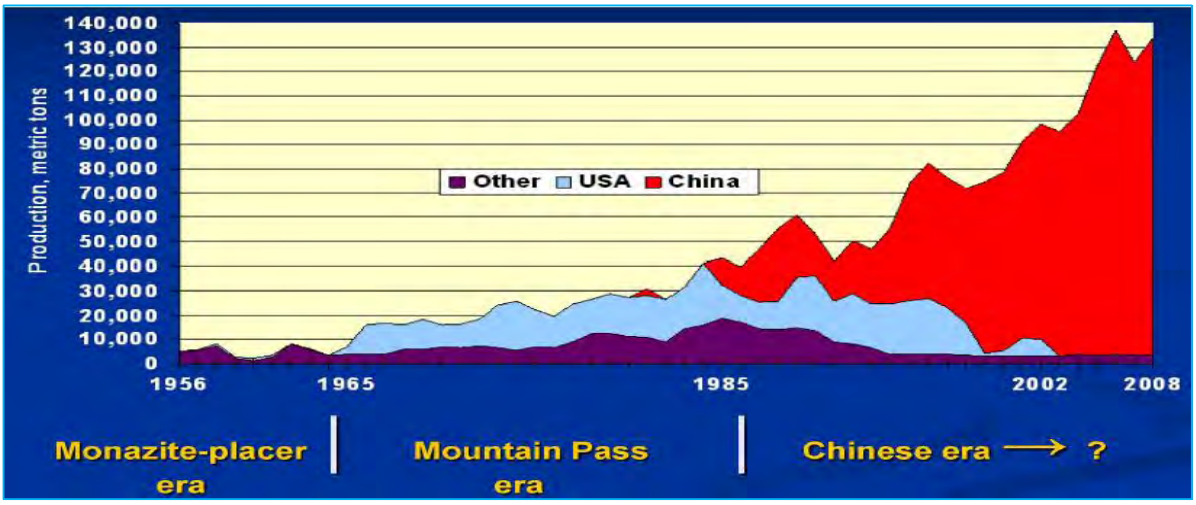
Due to the exceptional growth of the REE industry, China overtook the United States in mineral production from the late 1980s. Even though the U.S had dominated the REE market for almost three decades by running the Mountain Pass mine in California and fostering an R&D industry and developing new fields of application for REEs, the ambitions of the U.S were not strong enough to stave off China’s aggressive developments in manufacturing. The reason China's REE industry has become the world’s largest manufacturing base is that there has been a continuous support from government, as the Chinese government viewed REEs as a significant resources since the 1960s, and has consistently invested huge amounts of expenditure on improving their methods of REE production (Seaman, J. 2010:14).

As a result of its aggressive expansion policies, China today produces 97% of REEs as the world's largest nation, holding approximately 50% of total world's reserve. Moreover, it consumed 54% of the entire global production of REEs in 2010. These facts illustrate vividly the scale of influence of China's power in the world's mineral market. If we consider the increasing global trend and consumer appetite towards high-tech and green industries, China’s position with regards to its ability to wield power over the REE market can only be expected to increase over time. The recent minerals acquisition policies of China also illustrates how China's power over the REE market has been expanded through its monopoly control of REEs as a form of political leverage which it uses to expand its global power.

2.2. Production and reserves

Although China’s mineral reserves were discovered fairly early, the scale of their power with regards to production of REEs did not become apparent for some time. While the production of China's REEs began since 1957, the total volume of China's output remained lower than the United States until the mid-1980s. However, beginning from the early 1990s, China's production of REEs experienced a sharp ramping up, coinciding with their rapid phase of economic development between 1990 and 2000. As seen in figure 2, the production of China's REEs saw a very steep increase till 2008, whereas the Rest of The World's (ROW) production gradually decreased. In fact, China's percentage of REE production and acquisition underwent a drastic increase – from 27% in 1990 to more than 95% in 2010 – a 68% growth in less than 20 years (Jing, Y.C: 2011:51-52).

Figure 2: Global rare-earth-oxide production trends (1956-2008)



Source: Pui-Kwan, T. 2011.p3

In addition to its current levels of production, many of the best geological surveys and estimates maintain that China still holds some of the highest quantity of unexploited REE deposits in the world. When reviewing figure 3, we can see a map of China with 21 currently known REE deposits scattered throughout its provinces and autonomous regions - Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Henan, Hubei, Hunan, Jiangxi, Jilin, Liaoning, Inner Mogolia, Qinghai, Shannxi, Shandong, Shanxi, Sichuan, Xinjiang, Yunan, and Zhejiang.

We can see that almost every region of China with the exception of some minor local areas could eventually become production sites for manufacturing REEs. Of the 21 districts, the four marked with red stars indicate the current greatest areas of REE productivity.

Figure 3: Rare Earth deposits discovered in China

Source: Pencht, M. et al.2011.p18

The reason why the production of REEs in the four regions is more than that of any other of the 17 provincial areas is that 98% of the total mines are clustered densely on the four regions. By percentage, Baotou in Inner Mongolia has 80% of the mines, followed by the Shandong Territory (10%), seven provinces in the Southern part of China (6%), and Sichuan (2%) (Pencht et al., 2011:18).

Table 4: Regional reserves (per million tons), types, and grades of China REEs

Provinces or regions	Industrial Reserves (%)	Calculated reserves	Presumed reserves	Mineral species	Types of REEs	Grade (REOs %)
Bayan Obo, Inner Mongolia	43.5(83.6%)	106	Over 135	Bastnasite and Monazite	LREEs in Iron-Nb-LREE deposit	6
Shandong	4(7.7%)	12.7	Over 13	Bastnasite	La,Ce,Pr,Nd with high grade	7-10
Sichuan	1.5(2.9%)	2.4	Over 5	Bastnasite	LREEs with high grade	6-8
Seven Southern Areas	1.5(2.9%)	8.4	Over 50	Ion adsorption deposit	Middle and HREEs	0.1-0.3
Others	1.5(2.9%)	2.2	Over 3.7	-	-	-
Total	52	131.7	Over 206	-	-	-

Source: Modified from the' Schüler, D. et al. 2011. P8' by author

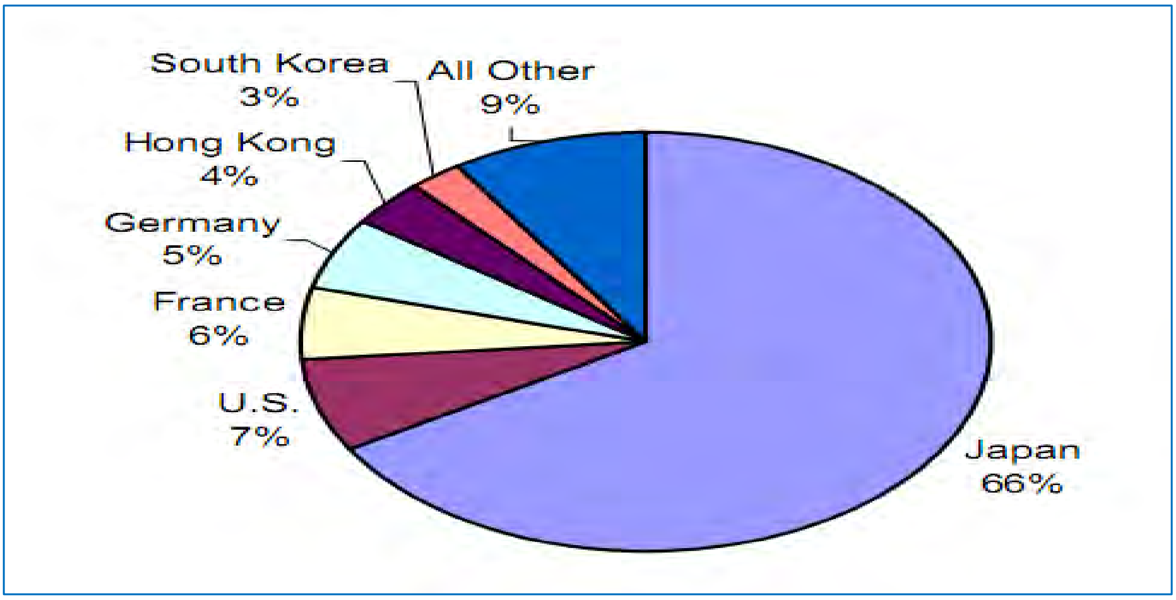
The ranking of mineral deposits among the distributed mines corresponds to the sequence of reserves illustrated in table 4. In relation to the sheer volume of deposits, no other single region's quantity of deposits is nearly comparable to Bayan Obo, which can fairly be considered the heart of China's REE deposits. Bayan Obo was the first location of REEs discovered by scientists in 1927, it accounts for about 83.6% of China's REE reserves and it makes up around 50% of the total REE production in China (Morrison, W. M. et al, 2012:8).

For the purposes of obtaining REEs, four kinds of mineral ores have a significant economic value and can be used to extract REEs for use in commercial products: bastnasite, monazite, xenotime, and rare earth-bearing clays (ion adsorption). While bastnasite deposits are dispersed primarily in two major countries – U.S and China – and monazite deposits are scattered broadly in many countries over three continents – SA in Africa, China, India, Sri Lanka, Thailand, Malaysia in Asia, Brazil and the United States in the Americas, and Australia in Oceania (USGS, 2008:135) – more than 80% of the world's ion adsorption deposits have been detected to exist among the seven southern regions of China (Vulcan, T.2008).

The formation of these minerals also differs according to the conditions present in their geographical location. The deposits of both bastnasite and monazite were formed as a result of magma activity, while those of rare earth-bearing clays (ion adsorption mining) were formed through prolonged exposure to underground weathering. As a result of these varied processes, deposits holding bastnasite and monazite are much closer to the surface of earth than those of ion adsorption mining; and of course the extraction procedures for surface mining are much less intensive, more economical and less environmentally damaging than those for underground mining (Molycorp, Inc.1994: 33-35).

As China emerged to become the world's largest REE producing country, accounting for around 97.3% of world total in 2011, its stature as an exporter of REEs in the global mineral market also rose in importance. Graph 3 depicts the dependencies of various countries on China's REEs, and we can see that Japan was by far the largest volume importer of REEs, holding 66% of China's volume of exports in 2011, followed by the U.S (7%), France (6%), Germany (5%), Hong Kong (4%), and South Korea (3%) (Morrison, W. M. et al, 2012:6).

Graph 3: Importers of China REEs in 2011(% of total)



Source: Morrison, W. M. et al. 2012.p6

2.3. Issues associated with China's REE production

The Chinese government has summarized the rationale behind its seemingly restrictive policies into three critical issues: meeting the requirements of increasing domestic demand, eradicating the practice of illegal mining and smuggling activities, and preventing further environmental destruction.

Firstly, concurrently with its rapid industrial and economic development, China’s demand for REEs increased abruptly; more than that of other country in the world over that period. According to statistics obtained in September 2013 by the World Trade Organization (WTO), China ranked top in relation to the quantity of merchandise exported in world trade for 2012 (WTO, 2013). This is a good indicator of the sheer quantity of REEs China requires in order to manufacture high-tech products such as magnets, batteries, catalysts, and phosphors. Data issued by Lynas supports the estimation that China’s consumption of REEs accounted for 54% of total world spending in 2010 (Nieto, A. et al, 2012:76). For this reason, some analysts have expressed concern that China could see a premature depletion of its reserves within a few decades unless it reins in the scale of its REE production. Moreover, if we consider both China's long-term plan to become the global leader in the electric vehicle market (Bradsher, K, 2009) as well as data estimates provided by Roskill Information Services that forecast

China's REE demand remaining at 70% of the global total by 2020 (Shaw, S et al, 2012), the increasing anxiety for stable supply and demand on REEs seems to be founded on plausible reasoning.

Secondly, while China's REE mining levels were the highest level of any other country in 2010, one aspect of their production was extremely troubling, both economically and from an environmental standpoint: the high levels of smuggling and illegal mining activities. In effect, China governmental policy placed such an overwhelming emphasis on the purely quantitative growth of their REE industry that they neglected to crackdown on illegal mining linked to the acceleration of environmental damage and smuggling, even to the detriment of their overall mining profitability. According to recent findings reported by Xinhua Press based on statistics obtained during the fifth China Baotou Rare Earth Industry Forum, "illegal mining of REEs was more than 40,000 tons in 2012". This illustrates the widespread scale of illegal mining activities in China and the laxity of Chinese government policies towards criminal mining industries (Xinhua Press, 2013). Additionally, it was revealed that the proportion of smuggling activities accounted for 40% (20,000 tons) of the total export volume (50,000 tons) in 2009 – a staggeringly high number shows vividly the urgency of Chinese governmental intervention to preserve its own domestic mining industry (Shujing, Z. 2013:11).

Finally, it is critical to mention the issues that have arisen due to the environmental deterioration caused by REE production, which are putting a strain on shoulders of the China government, mining industries, and residents living near these mining districts. The problem arose due to the basic principle that the rapid, aggressive expansion of China's REE production necessitated deregulation, since strong regulation would have deterred growth.

Strictly speaking, the Chinese government did not begin to undertake the regulation of illegal mining activities until the environmental problems came to be viewed as a major nationwide health and sustainability problem, and the REE industries grew sufficiently to the level that it made them the world's largest producer. Accordingly, the provinces most representative of REE production – the northern region known as Bayan Obo and the southern province known for HREE-rich sites – have suffered immensely as a result of the environmental destruction caused by the proliferation of illegal mining activities. According to the Metal's Edge, analysis of REEs revealed that they are composed of a large proportion of thorium, containing unsafe quantities of radioactive substances that bring about diverse outbreaks of diseases such as respiratory disorders, skin rashes, eruptions and digestive disorders occurring to residents living in contaminated areas. If those toxic materials were improperly disposed of by the mining industry due to inadequate governmental regulations, they could negatively affect both the ecosystem and human health. As an example, thorium is so poisonous that if it leaked into a source of water supply or farmland, they could become polluted to the extent that residents living in areas neighboring these mining industries could suffer serious, deleterious health effects (Metal's Edge, 2010:2-4).

Given that 2,000 tons of mine effluents are produced as by-products for extracting only 1 ton of REEs, we cannot overly emphasize the significance of managing the entire manufacturing process around the mining of REEs; not only to protect the lives and health of the general public, but to preserve the fragile ecosystem. Though the Chinese government's Ministry of Environmental Protection (MEP) initiated a policy for environmental regulation of REEs-oriented businesses in order to enforce the improvement of their facilities for the tackling of atmospheric pollutants, it remains to be seen whether the outcome will match the intentions of the policies. This is due to economic circumstances of small mining industries dependent on REEs being highly competitive, leaving little margin for implementing stringent controls and environmental regulatory compliance. Therefore, the additional cost needed to meet the requirements of the MEP could be so detrimental to the financial condition of small businesses that it becomes unenforceable. The regulatory program initiated by the MEP will face some particular criticisms around the aspect of its feasibility, since the guideline did not contain any incentive and financial support to assist companies with the funding needed to improve their facilities to tackle the environmental problems (Metal's Edge. 2010).

2.4. The directions of China's REE policy

In order for those three issues to be resolved, the Chinese government has implemented the following four categories of policies (Morrison, W. M. et al., 2012:11-20):

- Domestic consolidation policy: consolidating small businesses into state-owned companies by both merging and shutting down.
- Export restriction policy: restricting exportation volumes by abolishing export tax rebates, levying export duties, and designating export quotas.

- Technology-centered strategy: suspending export licenses and limiting foreign companies to operate diverse mining activities such as smelting and separation.
- Exploration overseas mineral resources: aggressively acquiring overseas mineral resources to obtain more REEs beyond its own border.

Deng Xiaoping's prescient statement in 1992 that "China's rare earth resources can be likened in importance to Middle East's oil" provides an excellent springboard to examine briefly the way in which the Chinese government has pursued four specific directions of mineral policies by means of which it hoped to leverage its copious REE resources to become a developed country. And indisputably, their success in a purely economic regard is an admirable lesson to other nations in a similarly underdeveloped position. With the benefit of hindsight, we can evaluate these four strategies as standards to gauge the extent to which China was successful in achieving its ambitious goals.

2.4.1. Domestic consolidation policy

By setting a policy of domestic REE consolidation, China's central government aimed to unify and control the entire administration of the minerals industry concerning the matter of production, sales, and management of REEs. In order to regulate the industry of small mining businesses engaged in illegal operation and smuggling properly, the Ministry of Land and Resources announced a plan as a guideline in 2008. The basic goal of the guideline – the Plans for Development of National Mineral Resources 2008-2015 – is to build a consolidated national system in three of the major REE production provinces within two systems as described in table 5.

Table 5: Contents of plans for development of national mineral resources (2008-2015)

<table>
<tr><th>Three Provinces</th><th>Components</th><th>Two Systems
Based on Kinds of REEs</th><th>Consolidation into X</th></tr>
<tr><td>North</td><td>Inner Mongolia and Shandong</td><td rowspan="2">LREEs-centered</td><td rowspan="3">state-owned firms</td></tr>
<tr><td>West</td><td>Sichuan</td></tr>
<tr><td>South</td><td>Mainly Jiangxi, Guangdong, Fujian, Hunan, and Guangxi</td><td>HREEs</td></tr>
</table>

Source: Modified from the 'Morrison, W. M. et al. 2012. p14' by author

This table illustrates that the motive behind the consolidation policy for the Chinese government is to strengthen its control over the domestic REE industry so that the all centers of consolidation are state-owned firms. Once the unification plan has been completed according to plan by 2015, the Chinese government would have built up a resilient system by which to control its domestic mineral industries. As an example, the Inner Mongolia local government in the Northern Province publicized a directive plan according to the guidelines in May 2011. As a result of the plan, 31 private companies have been shut down and others have been gradually merged into a single entity, the Baotou Rare Steel Rare Earth High-Tech Co.

Due to complexities arising from the fragmented domestic markets, and resistance from existing stakeholders with vested rights, the progress of the restructuring efforts of the mining industries in southern areas has been much slower and more tenuous than that of the southern regions. Nevertheless, China’s administration anticipates that the consolidation of the southern provinces will be fully accomplished within a few years into three state-owned conglomerates: China Minmetal Corp, Aluminum Corporation of China, and Ganzhou Rare Earth Minerals Industry Co. Ltd. Furthermore, apart from the efforts to consolidate the fragmented mining industry, China has pursued another ambitious project to build massive stockpiling facilities consisting of 10 storage areas to accommodate 100,000 REO metric tons – equal to the total amount of global annual production as seen in table 2. If we consider that ostensibly the basic function of stockpiling is to prepare for emergency situations, the sheer scale of China’s stockpiling could elicit unnecessary misunderstandings from its trading partners who might fear that China could make use of those facilities as a means to manipulate the global mineral markets for its own economic benefits rather than utilizing them for their original purpose. Supposing that China's two projects - the consolidation of domestic REE industries and the completion of stockpiling facilities - would be accomplished without major opposition in the near future, China's current power over the REE market could end up being even more dominant than at the present time.

Once the consolidation policy was put in place according to the policies designed by government officials, China would not only have solved the three problems but also would have been able to wield an influential power that controlled demand, supply, and price of REEs in the global market.

2.4.2. Export restriction policy

There can be no question that over short periods of time the most efficient way to protect precious mineral resources is to regulate them by quantitative volume, to ensure that they are not discharged without permission. Although such methods can be very effective, they can result in sharply increased pricing of raw materials, which for countries seeking to procure them for their own domestic manufacturing is highly onerous and can be perceived as anticompetitive. For that reason, the export restrictions instituted by China's policies resulted in a widespread resistance from countries dependent on those resources. Nevertheless, China's export restrictions policy on REEs has been stringently enforced by the use of two methods: a quota system and a tax policy.

Concerning the quota system, table 6 shows the development of China's REE export quotas from 2005 to 2012. We can see that quotas gradually decreased by more than 50% according to the guidelines allocated by the Chinese government.

Table 6: China's export quotas on REEs (2005-2011)
(Metric tons)

	2005	2006	2007	2008	2009	2010	2011
Domestic	**48,010**	**45,000**	**43,574**	**34,156**	**31,310**	**22,513**	**22,712**
Joint Venture	**17,570**	**16,070**	**16,069**	**15,834**	**16,845**	**7,746**	**7,472**
Total	**65,580**	**61,070**	**59,643**	**49,990**	**48,155**	**30,259**	**30,184**

Source: Modified from the' Morrison, W. M. et al. 2012. p17' by author

As China's domestic consumption of REEs drastically increased by more than three times between 2000 (19,000t) and 2009 (73,000t), the reason behind China's implementation of export quotas since 2005 appears to stem more from a desire to fortify its own manufacturing industry, rather than to protect its ecosystem or to take action against the illegal mining companies (Jing, Y.C: 2011:53). Moreover, China’s reduction of mineral allocation between its domestic and joint ventures was fairly stable until 2009, but from 2010 the proportions of resources shifted drastically towards domestic interests. From the point of view of competitiveness, the disparity in resource allocations by the Chinese government could be interpreted as an artificial manipulation with a goal of making its domestic businesses more price competitive than foreign companies. Due to the reduction of demand as a result of the global economic downturn in the late 2000s and the development of substitutes for China's products in consumer countries, the levels of the export quota ratio remained stable between 2010 and 2011. However, that should not be taken as an indication that the fundamental direction of China's policy has changed on the policy of export quotas because the Chinese government has reinforced the policy in specific and strict detail to adapt to the changing circumstances in both the domestic and global mineral market (Morrison, W. M. et al., 2012:17-18).

Another important means utilized by China to control the export of REEs is taxation policies. In the early 1990s, Chinese companies were encouraged to produce and sell REEs to overseas markets, receiving some rebates as incentives from the government on export taxes they had paid. However, as domestic demand has increased and profits started to dwindle gradually from 2000, the promotion plan was abolished in 2005. Instead, the Chinese government adopted even stricter taxation by imposing export duties on REE exporters from 2007 to control the amount of REEs exported and to subsidize its domestic industries, which were able to take advantage of internationally cheap resources. The export duties were imposed initially on fewer than 10% of items, and have been increasing until they peaked at 25% with a particular emphasis on products making use of REEs (Morrison, W. M. et al., 2012:15-16).

2.4.3. Technology-centered strategy

A significant implication of China's REE policy is that China has been able to leverage its supply of REEs as a means to attract foreign companies with advanced technology for manufacturing downstream products. This tactic is strongly reminiscent of former President Jiang Zemin's imperative in 1999 that China should "improve the development and applications of rare earth, and change its resource advantage into economic superiority". This clearly implies that the ultimate goal of the Chinese government is to leverage their enormous capital resources to develop a high-tech industry that could dominate the global market, and raise the economic stature of China to that of a fully developed nation.

China's ambition to become elevated to the status of a developed nation was specifically delineated in a proposal, the National Medium-and Long-Term Program for Science and Technology Development (2006-2020), released by China's State Council in 2006. The central thrust of the plan is to develop China's economic status to be a major innovation center by 2020 and a global innovation leader by 2050 (Morrison, W. M. et al, 2012:19). In order to achieve this stated goal, the Chinese government would have attempted to draw many leading foreign companies in high-tech products related to automobile and electronics to incentivize them to transfer their proprietary technology and manufacturing to China. This through strategies such as "Regulations of Foreign Investments in the Rare Earth Sector", issued by the National Development and Reform Commission in 2002, and "Export Licenses", implemented by the Ministry of Commerce (MOC) from 2006.

Embedded in those strategies is an element of strong-arming towards foreign companies involved in diverse mining activities such as trading, extraction, purification, smelting, and separation. This is due to policies which state that these activities cannot be permitted without joint participation by Chinese partners, and even forces them to invest financially into China's downstream application sectors and REE derived products. (Morrison, W. M. et al., 2012:1, 18-19) From a practical standpoint, foreign enterprises, being somewhat hamstrung by China’s stockpiling and enforcing of price disparities, and highly dependent on REEs in order to manufacture high-tech products at competitive price levels, are compelled to migrate their manufacturing and research facilities to China. A number of international voices have expressed a growing concern about the direction of China’s strategies – particularly from nations such as Japan, who have a deep economic engagement in high tech industries, and a concomitant dependency on REEs. Many reports emerging in the news evidence a strategic concern over China's purpose to become a technologically advanced country by wielding an inordinate influence over REEs; as follows:

> Showa Denko KK, a major rare earth alloy producer in Japan, announced recently it would increase output of its Chinese joint venture by 50 percent to 3,000 tons a year. Hitachi Metals Ltd. is also considering moving part of its Neodymium magnet production operations to China (Yan Pei, 2011).
>
> China is eyeing the valuable know-how foreign companies will bring into joint ventures with Chinese firms to gain access to rare earths," said a Japanese trading company official, who asked not to be identified. "Obviously, Japan's technology to produce high-end magnets is a target (Inoue, 2011).

2.4.4. Exploration of overseas mineral resources

Apart from the regulatory policies enacted by the Chinese government, another significant matter relates to China's ambition to accumulate overseas mineral assets. China's increasing rapacity for REEs does not seem to be limited within its own borders, which already hold an abundance of raw materials – as evidenced by the fact that China has spent considerable resources in the acquisition of mining rights to set up operation in countries in which REE industries have been initiated to some degree. As we examine in detail China's strategies in relation to overseas mineral policies, it becomes evident that their actions are driven by a single overwhelming motive: the desire to become the largest REE holding nation on earth; even to the extent of becoming a de facto monopoly power over the global mineral markets, both by intensifying their own domestic mineral resources efforts as well as gradually acquiring the mineral commodities of foreign countries.

Two cases in particular highlight the extent of China's ambition to become the largest global holder of REEs. The first case happened in the U.S in 2005 when the state-owned China National Offshore Oil Corporation (CNOOC) expressed an intention to take over Unocal, an American oil company which accounted for only 0.23% of global output. From an objective point of view, this initiative of the Chinese government seems meaningless because at that time China was intensifying its investment in oil energy towards the African continent rather than North America in which China spent just 2% of its total oil-related budget (Kim, D.H, 2011:109). Nonetheless, the attempted acquisition was frustrated due to strong opposition from U.S political leaders who expressed concerns over the transfer of US oil reserves to a company under the remit of China's government. It later became apparent that Unocal was the owner of Molycorp, a mining operator in the REE industry based in Mountain Pass in California. As a result of the government's resistance, Chevron Corporation purchased Unocal instead of CNOOC (Seaman, J. 2010:23).

A similar case occurred in Australia in May 2009 when China Non-Ferrous Metal Mining Co attempted to purchase a 51.6% share of Australia's Lynas Corporation, the owner of Mount Weld Mine, estimated as the world's largest single-deposit REE mine. The attempted takeover of the Chinese company was ultimately abandoned due to a new regulation introduced by the Australian Foreign Investment Review Board's that lowered the limit of foreigners ownership with respect to major iron ore mine to less than 50%, due to concerns about China's excessive investment in Australia's mining sector (Morrison, W. M. et al.,2012:22).

2.5. Review of the connection between China's policy and resource nationalism

2.5.1. Meaning of resource nationalism

Even though there is no clear definition of RN, in a broad sense it refers to a tendency of governments to attempt to both control the price and export or place production restrictions of resources, and to deliberately restrain the abilities of foreign companies to conduct normal business practices in order to maximize national profits. This nationalistic tendency manifests in a range of governmental interventions around any process related to natural resources: possession, production, stockpiling, development, exploration, trading, and price control.

According to the preface of the Permanent Sovereignty Over Natural Resources General Assembly Resolution 1803(XVII), adopted by the UN on 14 December 1962, “The resolution had resulted from the General Assembly’s focus on, firstly, the promotion and financing of economic development in under-developed countries and, secondly, in connection with the right of peoples to self-determination in the draft international covenants on human rights (UN, 1962).” According to this statement, the fundamental goal of RN is to safeguard the economic rights of countries to reserve a large proportion of their natural resources in order to empower them to achieve a self-sustained growth through economic development based on capital accumulated from their own resources. This is in contrast to the current situation where resources could be being manipulated not as an economic but as a political means to enhance a country's influence globally as seen in a case of a territorial dispute between China with Japan. Practically, the potential for the misuse of the principle of RN has materialized in a recent incident detailed below, which has caused great concern to neighboring or related nations. Thus, in a real sense the meaning of RN can be defined as a means by which resource-rich countries can exert their influence on the global stage by using their own abundant resources as a weapon for political rights and economic prosperity.

One example, elaborated below, demonstrates how the meaning of RN can be extended beyond economic fields into the political sphere, in a case where the Chinese government wielded their control of REEs as political leverage against Japan to deal with a territorial dispute over the Senkaku Islands.

2.5.2. Exerting of China's monopoly power through REEs

On 7 September 2010, a territorial dispute occurred as a result of a collision between a Japanese patrol ship and a Chinese fishing trawler over the Senkaku Islands in the East China. Japan's economic dependency on Chinese REEs for making high-tech products such as hybrid cars, wind turbines and guided missiles (Bradsher, K, 2010) was used as a negotiating tactic by the Chinese government. The economic imperative for REEs was so overwhelming that the Japanese government had no choice but to rescind its insistence upon the detention of a Chinese fishing trawler captain responsible for the incident. Although the dispute was resolved in a short time, the tactics of the Chinese government caused consternation amongst many countries involved with REEs, with a realization that natural mineral resources could also clearly be used as political ammunition. The implications of this incident were a catalyst to a number of countries, who have responded in a number of ways to prepare to mitigate the risks posed by the threat of RN by China.

If we interpret China's REE policy based on the concept of RN, taking into accounts is political and economic motivations, it becomes evident that the directions of China's REE policies are intrinsically connected to RN, as the Chinese government has sought to achieve economic prosperity through these policies – domestic consolidation, export restriction and technology-centered strategies – in addition to its political victory over Japan in an international territorial dispute.

2.6. Implications

The implications of our analysis of the actions of the Chinese government in relation to REEs are crucial to enable us to understand both its views towards RN and future core technologies.

Although the real motives of China's REE policies must remain concealed to itself, its assertive measures and the territorial dispute with Japan are sufficient indicators that RN is a significant factor, and have been responsible for the emergence of a number of countermeasures by importer nations to restrict the encroachment of China's monopolization of REEs; particularly for nations concerned about the possibility of an REE shortage due to stockpiling as a result of RN in the near future.

China has raised three arguments as justification for its actions in relation to REEs: meeting the need of increasing domestic demand, the eradication of illegal mining and smuggling activities, and the prevention of environmental destruction. The Chinese government has strengthened its regulatory power over its domestic mineral sector through a number of consolidation and regulation measures, as well as undertaken attempts to enlarge the ownership of REEs beyond its domestic territories, building gigantic stockpiling bases to accommodate nearly 100,000 REO metric tons – equal to their total annual global production.

This exorbitant level of stockpiling has raised concerns from a number of countries that China’s motives are not so much to safeguard their resources as to accumulate a monopoly power over REEs. Until now, we have not witnessed China taking large scale, aggressive actions which could be pointed to as clear evidence of a misuse of monopoly power, but instead have restricted their activities to trivial policies such as technology-centered strategies or occasional incidents like their dispute with Japan. However, there is a widespread expectation that once the national control system is completed and the depots are filled with REEs to a satisfactory level for the Chinese government, the influence of China over REEs will become more dominant than the current situation.

If we move away from the nationalistic perspective, it is crucial to see the importance of REEs as a driver of technology-related cutting edge advancement, and a growth engine to support sustainable economic development – a fact clearly recognized by China, as evidenced by its commitment to the National Medium-and Long-Term Program for Science and Technology Development (2006-2020). From a long-term perspective, the imperative to enable drivers of continuous growth is a key political occupation. Therefore, it is worthwhile to review the extent of the potential for REEs to have tremendous synergistic effects on all aspects of industrialization.

Even though China's aggressive territorial and acquisitive actions in relation to REEs are somewhat alarming, they also hint at the scale of the implicit value of REEs from the perspective of the Chinese administration. As a matter of course, nations with vested interests in the REE industry are more occupied with the concerns over China’s actions than the value of REEs – as witnessed by their hasty reactions to China's policies, which will be developed in Chapter 3.

The next chapter will examine the various responses towards China's policies that emerged as countermeasures from developed countries with a deep level of involvement in REEs. This review will also illuminate some possible desirable directions for policies to assist fledgling nations that have not yet adequately prepared themselves to face shocks related to the shortage of mineral assets, to sustain unexpected situations in the global market to safeguard their resources, and to create solutions appropriate to their own industrial ecosystem.

CHAPTER 3

COUNTERSTRATEGIES OF IMPORTER NATIONS

The territorial dispute between China and Japan raised concerns amongst a number of relevant nations involved with REEs such as Japan, U.S, EU, and Korea, who responded in a variety of ways. Those responses can be categorized, regardless of whether a country was in possession of natural mineral resources, into two broad approaches: attempting to avoid overreliance on China's REEs through diversifying supplies, stockpiling, recycling and R&D; and cooperative confrontations to secure a stable REE supply chain, through bringing a WTO case against China.

3.1. Japan

As the nation which directly endured a defeat in a territorial dispute with China, Japan's concerns perhaps exceeds any other manufacturing country to meet the demands of its high-tech industries linked to electronics and automobiles. As an advanced industrial nation, Japan's preparation to procure stable materials would have begun at the inception of its industrial development, as it would have recognized from a very early stage that its domestic resources could not meet the growing demands of high-tech industries such as electronics and automobiles. A document entitled the 'Strategy for Ensuring Stable Supplies of Rare Metal' published by the Ministry of Economy, Trade and Industry (METI) in 2009, outlined Japan's material policies, which have manifested in four strategies, as seen in table 7.

Table 7: Japan's major 4 strategies on raw material and stockpiling

Strategies	Crucial points
Securing overseas resources	• **Resources Diplomacy** - Building strategic cooperation with nations possessing mineral resources through making use of its capital strengths such as technological transfer, environmental conservation, and so on. - Linking Official Development Assistance (ODA) and resource securing strategy.
	• **Developing Resources** - Enhancing its exploration of mineral resources and securing mining rights. - Offering financial support and loans for development costs through agencies such as Japan Oil, Gas and Metal National Corporation (JOGMEC), the Japan Bank for International Cooperation (JBIC), and the Nippon Export and Investment Insurance (NEXI). - Developing its exploitation of deep sea mineral resources.
Recycling	- Establishing a recycling system of scrap from products (cell phones and digital cameras) containing high concentrations of REEs.
Development of alternative materials	- Promoting R&D of alternative materials. - Establishing strategic partnerships with industry, university, and government for fostering research activities of developing alternative materials.
Stockpiling	- Continuous evaluation of ore types for stockpiling to cope with the market's supply and demand in a flexible way.

Source: Modified from the 'Kim, Philsu.2009.p11' by author

3.1.1. Efforts to secure overseas resources for supply chain diversification

In order to extricate itself from an excessive reliance on China's REEs, Japan has attempted to secure overseas resources for supply chain diversification through both governmental diplomatic activities and business activities by invested companies. Significantly, the choices of target countries have not been restricted to any particular region, but rather a wide scope of global areas – from Central Asia, Africa, and South America – essentially wherever REEs can be found in abundance.

Japan's bargaining cards for facilitating resource diplomacy to secure overseas resources are varied and include technology transfer, environmental conservation, and infrastructure development, as means of persuading resource-rich countries to enter into contracts for mining development projects. In order for those bargaining mechanisms to be used effectively, the Japanese government has made extensive use of ODA and JOGMEC.

Furthermore, through leveraging the formidable negotiating power of JOGMEC, it has consistently pursued cooperative relationships with resource-rich countries through transferring technology and also participating in affairs connected with environmental conservation (WFF, 2011:59). The achievement of those efforts can be confirmed in a number of Memorandums of Understanding (MOU) signed with several countries located on different continents: Kazakhstan (2009), Mongolian government and Bolivia (2010), Uzbekistan (2011), and Mozambique (2012).

Along with the resource diplomacy endeavors of the Japanese government, the aggressiveness of companies as market actors has matched the government's own negotiations. A series of agreements by Japanese companies clearly demonstrate the ways in which cooperative and harmonious activities between government and industry can overcome the limitation of a lack of natural resources. The outcome of these cooperative undertakings would also not have materialized without the well-organized Japanese financial system composed of JBIC, Japan International Cooperation Agency, and NEXI. Japan's integrated system which links government, industry, and the financial system organically could serve as a model for nations lacking in mineral resources to enable them to create synergies with the mechanisms available to them in order to secure overseas resources (Hurst, 2011:2).

- Toyota Tsusho and Sojitz Corporations established a joint venture with Coal and Mineral Industrial Group (2008, Vietnam)
- Sojitz Corporation signed a contract with Lynas Corporation (2010, Canada)
- Mitsubishi signed a contract with Molycorp to import 750tons of REEs (2011, USA)

3.1.2. Recycling

Another measure adopted aggressively by Japan in order to compensate for its lack of mineral resources is recycling. 'Urban mining', a neologism coined by the government, demonstrates the extent of the national fervor for recycling. This ambition to promote recycling is manifested in two laws, the 'Home appliance recycling law (2001)' and the 'End-of-life vehicle recycling law (2002)', which attempt to enforce and enshrine recycling into Japanese daily culture. In fact, this approach is very logical considering that the amount of REEs extracted from Japan's recycled products is of such an extent that the term 'urban mining' is no exaggeration. A press release entitled 'Japan's "Urban Mines" are Comparable to the World's Leading Resource Nations' released by the National Institute for Materials

Science (NIMS) exposed the impressive scale of Japan's recycling.

> Japan's urban mines of many metals exceed 10% of world reserves, including gold, (approx. 6,800 tons, or about 16% of the world's current reserves of 42,000 tons), silver (60,000 tons, or 22%), indium (61%), tin (11%), and tantalum (10%)(NIMS, 2008).

Nonetheless, the recycling industry faces a challenge surrounding the procedural and structural complexity of extraction, as it is impossible to formulate a unified method to extract REEs from recycled products composed of varying shapes, structures and materials. Therefore, this would indicate that the financial burden of recycling can be onerous to both the recycling industry and manufacturing companies who purchase the extracted materials.

3.1.3. Development of alternative materials

Japan's efforts for developing alternative materials for REEs have progressed as significantly as its initiatives for recycling. A report by METI, 'The Situation Regarding REEs', outlines the targets of Japan's plans to develop substitute materials for REE's (METI: 2011):

- Indium for transparent conducting electrodes, 50% reduction
- Dysprosium for REE magnets, 30% reduction
- Tungsten for cemented carbide tools, 30% reduction
- Platinum Group Metals(PGMs) for emission control catalysts, 50% reduction
- Cerium for precise polishing, 30% reduction
- Terbium and Europium for fluorescent lamps, 80% reduction

We can see that the focus of their research activities is not on developing new materials to completely displace REEs, but on promoting reductive technologies to reduce the quantities of REEs used in manufacturing processes. The reason behind Japan's focus on the development of reduction technology rather than new materials is the dependency within their current industrial infrastructure upon escalating quantities of Dysprosium, which is used for making permanent magnets for the electronics and automobile industry; as well as the scarcity of elements such as Dysprosium and Terbium due to the imbalance between supply and demand, as shown in table 3.

Those research activities have been being carried out through a series of integrated mechanisms linking government, industry, and university in an organic way. For example, the project to reduce Dysprosium involves a wide range of participants from highly disparate business and civil arenas; including the Tohoku University, Yamagata University, NIMS, Japan Atomic Energy Agency, Santoku Corp., Intermetallics Co., Ltd., TDK Corp., Toyota Motor Corp (METI: 2011).

It is suggested that this impressive level of cohesiveness may have originated from the expertise cultivated while conducting a series of 16 research projects in the area of elemental strategies launched since 2007 by METI and Ministry of Education, Culture, Sports, Science and Technology-Japan as joint projects.

As illustrated in the Appendix, this comprehensive mechanism in which universities cooperate with enterprises to develop fundamental fields of research in areas viewed as crucial for industry can be highly efficient, as the results of the academic research can be linked directly to the applications of commodities. Practical outcomes for reducing the amount of REEs have emerged from those research centers in the following ways:

- NEDO's development of 40% reduction of dysprosium consumption in neodymium permanent magnet in 2010(Japan Metal Bulletin, 2010).
- Toyota's development of a new type of electric motor to cut its dependence on REEs in 2011(TODAY'S ZAMAN, 2011).

3.1.4. Stockpiling

The aim of Japan's stockpiling focuses on overcoming economic vulnerability in the event of an emergency, and in accordance with the demands of global industry that requires a continuous supply of REEs to meet the requirements of advancing high-tech products. In order to ensure a stable supply of mineral resources and smooth management of Japan's economy, the task of stockpiling is being performed by JOGMEC, established in 2004 (JOGMEC, 2013).

The scope of JOGMEC's activities to regulate and stabilize the supply of mineral resources are comprehensive; even encompassing Japan’s four major strategies for raw material and stockpiling (US DoE, 2010:63):

- Providing partial funding for overseas field surveys through the Joint Basic Exploration Scheme.
- Funding and engaging in scientific research on new types of exploration, mining and recycling.
- Providing loan guarantees and other financial assistance to high-risk mine development projects.
- Maintaining stockpiles of seven metals—nickel, chromium, manganese, cobalt, tungsten, molybdenum and vanadium—while closely monitoring the availability of Indium, REEs, platinum, gallium, niobium, tantalum and strontium.
- Gathering and disseminating information on mineral availability and policies in various nations.

Cumulatively, these three strategies – securing overseas resources, recycling, and development of alternative materials – form a cohesive stockpiling mechanism which thoroughly bridges private and public sectors. Specifically, the structure of Japan's REE stockpiling is clearly delineated into private and public stockpiling. The Japanese stockpiling target was set to 60 days, comprising 42 days as a national stockpiling target and 18 days as a private stockpiling target, to fully and adequately meet domestic demand according to data published by JOGMEC.

With respect to selecting the appropriate types and quantities of REEs, JOGMEC has endeavored to enhance the current stockpiling system to enable it to be more flexible in locating and stockpiling the proper species of metal based on current market trends. An outstanding feature of JOGMEC's strategy is their willingness to forge cooperative relationships with the private sector; even going so far as to set up a new committee for periodic monitoring of domestic inventories and the latest supply and demand trends on REEs, and allowing private sector companies to be involved in its administration. In addition to this cooperative system, JOGMEC also provides an efficient registration system to enable rare metals producers and manufacturing companies to purchase REEs according to their requirements (JOGMEC, 2013: 29).

Although Japan's confidential policies around their strategies and contracts makes it difficult to extract complete information on the species of mineral resources they are invested in stockpiling, we can infer that they are particularly concentrated on nine metals – chromium, cobalt, gallium, indium, manganese, molybdenum, nickel, tungsten, and vanadium – for managing as stockpiled materials, as JOGMEC's annual report in 2009 strongly indicates (RPA, 2012: Annex A-11).

3.2. United States of America

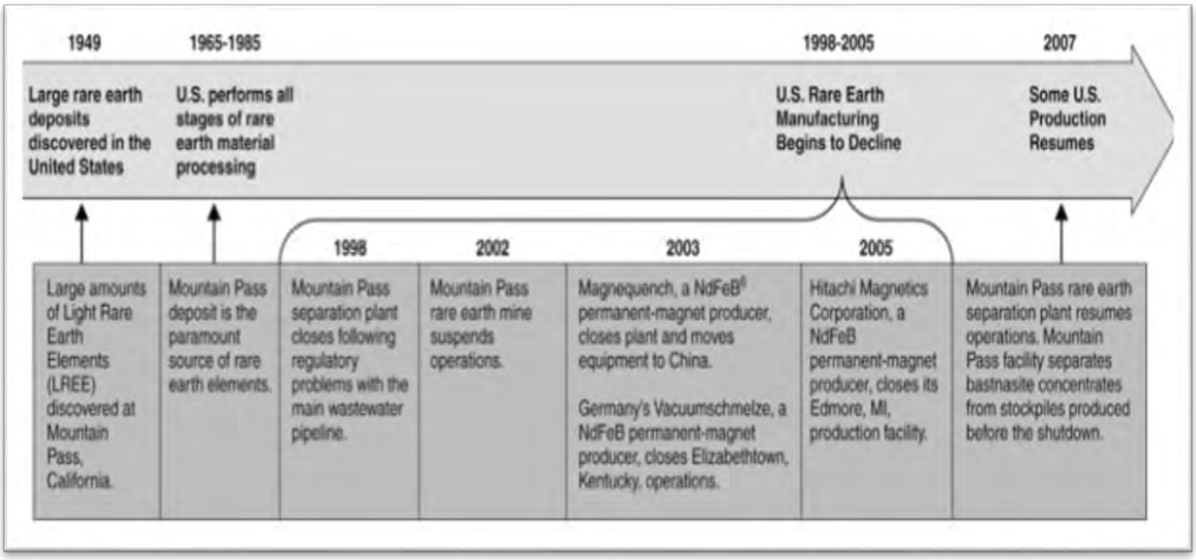
The basic goals of the U.S's mineral policy were aptly described in a research paper published by the Congressional Research Service in 2013 as being the promotion of an adequate, stable, and reliable supply of materials for the national security, economic well-being, and long-term industrial production of the US (Humphries, M.2013:1).

For the purposes of reforming their current predicament, which is somewhat vulnerable to market disruptions and incapable of supporting a stable, reliable supply of mineral resources, the US's policies have taken the form of four specific strategic frameworks: boosting domestic production, reducing dependency by diversification of supply and the development of new technologies, transforming the National Defense Stockpile (NDS) into a broader strategic materials security program, and making open complaints about Chinese export restrictions to the WTO (WFF, 2011:36).

3.2.1. Boosting of domestic production

Figure 4, provided by GAO in 2010, shows that the history of the US Rare Earth Industry began with the discovery of large rare earth deposits in 1949. In a sense, Mountain Pass mine in California, owned by Molycorp, once supplied most of the world's REEs; and that alone fully represents that period of US history on REEs. The United States' REE capacity for manufacturing technology surpassed China's, even to the extent that by the mid-1980s they were able to manage every stage of rare earth materials processing, in spite of discovering them later than China (GAO, 2010).

Figure 4: History of the US Rare Earth industry



Source: GAO. 2010. p17

The overwhelming influence of Mountain Pass mine on the global REE industry began to decline from the 1990s, due to a decrease of profits as a result of increased Chinese production, as well as heightened concerns around environmental pollution; until in 2002 Molycorp shut down its major operating facilities. As a result, the US has become almost 100% reliant on China's REEs since its domestic products were simply insufficient to satisfy the increasing demands of its industry (WFF, 2011:27). Nonetheless, the operability of the closed mine must have been maintained, evidenced by the fact the mine operations were resumed in order to separate bastnasite concentrates from stockpiles produced before the shutdown in 2007. Indeed, given that Mountain Pass mine has the capacity to produce approximately 18,143 metric tons of rare earth oxide per year, its revitalization in 2012 was somewhat inevitable (WFF, 2011:29). However, even more than its production capacity, the real reasons that forced the US to reopen Mountain Pass mine in 2012 can be explained through the following cases (Cho, R. 2012).

Specifically, one incident surrounding a trial of NdFeB magnets in 1995 made an indelible impression on the US, and took over the Unocal by CNOOC in 2005 (Kim, D.H, 2011:129). A magnet named NdFeB possessing permanent magnetic properties was discovered by scientists from General Motors (GM) in 1983. As the size of the magnet was small enough to be used in its vehicles, GM established a production factory called Magnequench as a subsidiary company in 1986 to commercialize the magnet. Afterward, the factory line was sold to Sextant Group Inc., practically owned by Chinese companies after being reviewed by the Clinton government in 1995 under the condition to keep Magnequench in the US for at least five years (Hurst 2011). As soon as the compulsory term was expired, Sextant started to move the company's operational facilitates from the US into China gradually from 2000 and finalized its movement in 2003. Probably, the effect of the transfer would not have given a big shock to America at the time because the value of REEs remained lower than at present. However, by 2010 China had become the world's largest producer of NdFeB, accounting for 75% of the total global production; a fact that must have caused the US to re-evaluate the magnet and REEs more precisely (Kim, D.H, 2011:131). The public statement by Karl Gschneidner that "they are all sorry about that mistake…as the business went, technology went", plainly confirms how lax the US's policy was in the past on REEs (Hurst.2011).

In addition to these two cases, China's recently enforced policies on REEs would play an major role in catalyzing the revitalization of the Mountain Pass mine, as the US will never be in a position to undervalue the unusual metals essential to making high-tech military equipment or products (WSJ, 2010). As an example, the requirement for the US to secure a stable REE supply chain is closely connected with the matter of national security, in that the military application for REEs is much wider in the US than in any other country. With widespread use in high-tech military equipment such as jet-fighter engines, missile guidance systems, antimissile defense, and space-based satellites, the US Congress in 2010 declared them to be materials either strategic or critical to national security (WFF, 2011:26).

3.2.2. Critical Minerals Strategy

Along with the resumption of Mountain Pass mine productivity, the US has developed a strategy to tackle the issues surrounding strategic raw materials, since the terms 'critical minerals' and 'strategic minerals' entered US policy lexicon with the Strategic and Critical Materials Stock Piling Act in 1939 (WFF, 2011:23).

The current direction of the US's policies is reflected in a document, the Critical Raw Materials (CRM) Strategy, released in 2010 by the Department of Energy (DOE), a governmental actor, as follows (WFF, 2011:30):

- Diversifying supply chains through globalizing for strategic materials
- Developing substitutes and promoting recycling
- Improving re-use and efficient methodology for strategic materials

Apart from the lessons on methods for optimally securing supply chains which we can gain from studying the similarities between the strategic approaches of the US and Japan in relation to the components of their mineral policies, another very intriguing development in the US's policies is that their traditional policy which originally focused on national defense is undergoing a change into a Strategic Materials Security Program. The aims of this transformation are to enhance the ability of the US to adapt strategically to developments in the minerals market and to ensure availability of strategic minerals for military and economic purpose (WFF, 2011:35). One paper, the CRM Strategy published by DOE, emphasized that REEs and other minerals are crucial for the development of clean energy technologies – a statement that confirms the transformation of the US's mineral polices (Raquel Quaresma de Lima, 2012:6). This changing trend shows that the value of REEs as a growth engine is increasing. It is also instructive to evaluate several acts of the US legislature (comprising the Senate and the House of Representatives) related to strategic non-fuel minerals, as outlined in table 8. This list of acts provides a valuable insight into the ways in which US mineral policies have gradually shifted direction in the ways discussed above (WFF, 2011:33-34).

Table 8: Summary of Contemporary Legislation

The Name of Legislation	Proposer	Introduction	The goal of Act
H.R. 4866 RESTART Act	Representative Coffman	17 March 2010	- Establishing a domestic supply cycle for REEs: re-establish a competitive domestic rare earths minerals production industry, a domestic REE processing, refining, purification and metals production industry and a domestic rare earth metal based magnet production industry and supply chain in the US.
S.3521 RESTART Act	Senator Lisa Murkowski	22 June 2010	- Establishing a Rare Earth Policy Task Force to monitor and assist federal agencies in expediting the review and approval of permits to accelerate the completion of projects that will increase investments in, exploration for, and development of domestic rare earths.

H.R.6160 Rare Earths and Critical Materials Revitalization Act of 2010	Representative Kathy Dahlkemper	22 September 2010	- Developing an REE program, to amend the National Materials and Mineral Policy, R&D Act of 1980.
P.L. 111-84, the Fiscal Year 2010 National Defense Authorization Act	Unidentified	Unidentified	- Determining the extent of US mineral vulnerability. - Measuring to determine which specific military weapons systems currently depend on REEs to alleviate potential threats to national security.
H.R. 5136 Fiscal Year 2011 National Defense Authorization Act	Unidentified	Unidentified	- Assessing of the REE supply chain and determine which materials are strategic or critical to national security. - Ensuring the long term availability of these materials by 2015. - Establishing of a domestic source of sintered NdFeB for defense systems.

Source: Collected from the ' The Library of Congress (http://thomas.loc.gov)' by author

Reading through this list, it becomes clear that these acts are all designed to adhere to the US's requirement to enhance technology through the use of REEs, and ensure national security through establishing a reliable stable chain of REEs.

3.2.3. Stockpiling

The NDS of the U.S was instituted to provide a secure supply of strategic and critical materials to support the military industry and essential private sector needs in times of national emergency, as mandated by the Strategic and Critical Materials Stockpiling Act established in 1939. According to this law, the strategic and critical materials were labeled as those that "would be needed to supply the military, industrial, and essential civilian needs of the US during a national emergency, and are not found or produced in the US in sufficient quantities to meet such need"(RPA, 2012: Annex A-21).

The Footprint of the NDS is described in table 9, which shows the historical list of prescribed Strategic Minerals or Critical Minerals designated as stockpiled materials from 1970s to 2010.

Table 9: The Footprint of National Defense Stockpile (1970s to 2010)

1970s-80s Strategic Minerals	2008 Critical Minerals	2010 DOD Recommended Materials for NDS
Aluminum	PGMs	Beryllium Metal
Chromium	REEs	Chromium Metal
Cobalt	Indium	Cobalt
Manganese	Manganese	Ferro chromium
PGMs	Niobium	Ferro manganese
Titanium		Germanium
		Iridium
		Niobium
		PGMs
		Tantalum
		Tin
		Tungsten
		Zinc

Source: Modified from the 'WFF.2011.p25' by author

As the table shows, the list of designated materials has not remained static, but has varied drastically over time since the period from 1970s to 1980s. The NDS's reasoning behind the drastic evolution of their strategy is described in a report entitled "Managing Materials for a 21st Century Military" published in 2008 by the National Research Council. The report pointed out that the current mechanism of NDS is disconnected from the actual national defense material needs due to the unrealistic evaluation system, and recommended a new approach which can identify the materials needs of the military based on the risk of disruptions to mitigate the impact of surges in requirements and unexpected shortfalls in inputs (RPA, 2012: Annex A-21).

As a result, based on the National Research Council's recommendation the US DOD published a report in 2009 containing both the revision of DOD's current policy for the disposal of stockpiled materials and the reconfiguration of the NDS to respond thoroughly to evolving conditions in the global market and to changing requirements for both traditional and new materials, as the central components of its revised direction. In essence, the recommended solution was to build a wide-ranging Strategic Materials Security Program that would identify, on an on-going basis, a set of strategic and critical materials to meet the specified requirements of national security. The key factors of the reconfiguration can be summarized as the following (RPA, 2012: Annex A-22): constant surveillance of global of the global marketplace to assess its constantly changing materials needs, maintaining a dynamic list of material needs, assessment of the reliability of various countries, and risk mitigation strategies to ensure material availability.

The factors of this reconfiguration illustrate the ways in which the US's stockpiling management policy with respect to mineral resources has undergone a drastic evolution from their past inflexibility, to emulate the flexibility and extemporaneity of the Japanese model, to meet the constantly fluctuating conditions of the marketplace. In addition, the US shares another commonality with Japan, in seeking to make use of a private stockpiling system as a buffer zone to supply stockpile minerals in the event of national emergencies (RPA, 2012: Annex A-23).

3.2.4. Bringing a WTO case against China's policies on REEs

The restrictive policies of China - "export quotas, export duties, minimum export price requirements, export licensing, and export quota administration requirements on certain raw materials" – were sufficiently alarming that the US including other complaints such as EU, Japan, which rely heavily on China’s REEs, responded with strong resistance by filing a WTO case against China over export restraints on raw materials (USTR, 2011). The US complained that China's export restraints could create scarcity and cause higher prices of raw materials, which would provide the Chinese domestic industry with a significant advantage through both over supply and by lowering and stabilizing their domestic prices for raw materials. China defended itself by insisting that some of its export duties and quotas can be justified in order to conserve its exhaustible natural resources as well as for the protection of the health of its residents caused by environmental pollution (WTO, 2013).

The battle between the complainants and China surrounding REEs does not appear to have any easy resolution, because the differences in their opinions expressed since 2009 in the WTO are of a great magnitude; this despite several impactful decisions made at the WTO, as listed in table 10.

Table 10: The Current Status of WTO Trade Dispute (2009 to 2014)

Date	Sketch	The objective of dispute
23 June 2009	The US's requesting consultation with China with respect to China's restraints on the export from China of various forms of raw materials	Raw Materials
2 July 2009	EU's requesting to join the consultations	
6 July 2009	The requesting of Canada, Mexico, and Turkey to join the consultations	
4 November 2009	The US's requesting the establishment of a panel	
21 December 2009	The establishment of a panel	
5 July 2011	The panel concluded in the circulated report that China's restrictions on raw materials are inconsistent with WTO rule	
31 August 2011	China notified the Dispute Settlement Body(DSB) of its decision to appeal certain issues of law and legal interpretations of the panel report	
30 January 2012	The appellate body report was circulated - contrary to the Panel's findings, the AB saw nothing in the text of Article XX(g) of the GATT 1994 to suggest that, in addition to being "made effective in conjunction with restrictions on domestic production or consumption", a trade restriction must be aimed at ensuring the effectiveness of domestic restrictions, as the Panel found	
22 February 2012	DSB adopted the appellate body report and the panel report, as modified by the AB report	
17 January 2013	Implementation of adopted reports	
13 March 2012	US's requesting consultations with China with respect to China's restrictions on the export of various forms of Rare earth	REEs
22 March 2012	EU and Japan requested to join the consultation	
27 June 2012	The US's requesting the establishment of a panel	
23 July 2012	The establishment of a panel	
26 March 2014	The panel concluded that China's trading rights restrictions breach its WTO obligations	
25 April 2014	China filed a notice of appeal in rare earth disputes	

Source: Collected from the 'dispute settlement news archive (http://www.wto.org)' by author

Unless one of these parties is willing to concede ground on its own arguments, the unceasing disputes between the major importers and the monopoly supplier of raw materials including REEs is expected to continue in the WTO arena into the future. The predictability of these outcomes leads to a disturbing conclusion, that China's policies will only continue to reduce REEs, and that as a result resource poor nations have an urgent requirement to prepare themselves for ongoing shortages of mineral resources. This can take the shape of boosting their recycling industry, expanding investment in R&D to facilitate the development of alternative resources, and enhancing cooperative partnerships with resource-rich countries, in order to secure a stable supply chain.

3.3. European Union

Like many other countries lacking in mineral resources, the pressures arising from a growing scarcity of REEs will place a large burden upon the EU. In particular, the responsibility of the EU to protect the environment through promoting green technologies such as the spread of solar and wind energy as well as the reduction of carbon emissions will place a constraint on its REE supply; as well as its mission of enhancing competitiveness in global markets by fostering high-tech industries. Moreover, another challenge that the EU needs to address urgently is the institution of an integrated system to overcome the disparate and fragmented mineral policies belonging to its Member States. Accordingly, the outline of the Raw Materials Initiative (RMI) published in November 2008 and carried out by the European Commission (EC) demonstrates both the EU's attempts to overcome those challenges and policy directions and its ambitions to secure a supply of strategic raw materials. With regard to the necessity of creating a stockpiling program, the autonomous systems based on respective Member States will provide the EC with sufficient time to consider its validity in depth.

3.3.1. Challenges

Besides the issues caused by its resources shortage, which are common to all resource poor countries, two more factors unique to the European regulatory framework prevent the EU from building a stable supply chain of mineral resources: the strictness of mineral regulations and the absence of a centralized and coordinated policy.

Firstly, the EU's environmental standards are much more complicated than any other country due to the 0numerous legislative and regulatory measures based on national and regional procedures and policies enacted by each Member State, which create an arduous and prolonged process of application and approval for mining exploration to access new sources of internal raw materials (Crowson, P.C.F. 2008).

As the development of new mines has been delayed by these laborious regulations, mining activities in the EU have been driven by existing enterprises to easily obtain permission for infrastructure expansion (Tiess, G. 2010:193). In addition, several warnings related to the depletion of EU resources indicate that the EU’s current situation is unable to satisfy increasing demand and support the growth of high-tech industries.

Furthermore, it is an unfortunate fact that EU mineral policies have more independent and fragmented features than other countries, since each Member State has favored protectionist policies towards their own national industries, contrary to a centralized and coordinated policy. The disharmony of these policies can be evidenced by the fact that the European Coal and Steel Community of the 1950s and for decades since that time did not consider the supply of raw materials for the European economy as a primary goal of its common policy (Tiess, G. 2010:192). As a consequence, the EU’s institutional capacity in relation to mineral resources has been unfortunately rather limited (Gerber, L.2012: 4).

3.3.2. The EU Raw Materials Initiative

Through attempting to address these fundamental challenges to build sustainable supply frameworks to cope with the volatile global raw materials environment, the EC suggested the RMI as a common EU mineral policy in November 2008 (OFSE, 2013:6).

The outlines of the RMI in table 11 show the three pillars of the EU's directions to address three primary issues: ensuring the accessibility of raw materials in the global marketplace, fostering an environment to generate a sustainable internal supply, and increasing resource efficiency by reducing consumption of crucial raw materials.

Table 11: Three pillars of Raw Material Initiative

First Pillar	Second Pillar	Third Pillar
Access to raw materials on world markets at distorted conditions	**Foster sustainable supply of raw materials from European sources**	**Reduce own consumption of primary raw materials**
- Pursuing raw materials diplomacy to secure access to raw materials - Promoting enhanced international cooperation through G8, OECD, UNCTAD, UNEP, World Bank, etc. - Prioritizing the matter of trade and regulatory policy - Enabling win-win situations for fostering undistorted access to raw materials	- Facilitating a sustainable supply from European deposits - Improving the knowledge base of mineral deposits within the EU - Improving networking between the national geological surveys - Promoting research projects in relation to extraction and processing of raw materials - Dealing with the growing problem of skills shortage	- Prompting of resource efficiency and eco-innovative production processes - Boosting the use or recycling of products - Implementation and enforcement of waste legislation

Source: Modified from 'OFSE.2013.p7 & EC Homepage (http://ec.europa.eu)' by author

3.3.2.1. First Pillar

Given that the EU is currently faced with a substantial shortfall in their short-term access to mineral resources, enhancing its resource diplomacy is currently their best strategy to increase the accessibility of raw materials. This in contrast to pursuing the second and third pillars of their core strategy, since it has the ability to produce outputs in a shorter period of time than the other goals which require significantly more time and effort to achieve. In order to maximize the accessibility of raw materials with undistorted conditions, the diplomatic strategies of the EU have been implemented in four frameworks (EC: 2008):

- Building a comprehensive diplomatic relationship with three parties: Africa, emerging resource-rich countries (such as China and Russia), resource-dependent countries (such as the US and Japan) by reinforcing dialogue and joint actions.
- Promoting of international cooperation to raise awareness of raw materials through activities in OECD, UNCTAD and UNEP, and to explore opportunities for cooperation with international organizations such as World Bank.
- Improving undistorted trade and regulatory policies by promoting new rules and agreements to ensure compliance with international commitments at the multilateral and at bilateral levels.

- Enabling win-win situations that foster undistorted access to raw materials by assisting developing countries with abundant natural resources to transform their availability of mineral resources into inclusive economic growth.

3.3.2.2. Second Pillar

In contrast, the Second Pillar emphasizes the reconstitution of the EU's internal regulatory environment to foster a sustainable supply of raw materials. With a view to facilitating the sustainable supply of mineral resources by internal efforts, the EU attempts to enforce cooperation amongst its Member States for a thriving mineral industry via the following steps (EC: 2008):

- Streamlining its administrative conditions and speeding up the permits process for accessibility to land in order to improve exploration and extraction activities.
- Creating cooperative systems of geological surveying by building a knowledge base of mineral deposits, establishing networking in relation to the extraction and processing of mineral resources
- Tackling challenges related to skills shortages and limited public awareness of the available domestic raw materials by building effective partnerships between universities, geological surveys and industries.

3.3.2.3. Third Pillar

In addition, the EU has made a concerted effort to reduce the consumption of primary raw materials by fostering recycling through a variety of methods (EC: 2008):

- Promoting research projects that focus on resource-efficient products and production methods.
- Ensuring sound and harmonized enforcement of the Waste Shipment Regulation to prevent loss of valuable secondary raw materials.
- Full implementation and enforcement of relevant recycling legislations through a series of new provisions in the Waste Framework Directive.

3.3.2.4. The implementation of the Raw Materials Initiative

The EC incorporated its divergent strategies into a unified framework consisting of three pillars, which enabled it to respond in an appropriate manner to the various challenges around accessing non-energy raw materials (EC: 2013, 2014).

- Pillar 1: Reinforcing Raw Materials Trade Strategy, diversifying raw material dialogues, and fostering diplomatic relationships with a wide range of countries (such as the US, Japan, Russia, Argentina, Brazil and China), and building win-win situations with developing countries to enable their own developmental goals (such as the Joint Africa-EU strategy and African, Caribbean and Pacific). The framework for cooperation between the EU and the African Union focuses on three areas: governance, investment and infrastructure, and geological knowledge and skills.

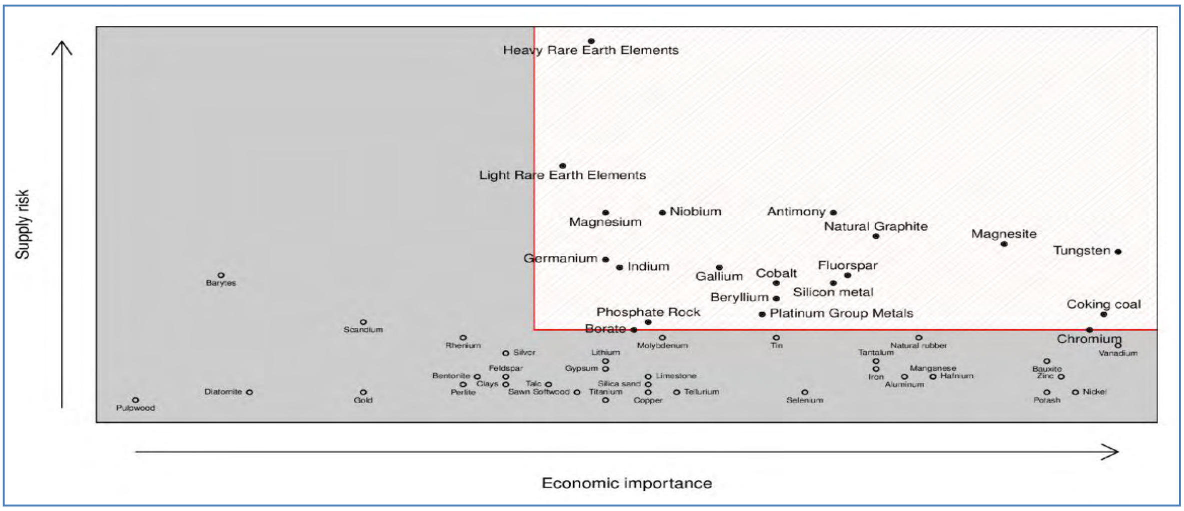
- Pillar 2: Facilitating exchange of best practices for promoting investment in extractive industries, enhancing and improving EU knowledge base, promoting research and skills, and launching of seabed mining study.

- Pillar 3: Better implementation and enforcement of existing EU waste legislation to promote recycling & resource-efficiency, strengthen the enforcement of the waste shipment regulation, and boost resource efficiency and increase the amount of recycling.

3.3.3. The identification of Critical Raw Materials

Along with RMI, the EU has since 2010 identified a subset of CRM to tackle the uncertainty of the supply risk, based on measuring of the degree of the economic importance and the supply risk as seen in figure 5 (EC report on CRM, 2014):

Figure 5: The identification criteria of Critical Raw Materials



Source: EC. 2014. Report of the Ad hoc Working Group on defining CRM. p33

The first critical analysis for raw materials was conducted by the Ad-Hoc Working Group on Defining CRM, and 14 CRM were identified from a candidate group of 41 non-energy, non-agricultural materials in 2010. The second analysis was conducted in 2013 through an intense cooperation between the EC, the Ad hoc Working Group on Defining CRM and consultants from Oakdene Hollins, Frauhofer ISI and Roskill; and 20 CRM were identified from an extended list which included seven new biotic materials and three biotic materials, as illustrated in table 12. Due to a lower supply risk, tantalum was excluded from the list of 14 CRM in 2010, while 6 CRM (borates, chromium, coking coal, magnesite, phosphate rock and silicon metal) were included to the list (EC report on CRM, 2014).

Table 12: The identification of Raw Materials Initiative (2010 and 2013)

14 CRM	20 CRM (major producer & %)
Antimony	Antimony (China 87%)
Beryllium	Beryllium (USA 90%)
Cobalt	Borates (Turkey 38%, USA 30%)
Fluorspar	Chromium (SA 43%, Kazakhstan 20%)
Gallium	Cobalt (DRC 56%)
Germanium	Coking coal (China 51%)
Graphite	Fluorspar (China 56%)
Indium	Gallium (China 69%)
Magnesium	Germanium (China 59%)
Niobium	Indium (China 58%)

PGMs REEs Tantalum Tungsten	Magnesite (China 69%) Magnesium (China 86%) Natural Graphite (China 69%) Niobium (Brazil 92%) PGMs (SA 61%, Russia 27%) Phosphate Rock (China 38%) Heavy REEs (China 99%) Light REEs (China 87%) Silicon Metal (China 56%) Tungsten (China 85%)

Source: Report on CRM for the EU (2014)

The worldwide distribution of the major producers of 20 critical CRM not only shows clearly just how influential China's power has become, and the extent to which it could impact economically on the 14 CRM in the global market, but also explains why the EU identified its list of 20 CRM focusing on both their economic importance and their potential supply risk. Although the reassessment was conducted three years from the first analysis, the data produced from the evaluative system which measured the degree of supply risk as a global forecast clearly demonstrated the need to produce a flexible system of mineral resource procurement and management, in the same manner as the US and Japan. The EC's publication of the list of 20 CRM and the implementation of RMI in May 2014 also show that the strategic direction of the EU's mineral polices is becoming integrated to meet the goals set by RMI.

3.3.4. Stockpiling

According to a key announcement in 2011, the EC signaled that it was "ready to examine with Member States and industry the added value and feasibility of a possible stockpiling program of raw materials". In this regard, the EU contracted a company to carry out a study to identify the potential desirability, feasibility and cost benefit of a stockpiling program. The study eventually reached the conclusion that to organize a voluntary stockpiling initiative from the private sector could be an appropriate option with public financial support due to their acknowledgement that the shortage of raw materials could be tackled through structural solutions (such as substitution development, recycling, and domestic production) with a long-term perspective. The EC's inflexibility in its ability to address volume requirements timeously could bring about a substantial budgetary deficit in implementation, and redressing this shortfall would require a perfect knowledge of value chains, the uses of each raw material, and processing facilities. Although the Commission had an opportunity to discuss the results of the study in 2011, due to some disagreements around the necessity of stockpiling program among its Member States the issue has remained unresolved by the Commission, which appears to be hamstrung until now on this matter (EC, 2013:3-4).

3.4. Korea

The efforts undertaken by Korea to secure a stable supply chain for REEs – namely, vitalizing resource diplomacy to procure overseas resources, an improved stockpile system, fostering of a recycling environment, and developing alternative materials – are inevitable given their lack of mineral resources. These efforts are also comparable to the strategies taken by other countries with a combination of both limited minerals and a technology-driven industrial environment, which urgently requires an abundance of mineral resources to compete in manufacturing.

Nonetheless, the outcomes of their efforts cannot be achieved in the short term due to late diplomatic efforts and undeveloped material technology compared to China and Japan. With a view to overcoming both of these problems and challenges presented by China's restrictive REE policies, the Ministry of Knowledge Economy (MKE) in 2010 drafted a proposal entitled "Plans for Stable Procurement of Rare Metals”. Korea's mechanism in relation to REE can be crystallized into four primary aims – expansion of overseas mining investment, development of domestic mineral resources, enhancing R&D activities for materialization, and circulating technology to build infrastructure.

3.4.1. Efforts to secure overseas resources for supply chain diversification

The Korea Resources Corporation (KORES), a state-run body established in 1967, has carried out a strategy of resource diplomacy with a goal of reducing heavy dependence on imports of China's REEs through supply chain diversification, by a number of means such as ODA, Foreign Direct Investment (FDI), dispatching investigation teams, and establishing cooperative relationships. According to data provided by KORES, 35 MOUs have been signed with 17 countries possessing rich resources such as Uzbekistan, Kazakhstan, Australia, Russia, and South Africa since 2003. However, those attempts received a poor evaluation from the relevant National Assembly Committee (NAC) due to the low rate of success originating from an inadequate feasibility and profitability study (YNA, 2013).

For this reason, evaluators engaged in the evaluation of NAC pointed out that Korea would need to improve its internal analysis methodologies to effectively evaluate the feasibility and profitability of mineral resources prior to initiating negotiations with rich-resources countries, if it hoped to produce materially beneficial outcomes.

3.4.2. Development of domestic mining

Efforts to procure REEs within mineral resources have been implemented by the Korean Institute of Geo-science and Mineral Resources (KIGAM). The outcomes of the study were announced on 30 June 2011 by KIGAM, which analyzed soil samples gathered from 11 locations around the country, and found two major deposits of REEs from Hongcheon in Gang-won Province and Chung-ju in North Chung-cheong Province which were estimated to produce about 150,000 tons – enough to satisfy Korea's demands adequately for the next 50 years (CHOSUNILBO, 2011). Nevertheless, the extraction of REEs will be delayed for a long time because of a number of complex procedures that need to be carried out before starting production, such as conducting a profitability study and enacting a series of environmental protection laws. In relation to extraction, in order to decide whether the two deposits will materialize, the MKE unveiled its plans in 2011 to evaluate the economic value of the deposits (EKN, 2011).

3.4.3. Enhancement of R&D and recycling

One major R&D challenge for Korea is that it has never developed a sufficiently mature infrastructure with which to both foster the material and component industries of REEs and to investigate alternative materials for REEs. In order to overcome its excessive dependence on foreign end-product components, Korea has attempted to improve technical partnerships with other countries by either signing MOU or mutual agreements.

- The signing of a MOU between the council of REE manufacturers in Korea and the Baotou Research Institute of Rare Earths in China for conducting mutual research programs on REE manufacturing technology by assisting with research facilities and equipment, providing necessary information, and exchanging human resources (YNA, 2011).

- The signing of a MOU between KORES and Mintek, established as a minerals research laboratory by the government of SA in 1934, for cooperative research to develop technology for separating, smelting, and processing REEs; as well as mutual endeavors to develop and explore the potential of South African mineral resources (FINANTIAL NEWS, 2011).

- A mutual agreement between MKE and the Agency for Natural Resources and Energy of Japan for technological development in the area of recycling and exploiting mines based in third-world countries (DongA.com, 2010).

Besides those attempts to reinforce international research activities, the process of reconfiguring Korea’s internal conditions to create an optimal environment that can support integrated REE research activities has already made some serious strides (MKE, 2010).

- To support the research activities of the REE industry efficiently, the Korean government established Korea Institute for Rare Metals (KIRAM) on 28 January 2010. The role of KIRAM as a center of REE research was initiated through the launch of four primary frameworks: developing of resources and stockpiling, fostering the materials industry, facilitating national recycling, and building of Industry-University-Institute research networks.

- Besides establishing KIRAM, MKE has invested in the expansion of infrastructure for the training and development of highly skilled manpower. For this initiative, MKE designated Kongju and Sunchon universities with another four academies as specialized centers of learning for producing minerals experts through the use of educational programs to contribute to the wider field of technology-based employees within Korean companies.

Korea's efforts to vitalize its recycling industry have been guided by ‘The law of resource preservation and fostering recycling' established in 1992 (MGL, 2014). According to section 7 of the law, the Ministry of Environment (ME) and another four related ministries in 2011 devised an integrated plan collaboratively entitled "The First Plan of Resource Recycling from 2011 to 2015" with an awareness that Korea lacks the sufficiently developed technology to enable an economically viable recycling industry, despite having made improvements to its technology to within 70% of the capacity of more developed countries. To achieve the specific goals of the plan – the development of high value REE recycling technologies, the acquisition of global technology for re-energizing end-of-life resources, and the streamlining of R&D programs – the Korean government will implement the draft by stages until the technology for resource recycling reaches 90-95% of the capacity of developed countries by 2020, and occupies 6% of the global market share by 2030 (ME, 2011: 115).

3.4.4. Stockpiling

The goal of Korea's stockpiling, as a resource poor country, is to ensure a reliable supply chain for supporting its critical industries such as automobile, electronics, and steel manufacturing with on-going stability. With a view to managing its stockpiling system effectively, KORES and the Korean Public Procurement Service (PPS) have each run a stockpiling system. The types of minerals were decided by an administrative meeting to determine the functions of stockpiling, held in February 2007 (Newspim, 2011). Accordingly, the PPS has undertaken stockpiling efforts to meet a set of economic and strategic goals, particularly around 15 types of mineral (RPA, 2012: Annex A-15):

- Non-ferrous metal group: Copper, Aluminum, Lead, Zinc, Tin, Nickel
- Nine additional minerals: Silicon, Manganese, Cobalt, Vanadium, Indium, Lithium, Bismuth, Strontium, Tantalum

Meanwhile, KORES has managed to stockpile 10 types of minerals to meet its strategic goals (RPA, 2012: A-17-19): Antimony, Niobium, REEs, Tungsten, Chromium, Molybdenum, Selenium, Titanium, and two unidentified types.

The allocated period for stockpiling was determined to be 60 days, which breaks down into order and load (30 days), delivery by sea (25 days), delivery at local warehouse (5 days) according to the rules set by KORES (RPA, 2012: A-16).

In order to enhance its own stockpiling system, the Korean government has constantly increased its budget and related ministries – PPS, KORES, and Ministry of Trade, Industry and Energy (MOTIE, previously MKE and changed name in March 2013) - signed a MOU for an effective stockpiling for collaborating efforts (KGPG, 2013).

3.5. Comparative conclusions on REE importer strategies

We can draw a number of conclusions from studying these diverse governmental efforts to create an optimal model to respond to the REE supply problem; for instance, some ways to prepare for and overcome future shortage of resources in the global market, and some possible policy models to create mutual benefits between importers and exporters of mineral resources. As each country's situation has some common denominators, their responses to these issues are similar and collectively valuable for a country in a similar position to Korea, which urgently needs to build a stable supply chain to prepare for emergency situations.

Firstly, concerning the matter of securing overseas resources, the balanced and inclusive approach developed in Japan and the EU should be considered a model for other countries to follow. As a nation with a developed materials industry, Japan has a balanced structure linking the public and private sector. In the cooperative mechanism between its sectors, the government has expanded its resource territory by assisting infrastructure development near mining areas through the ODA policy, and has encouraged the private sector to act aggressively to secure overseas resources by providing financial incentives. The achievements of the private sector demonstrated the value of their well-developed systems to mitigate volatile market situations, through building partnerships with foreign countries that enabled them to avoid an overly heavy dependence on the government. In addition, the first pillar of RMI denotes that the comprehensiveness of the EU's resources diplomacy to maximize their stated outcomes – securing resources from emerging resource-rich countries, improving distorted market environments, and accelerating exchange of information related to common interests – by reinforcing dialogue and joining actions with many countries across the political, geographical, and economic spectrum.

Secondly, a number of endeavors have involved attempting to vitalize domestic products to secure a stable supply chain of REEs. From the viewpoint of rich-resource countries, these attempts would be closely connected with the vitalization of their domestic mining industries. Examples include the reopening of the Mountain Pass mine in 2012, which was closed since 2007 due to the deterioration of profitability, and the EU's efforts to improve its internal regulatory hindrances such as strict regulations and fragmented policies between Member States to facilitate the production of its mines. The mistake made by the US in shutting down and later reopening Mountain Pass mine must have impressed upon them the need for strict evaluation of economic profitability from a long-term perspective to prevent unnecessary waste of time and finance. Moreover, the EU's example can offer a lesson to nations preparing new mining developments concerning the significance of a strict regulatory environment prior to the extraction of minerals.

By contrast, the focus of resource poor nations must be not only towards developing their mining efforts, but also strongly promoting urban recycling and developing new technologies to reduce the amount of mineral resources used in their manufacturing processes. In particular Japan's efforts to reduce their dependencies upon particular minerals used for the electronic and automobile industry demonstrate that it would be more useful to promote reduction technology rather than merely recycling in the short term. The underlining of resource efficiency in Pillar 3 of the EU's policies again shows through their research that the former method is more effective than the latter to solve a shortage of resources in a reduced period of time. Nonetheless, the value of recycling is very significant, to the extent that Japan has termed it 'urban mining', and has expended considerable resources towards its recycling technologies. Their positive experiences must impress on similar nations the importance of developing recycling technology to extract minerals from end-of-life products, as this approach could supply a lot of mineral resources – even potentially as much as the quantities from domestic mines.

Thirdly, nurturing R&D activities around REEs is by far the most important task, as it can produce two significant outcomes – the development of substitutes and the fostering of the materials industry – which can become a cornerstone of a sustainable economy. As previously stated, the fact that every country considers the enhancement of R&D on REEs as a new growth engine means that it has the potential even to create a thriving and diverse industry of small businesses. The Japanese model involves both a cooperative mechanism connecting industry, university, and government, and an organic structure to lead research results into final products. Unquestionably, the allocation of common research projects between universities and private companies as portrayed in Appendix must give them an opportunity to cooperate with one another to maximize the effectiveness of the research outcomes.

Moreover, their model which links industry, university, and government has the capacity to efficiently create a diverse range of small businesses which require knowledge, financial, or technological support, as they can receive important assistance through the cooperative system. Given that promoting small businesses could produce a lot of jobs, and producing jobs is a cornerstone of sustainable development, Japan's model warrants serious attention from countries seeking economic growth through promoting industrial technologies.

Lastly, the merits of the stockpiling mechanism – its balanced structure and flexible evaluation system – in the systems of Japan and the US are immensely valuable for countries aiming to build systems for managing their own stockpiling. Firstly, the supplementary system that was developed between the private and public sector was shown to be more stable than a purely government-run system, as it has the ability to supplement its supply chain more effectively, and is more resilient to volatile market situations.

When viewed from the economic perspective, a cooperative system makes more financial sense to the private sector, as they can more effectively store and manage essential minerals in the event of an emergency by reducing wastage from improper mineral choices. The fact that the materials industry was developed in Japan also explains why Japan became more vulnerable to a lack of resources than countries heavily reliant on the import of materials, and explains why Japan built its supplementary stockpiling system. For this reason, to countries envisioning the development of a materials industry, the stockpiling system built by Japan could provide an optimal model for resilience against fluctuating market conditions. Moreover, beyond the need for resilience, the need to institute a systemic flexibility that is able to evaluate and purchase types of minerals according to market conditions is exemplified in three countries – Japan, the US, and the EU (despite the latter's managing CRM not by stockpiling but by RMI). This experience in reducing factors of waste caused by choosing unsuitable materials for the market's trends is an invaluable template for the ROW. Furthermore, Japan's establishing of a committee consisting of both public and private members to periodically monitor domestic inventories and current trends related to REE supply and demand is a lynchpin of Japanese policy to enable them to form a secure and stable supply chain.

However, whereas we can find a multitude of international responses to the first dilemma, the second major issue – creating a useful and mutually beneficial diplomatic model between importers and exporters of mineral resources – requires some originality and fresh perspective, as there is an absence of ready examples from which to draw a ready framework.

One of the goals expressed in the first pillar of RMI may offer a plausible insight for producing a cooperative model in that the EU's diplomatic strategy for building win-win situations by assisting developing countries with abundant natural resources to transform their availability of mineral resources into their economic and inclusive growth.

Despite the fact that many developing nations exist in Africa with greatly different circumstances, the generic knowledge gleaned from South Africa's mineral policy is valuable in relation to the above goals, as it has articulated a clear national plan for economic growth, while its status as the biggest mineral asset holder in the African continent has gradually increased. In the same vein, the fact that the diplomatic strategies deployed by China, Japan, and Korea to procure mineral resources from Africa share some similarities with the EU's diplomatic direction implies that the cooperative model we are seeking would have a close relation to a number of elements essential for the economic development of Africa.

CHAPTER 4

SOUTH AFRICA AND THE COOPERATIVE MODEL

4.1. South Africa

4.1.1. The mineral resource of South Africa

The position of SA as a supplier of mineral resource from a global perspective is not insignificant, as it has been assessed as the 5th largest mining economy behind China, US, Australia, and Brazil (Sibiya, 2012:8). According to a recent study conducted by Citibank, its generic value is estimated to be at least R28 trillion (19.6 billion Euros), which indicates that its value and position in the marketplace will only continue to expand as the potential for exploiting its resources becomes realized (DM, 2014). As seen in table 13, SA is a producer of major elemental resources including the four classes of minerals – PGMs (Platinum Group Metals), Titanium, Manganese, and Chromium – which are ranked first on the world market in 2013.

Table 13: Reserve and production of major mineral resources of South Africa

Type of Mineral	**Unit**	**Reserve**		**Production(2013)**	
		SA	**World Ranking**	**SA**	**World Ranking**
Antimony	Metric tons	**27,000**	**5**	**4,200**	**5**
Chromium	Thousand metric tons	**200,000**	**2**	**11,000**	**1**
Gold	Metric tons	**6,000**	**2**	**145**	**6**
Iron ore	Million metric tons	**1,000**	**13**	**67**	**7**
Manganese	Thousand metric tons	**150,000**	**1**	**3,800**	**1**
Nickel	Thousand metric tons	**3,700**	**7**	**48**	**11**
PGMs	Metric tons	**63,000**	**1**	**222**	**1**
Titanium	Thousand metric tons	**63,000**	**3**	**1,100**	**1**
Vanadium	Thousand metric tons	**3,500**	**3**	**20**	**2**
Zirconium	Thousand metric tons	**14,000**	**2**	**360**	**2**

Source: Collected from the 'USGS. 2011' by author

The rising value of SA, due to an increasing awareness of its diverse and abundant mineral resources, has become an attraction which has drawn strong attention both from countries exploring overseas resources in order to build a stable supply chain as well as for its own domestic aims to achieve economic development. Particularly in the area of PGMs, where it possesses over 80% of the world's reserves and produces an astounding 90% of the world's supply, we can see an illustration of the crucial value of SA in the global minerals industry (MININGQ). SA leads the production and export of PGMs, which are critical for possessing the distinctive qualities of resistance to high temperatures and the ability to catalyze chemical reactions, and have no fungible counterparts in other minerals for the various industrial spheres in which they are needed. This includes the motor industry, where they used in catalytic convertors for turning harmful emissions into inert exhaust, and for making jewelry in the ornament markets. Furthermore, Ruthenium and Iridium, which belong to the class of PGMs, also are widely used for enabling vertical memory storage in hard drives and advanced lighting techniques. The fact that PGMs are used in such a range of high demand areas, with applicability across a spectrum of conveniences that have become indispensable in modern life, explains the significance of SA as one of the world's leading providers of PGMs.

Therefore, it is clear that SA has become a very important area of global interest, attracting enormous investments from developed countries such as the UK, US, Germany, Netherlands, and Japan with the objective of gaining a foothold in the extraction of its commodity resources, as illustrated in table 14; and with a particular concentration of that investment in its mineral resources, as described in table 15 (UNCTAD, 2008:581, 594).

Table 14: The scale of investment of developed countries in South Africa (2006)

Countries	United Kingdom	United States	Germany	Netherlands	Japan
Millions of Rand	440,257	37,378	34,121	22,106	14,725

Source: UNCTAD. 2008. p 587

Table 15: The objectives of investment on South Africa (2006)

Objectives	Mining	Secondary	Finance	Trade	Transport	Construction	Electricity, gas and water
Millions of Rand	250,361	165,432	162,521	16,172	13,809	1,983	29

Source: UNCTAD. 2008. p594

4.1.2. The content of South Africa's policy on mineral resources

4.1.2.1. Socio-economic context of South Africa

The major economic indicators in table 16 show that the economic growth rate of SA has increased steadily over the past few years. As a percentage of the total amount ($11,939) of Gross Domestic Product (GDP) of African countries, composed of 46 nations, South Africa's GDP in 2012 ($4,199) accounted for 34.1% - a fact that clearly illustrates SA's economic preeminence in Africa as the largest market among the African countries (KERI, 2012:265,516). Nevertheless, the troublingly high unemployment rate, which remains at just over 25% in October 2014, denotes that there are severe, structural problems of economic inequality that need to be tackled at the national level (TE).

Table 16: Major economic indicators (2012)

Indicators	Unit	2008	2009	2010	2011	2012
GDP	$ million	2,742	2,842	3,635	4,081	4,199
GDP per capita	$	5,606	5,746	7,271	8,066	8,202
Economic growth rate	%	3.6	-1.5	2.9	3.1	2.3
Industrial production growth rate	%	0.6	-12.8	4.9	2.5	2.1
Gross domestic investment/GDP	%	22.5	19.6	19.3	19.9	-
Unemployment rate	%	22.9	23.9	24.9	24.5	23.8
Consumer price growth rate	%	11.5	7.1	4.3	5.0	5.3

Source: KERI. 2012. p 256

There has been, since the end of apartheid, a deep and persistent income gap between rich and poor, as seen in table 17.

Table 17: Per capita income overview (1993-2008)

	1993 Income Share/Pop. Share	2000 Income Share/Pop. Share	2008 Income Share/Pop. Share	1993 (Rand)		2000 (Rand)		2008 (Rand)	
				Mean	Median	Mean	Median	Mean	Median
African	0.47	0.54	0.56	539	304	762	360	816	367
Coloured	0.92	1.03	0.94	1072	795	1443	816	1381	800
Indian	1.88	1.98	2.90	2148	1430	2625	1536	4288	1860
White	4.06	4.82	4.27	4632	3418	6005	4170	6275	4188
Overall	1	1	1	1147	419	1349	453	1456	450

Source: OECD.2010.p78

A number of concerted efforts to narrow this discrepancy have been implemented in the post-Apartheid period through national development projects, which have achieved some positive outcomes in terms of improving accessibility to basic services such as housing, water, electricity and sanitation, as depicted in table 18.

Table 18: Changes of household accessibility to basic services

	Formal Dwelling	Piped Water	Electricity for Lighting	Electricity for Cooking	Flush/Chemical Toilets
1993	68.3%	59.3%	51.9%	45.2%	52.6%
1999	74.2%	65.7%	69.5%	52.7%	55.5%
2004	73.6%	67.8%	80.2%	59.4%	57.2%

Source: OECD.2010.p20

4.1.2.2. South Africa's Mineral Policy and Socio-economic development

The potential for SA's mineral resources to be used as an apparatus for fostering economic growth has been repeatedly emphasized in a number of documents embodying the direction, vision, and strategy of various national development projects:

> The national wealth of our country --- shall be restored to the people; the mineral wealth beneath the soil, --- (The Freedom Charter, 1955).

> Policies will be developed to integrate the mining industry with other sectors of the economy by encouraging mineral beneficiation and the creation of a world class

mining and mineral processing capital goods industry (Ready to Govern, 1992).

> Our economy must adjust to these pressures if we are to sustain economic growth and continue to develop a large domestic manufacturing sector that makes greater use of our own raw materials and minerals (RDP, 1994).

> SA’s endowment of mineral resources --- Exploitation of minerals must optimize their developmental impact, especially job creation, across the economy. Mining must catalyze broader industrialization --- (The Polokwane Conference Economic Transformation resolution, 2012).

Accordingly, the basic direction of SA's mineral policy extends significantly beyond the boundaries of mineral resources, since the policy instruments of SA are so intensely focused on the matters of economic growth and income redistribution.

A detailed exposition of SA's mineral policy as an enabler of economic growth can be found in a government white paper, entitled: ‘A Minerals and Mining Policy for South Africa’, released by the Department of Minerals and Energy (DME) in 1998. Six main themes emerge from the white paper:

- Business Climate and Mineral Development, which looks at the continuation of policies conducive to investment, and includes a section on Mineral Rights and Prospecting Information which presents changes to the system of access to, and mobility of, mineral rights
- Participation in Ownership and Management, which examines racial and other imbalances in the industry
- People Issues, which looks at health and safety, housing needs, migrant labor, industrial relations and downscaling
- Environmental Management
- Regional co-operation
- Governance

These areas of focus indicate that many common endeavors have been undertaken. These include extensive surveys, holding both public mineral policy workshops as well as bilateral meetings between the government and investors. In addition, the Mineral Policy

Process Steering Committee comprises a wide range of representatives from both the executive and legislative branches in Government, as well as organized business and organized labor, which culminated in the introduction of the inclusive report for the realization of economic growth (DME, 1998).

Another distinguishing feature of SA compared to other countries is the government's incorporation of the policy of Black Economic Empowerment (BEE)[1], based upon 'The Broad-Based Black Economic Empowerment Act', into 'The Mineral and Petroleum Resources Development Act (MPRDA)'. The provision is detailed in the section 100 (2) (*a*) of the MPRDA:

> To ensure the attainment of the Government's objectives of redressing historical, social and economic inequalities as stated in the Constitution, the Minister must within six months from the date on which this Act takes effect develop a broad-based socio-economic empowerment Charter that will set the framework, targets and time-table for effecting the entry of historically disadvantaged South Africans into the mining industry, and allow such South Africans to benefit from the exploitation of mining and mineral resources(DME, 2002).

To facilitate the goals of the MPRDA – elevating the participation of HDSA (Historically Disadvantaged South Africans) in the mining and minerals industry – the Broad-Based Socio-Economic Empowerment Charter for the South African Mining Industry was published according to the legislation referred to above, and was later amended to address a number of shortcomings discovered in 2010 in the process of implementing various elements of the Charter. The institutional goals of economic growth and income distribution integrated into the Charter's approach towards the mining industry are plainly confirmed in its objectives (DME: 2010):

- To promote equitable access to the nation's mineral resources to all the people of SA
- To substantially and meaningfully expand opportunities for HDSA to enter the mining and minerals industry and to benefit from the exploitation of the nation's

[1] BEE is a program launched by SA government to redress the economic inequalities derived from Apartheid by giving disadvantaged groups (Blacks, Coloureds, Indians, and Chinese who arrived before 1994) economic privileges previously not available to them (source: http://en.wikipedia.org).

mineral resources

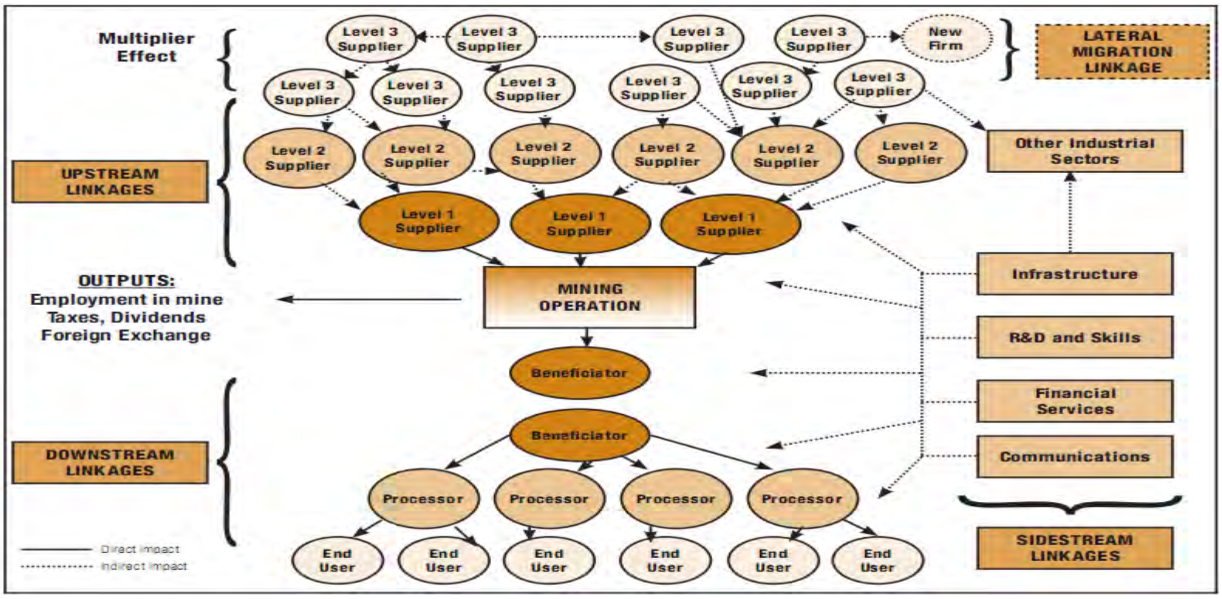
- To utilize and expand the existing skills base for the empowerment of HDSA and to serve the community
- To promote employment and advance the social and economic welfare of mine communities and major labor sending areas
- To promote beneficiation of SA's mineral commodities
- Promote sustainable development and growth of the mining industry

4.1.3. Strategic framework

We can summarize the framework being pursued by SA for promoting its mining policies in the following way, which can be extracted from two documents, ‘Ready to Govern’ (1992) and ‘The Polokwane Conference for Economic Transformation Resolution’ (2012): “Pursuing the maximization of policy effectiveness through integrating the mining industry with relevant sectors”. The specific aims of the integration of mining with other sectors was further outlined in 'The African Mining Vision', adopted by the African Union Heads of State in 2009 as a series of linked components (portrayed in figure 6), operating and functioning independently of each other but achieving their maximum operability through interaction and overlap (AU, 2011:103), as below (AU, 2009:5).

- Down-stream linkages into mineral beneficiation and manufacturing
- Up-stream linkages into mining capital goods, consumables & services industries
- Side-stream linkages into infrastructure and skills & technology development
- Mutually beneficial partnerships between the state, the private sector, civil society, local communities and other stakeholders
- A comprehensive knowledge of its mineral endowment

Figure 6: Linkages in the minerals industry and the relationship between firms



Source: AU.2011.p103

To SA, the significance of R&D as a backbone for upholding the other linkages is surely a crucial strategic factor which cannot be ignored as other countries have done, since SA envisions the enabling of sustainable economic development through utilizing mineral resources as a growth engine; a goal clearly articulated as "a knowledge-driven African mining sector that catalyzes & contributes to the broad-based growth & development of, and is fully integrated into, a single African market"(AU, 2009:5). Indeed, SA can glean a valuable lesson from the examples of two Asian countries: Japan's success in producing substantial profits through nurturing technical skills despite a lack of abundant mineral resources, and China's efforts to entice foreign companies possessing advanced technologies to facilitate technological transfer; namely, the awareness that sustainable economic growth comes not only from an abundance of natural resources but from excellent human resources driving innovative, marketable R&D activities.

4.1.4. Challenges and analysis

These three unquestionably positive factors in SA – the diverse and abundant mineral resources, the clear direction of their mineral resource policy, and a clear strategic framework – would, it seems, be the most effective instruments to achieve their goals if they were permitted to operate organically and without any obstacles. However, in the following sections shall examine a number of factors presenting practical gaps between the idealistic political goals and the reality of South Africa's REE environment. As a methodological approach to find an optimal model and to analyze the generic environment of SA's mineral resources policies, the SWOT (strengths, weakness, opportunities and threats) analysis approach can be applied to gain a balanced and multifaceted view of SA's characteristics in relation to its intention to use minerals to promote economic prosperity, and its negotiating position towards foreign countries seeking to exploit SA's resources.

To begin, it will be instructive to define the four components of the acronym instrumentally, and place them in the context of both the domestic situation of SA's mineral industry and their position in the context of the resource diplomacy policies of China, Japan and Korea. The first part will focus on the strengths and weaknesses, followed by an exploration of the opportunities and threats. The broad approach is therefore summarized below:

- Part 1: Analysis of Strengths and Weaknesses
  - Strengths: advantages inherent to SA's internal environment
  - Weaknesses: pitfalls and vulnerabilities within SA's internal environment.
- Part 2: Analysis of Opportunities and Threats
  - Opportunities: advantageous factors within the external environment
  - Threats: potentially threatening elements within the external environment

4.1.5. Strengths

As described in the previous section, SA's core strengths are firstly its abundant, high quality mineral resource deposits, and secondly its clear vision and optimistic principles. The first of these strengths has drawn intense interest, particularly in the past five years, from countries exploring the potential to accumulate resources both domestically and abroad. These countries have invested enormous sums of money to construct a stable supply chain of mineral resources, essential for sustaining a high-tech driven economy from a long-term perspective. The second of SA's strengths embodies a nationalistic vision that materializes in concrete policies around the core concept that SA should make use of its own endowments through the mining industry as a means of fostering its national prosperity. This view, forcefully articulated, can become a road map to inspire continuous motivation for the national mobilization and unity of the South African people.

4.1.6. Weaknesses

Despite the formidable potential of the strengths of SA's minerals situation, it has consistently struggled to realize its goals – a fact that can be attributed to vulnerable side stream linkages in its industrial developments, as portrayed in figure 6. These side stream linkages are in fact vital components of the strategic framework of SA, as they contain Infrastructure, R&D, and skills – factors that are in fact an integral cornerstone for reinforcing and unifying all the other linkages. The following statement, based upon an analysis of data collected from a number of relevant documents cited in table 19, illustrates some of the fundamental challenges facing SA, both in its infrastructure and in its R&D and skills situation: "An inadequately educated workforce, restrictive labor regulations, poor labor-employer relations and low levels of productivity relative to the cost of labor constitute some of the most problematic challenges facing business in SA"(Wocke & Sing, 2013: 2).

Table 19: South Africa Mining industry and challenges

Classification	Detail Fields	Extracted Sentences
Infrastructure	**Industry infrastructure**	· Inadequate power supply infrastructure - "The supply of PGMs is affected by the erratic power supply"---the prospect of cobalt production from PGM mines is hampered by the chronic electricity shortage in SA (Burgess, 2010:7)". - "Electricity shortages --- have hindered the mining operations and the development of beneficiation of PGMs--- (Burgess, 2010:12)". - "Shortages of critical infrastructure such as rail, water, ports and electricity supply have a material impact on sustaining current beneficiation initiatives and a major threat to future prospects of growth in mineral value addition (DME, 2011:5)". · Poor railway infrastructure - "The problem with exporting ore is inadequate railway capacity (Burgess, 2010:9)". - "The shortage of railways, highways and carrying capacity hampers exports. Transnet, the transportations parastatal, has been widely criticized for inefficiency (Burgess, 2010:12)". - "Infrastructure constraints ---SA has benefited from the commodities boom since 2002 for minerals depending on rail or energy-intensive process --- the main constraints have been transport(rail) and energy infrastructure capacity that have been unable to expand to meet--- (SIMS, 2012:24)".
	Society and Environment infrastructure	· Frequent incidences of production loss from consecutive mining strikes due to a weakened social infrastructure - "500,000 ounces of PGM production were lost due to strike action. --- In the mining sector it is not just about individual mineworkers' wages, but that problem is exacerbated by the deprivation in surrounding communities. In these communities the low 'social wage' – by which we mean a basket of services citizens should have access to such as water, sanitation, housing, safety, transport, health, education and electricity – places great strain on mineworkers as they must meet these needs from their individual wages. This in turn gives impetus to higher wage demands (Sibiya, 2012:5-6)". - "The mining industry continues to operate under severe pressure, and the problems were exacerbated by the events at the Lonmin platinum mine in Marikana in August 2012, when wild-cat strikes for higher pay turned violent and the South African Police Service opened fire on protesting miners (Wocke & Sing, 2013: 6)". · Concerns about the environmental infrastructure - "Acid mine water in the greater Johannesburg region could pollute major mining operations --- This is a growing issue that could prove catastrophic for mining--- (Burgess, 2010:6)".

		- "Cumulative harm to off-mine populations resulting from --- contaminated ground water sources, acidic mine drainage, and ground instability must be addressed before they lead to even more devastating socioeconomic, political, and environmental damage (SIMS, 2012:25)".
Skill And R&D	**R&D**	· Shrinking R&D base - "Mining companies functioned poorly, starved of investment in plant and machinery--- They also suffered from a general lack of R&D to keep mining and processing operations competitive (AU, 2011:3) ". - "Low research output in mining (Leeuw, 2011:17) ". - "There is a widespread view that while both the Council for Scientific and Industrial Research (CSIR) and MINTEK have some capacity, there has been a clear deterioration over time. There are no specialist mining research units at any of the universities in SA although attempts are now being made to establish a center for mining mechanization at the University of the Witwatersrand (Kaplan, 2011:20)." - "SA's limited exposure to break-through research and development programs thwarts the prospects of innovation in creating new products for beneficiation (DME, 2011:6)."
	Skill	· Dwindling skills base - "Import-substitution based industrialization, domestic minerals were seldom processed locally and converted into industrial products (AU, 2011:3) ". - "Low capacity to develop and manufacture products based on research finding (Leeuw, 2011:17) ". - "---it would seem the quality of mining engineers and related skills has been in decline (Kaplan, 2011:18)". - Skills shortage is being exacerbated by aggressive recruiting on the part of competitor firms, especially in Australia--- In a recent survey, 50% of the 45 firms supplying goods and services to the PMSs sector surveyed regarded the shortage of engineering and technical skills in SA as---the main obstacle to future growth--- (Kaplan, 2011:19).
	Education	· Weakening educational base - "Low number of doctorates per capita in South Africa compared to its international competitors (Leeuw, 2011:17) ". · "The University of the Witwatersrand---and the University of Pretoria has seen significant declines in their capacities. --- There are some indications that the number of firms offering training has declined ---. There is now perceived decline in the local competencies---due to large number of skilled professionals moving abroad (Kaplan, 2011:18-20)".

Source: Collected from documents, 'AU.2011.p3, Burgess.2010.p6-12, DME.2011.p5-6, Kaplan.2011.p18-20, Leeuw.2011.p17, Sibiya.2012.p5-6, SIMS.2012.25-25, and Wocke & Sing.2013.p6', by author

4.2. Resource Diplomacies: East Asia and Africa

Several Asian countries such as China, Japan and Korea, began making overtures towards the African continent from the late 1950s, with a view to forming political allegiances with SA directly and indirectly, apart from some western nations that had been involved with colonialism. As an example, China recovered its seat in the UN Security Council (UNSC) by a vote of the UN member states due primarily to receiving support from a number of African nations on the basis of its diplomatic success with the Nixon US administration during the Maoist period between 1971 and 1972 (Pannell, 2008:708). In the same vein, the attempts of Korea to build up diplomatic relations with African nations began to compete with North Korea's efforts, which initially began in the 1960s – earlier than Korea. Although Korea in the 1970s had only ten embassies in Africa, far less than the 23 embassies of North Korea (NK) due to their belated realization of the significance of Africa, various diplomatic strategies such as their promotion of the Hallstein Doctrine in 1973 which urged nations to refuse relations with countries that recognized NK, and a presidential visit to Nigeria, Gabon, Senegal, and Kenya in the early 1980s enabled Korea to take its place as a member of the UN along with NK in September 1991 through a similar strategy of securing formal recognition from African leaders (Kim, S. 2012:54-55).

It is worth noting that Africa is an area of intense interest from Asian countries not only due to its abundant natural resources, but also as an enormous consumer market of Asian goods and commodities – an attractive proposition for these countries that need to expand their local sales and provide sustainable economic growth.

Unlike European partners such as UK or France that have aggressively explored and already invested a great deal of money on businesses linked to mineral resources since the colonial period, the approaches of the three major Asian countries towards Africa is worth examining in some detail, firstly because African researchers have lately intensified their studies into the stance of Asian actors towards Africa, and secondly because we can hope to obtain an optimal, mutually beneficial model of the relationships between African-Asian trading partners by analyzing the following areas:

- What approaches have these Asian countries taken towards Africa?
- How much can these strategies meet the practical requirements of Africa?

- If they cannot suffice to meet Africa’s requirements, how should African countries respond to possible threats posed by Asian countries’ encroachments?

In order to understand the relationship between Asia and Africa adequately, it will be useful to consider the direction of their approach particularly with regard to their ODA policies, regular forums, and a broad evaluation through an analytical framework, as a number of crucial similarities will emerge between these countries, particularly in relation to their ODA and forum policies. It will then be possible to consider the results of this analysis in the broad context of the opportunity / threat dichotomy which constitutes the first half of the SWOT analysis method, in order to generate a model of mutual cooperation.

4.2.1. China

4.2.1.1. The feature of approach and ODA

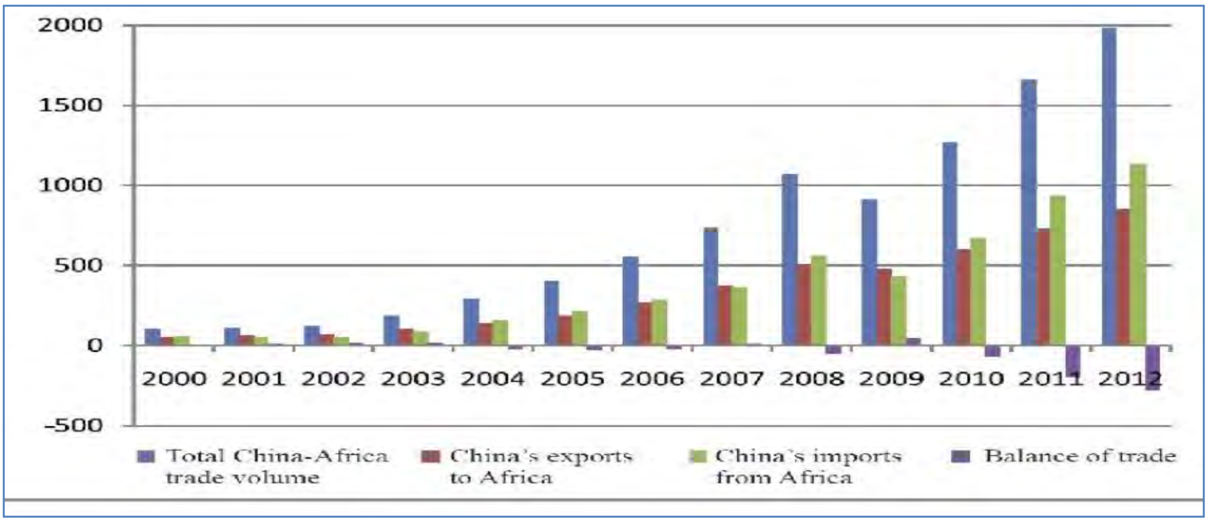
China's approaches towards Africa have been implemented in a comprehensive manner, regardless of the particular field, through the provision of social, economic, cultural, and educational assistance based on the principle of soft power defined by Harvard Professor Joseph S. Nye, Jr in 1990 (CRSLC, 2008:3) as the ability to attract rather than coerce as a means of persuasion in order to expand its influence and power over Africa politically and economically. As a result, China is held in a position of high regard and credibility by the African nations with whom it has been involved for ODA. As a result of their comprehensive efforts, China became Africa's major trade partner, outpacing the US, which had hitherto maintained a preeminent position in Africa since 2009. A comparison of the trade volumes of China ($117billion) and US ($113billion) in Africa from this year shows that they have maintained their dominance. (Shinn, 2011:3).

The reason that China was able to expand its position in Africa faster than any other country can be attributed to the fact that China's assistance policies have continuously provided service infrastructure into a diverse range of fields related to service infrastructure, construction of roads, railways, government office building, schools, water systems, dams, and power plants – in a broad and unconditional manner (Pannell, 2008:708). Unlike the Western donors who set political conditions upon Africa to improve factors such as democratization, proper governance, and human rights, China's policy based on the principle of non-interference in the internal affairs of their partner nations has evidently played an important role in enabling its diplomatic strategies to permeate into the political atmosphere and ground of Africa without resistance (IWATA, 2012:211). Furthermore, China's assistance in providing educational and cultural programs has also played a contributory role to nurture the relationship between Africa and China. As examples, a diverse range of educational opportunities such as vocational and technical education, Chinese learning programs, scholarships for a chance to study in China, and programs for elite students have been developed and provided by China to assist African development and to improve the production and quality of African human resources (Pannell, 2008:716).

Aside from the success of China's political influence on Africa, the extent of its financial profitability can also be confirmed through data provided by Standard Chartered showing increasing trade volumes, as illustrated in graph 4, as a close correlation of its broad development assistance based on the policy of soft power.

Graph 4: China-Africa trade volume (2000-2012)

(Unit: US$10 million)



Source: PRC. 2013 p4

Graph 4 shows that the trade volumes between China and Africa have increased significantly over the past 12 years; initially at a slower pace between 2000-2003, but then sharply from 2003-2012, keeping an impartial balance of trade among the parties. However, if we consider those figures from the point of view of comparing the volume of imports and exports, a concern emerges regarding a trade imbalance, in that most of China's exports consist of commodities such as mechanical and electrical products – consisting of 45.9% of China's total commodity exports to Africa (PRC, 2013:4) – whereas China's imports from Africa still comprise mainly fuels, ores and metals, which are driven by China's strategic interest in securing access to natural resources (SC, 2011:4). In other words, the trend of increasing commodity exports could be an indicator that China's most significant challenge – job creation – is gradually being overcome as its economy develops, and allows for greater social and political stability (Pannell, 2008:711). On the contrary however, the dramatic trade deficit of Chinese goods could also be an indicator that the unemployment rate of Africa will only increase over time as raw materials flow out of the continent, and manufactured goods return. For African countries with the ambition of enabling a national development plan through leveraging their natural resources, such a trend must appear manifestly detrimental to their development plans.

It is worth noting that China's definition of ODA as a source of development assistance to

Africa is fundamentally different to that of the OECD as to it is reticent to use the terms ‘aid’ or ‘donor’ in its cooperation in order to stress the concept of South-South cooperation by implying that China’s assistance of other developing countries is on the basis of itself being a developing country; and has nominated for itself the position of self-appointed leader of non OECD-DAC partners (Lum et al., 2009:1) (IWATA, 2012:214). The possible motive for China to be a non OECD-DAC partner could be attributed to a reluctance of the Chinese administration to be recognized as a major aid donor because of a fear by the government that its citizens may object to lavish spending on economic projects abroad (Lum et al.,2009:1). Thus, it prefers to use the expression ‘South-South cooperation’ to the terms ‘aid’ or ‘donor’, which emphasize that their aid does not originate from free support as well as insisting that their support to Africa must be reciprocated (IWATA, 2012:214). In order to further distance themselves from giving the image of providing official governmental assistance, the management of China's ODA is handled by the Ministry of Commerce through the arm of Eximbank established in 1994 through concessional loans; unlike other major donors that commit their administration to a centralized aid agency affiliated with a foreign affairs ministry (Lum et al., 2009:5) (IWATA, 2012:215).

4.2.1.2. The forum on China-African Cooperation (FOCAC)

The role of the FOCAC to enhance the relationship between China and African countries has facilitated a deepening of the collaboration between both partners in a wide range of aforementioned fields, having undertaken five meetings since 2000. From a political aspect, one internationally startling consequence of the forum was the re-establishment by Senegal and Chad of their previously annulled diplomatic relations with China, at the cost of giving up their relationship with Taiwan before FOCAC 3 in 2006 (IWATA, 2012:216). An overview of the agendas under discussion in the framework of the FOCAC is illuminating as an overview of China’s strategic approach, from the economic and infrastructural aspect, towards the African continent, as outlined in table 20 below.

Table 20: Overview of agenda of FOCAC meetings (2000-2009)

Agenda		FOCAC I (2000)	FOCAC II (2003)	FOCAC III (2006)	FOCAC (2009)
Economy	Finance	- Debt cancellation of up to RMB 10 billion for the HIPC and LDC	- Continuing to increase assistance	- Double aid by2009 - Provision • US$ 3 billion as preferential loans US$ 2 billion as preferential buyer's credits • RMB 300 million for artemisin (anti-malaria drug) - Cancel government debt: matured interest free loans due in 2005	- Provision • US$ 10 billion in concessiona l loans • US$ 1 billion for small and medium size business - Cancel debt Associated with interest-free government loans
	Trade and Investment	- Give preference to import of African product - Ensure operation of Investment and Trade Promotion Centers for assisting African states to set up similar entities in China	- China will grant tariff-free access to some commoditi es from LDCs	- Set up the China-Africa Development Fund, an investment fund with US$ 5 billion capital - Increase the number of zero-tariff export items from 190 to 440 - Establish 3 to 5 trade and economic cooperation zones	- Duty-free and quota-free treatment for 95% of products from African LDCs

Infrastructure	- Send medical teams, including equipment for promoting medical skill - Establish an African Human Resources Development Fund	- Train up to 10,000 African personnel in various fields	- Train 15,000 African professional, send 100 agricultural experts, set up 10 special agricultural centers, build 30 malaria prevention centers, dispatch 300 volunteers, and increase the number of scholarships for African students from 2,000 to 4,000 per year. - Build an African Union conference centre - Build 100 schools and 30 hospitals	- Launch China-Africa science and Technology partnership, carry out 100 joint Demonstration projects on science and technology research and receive 100 African postdoctoral fellows in China. - Increase the number of agricultural demonstration centers to 20, send 50 agricultural technology teams, and train 2,000 agricultural experts - Launch a China-Africa joint research and exchange program

Source: Modified from the 'Grimme, S.2012.FOCAC'S role and functioning.p3' by author

Although it is difficult to evaluate precisely whether FOCAC has the capacity to create substantive mutual benefits from a long-term perspective, China's policies based on the principle of "South-South cooperation" have unquestionably garnered it goodwill both domestically and from African countries. This is evident in the affirmative signals given to China for tackling the unemployment problem through the increase of exported commodities to Africa, as well as the fact that it has enabled several countries within Africa to develop economically through financial and infrastructural assistance.

4.2.1.3. Evaluation

An overview of the Chinese/African relationship was summarized by a report entitled 'Africa's Silk Road: China and India's New Economic Frontier', published by World Bank in 2007, stating "China and India's newfound interest in trade and investment with Africa presents a significant opportunity for growth and integration of the Sub-Saharan continent into the global economy". Indeed, it is difficult to deny that China's reciprocal policies have contributed considerably to provide Africa with new opportunities for economic growth (Broadman, 2007:1). Despite such an affirmative evaluation of China's approach towards Africa, some have expressed concerns about the honesty of China's motives in several African countries, as evidenced in the following documents:

- Trade imbalance detrimental to job creation
  - Dwindled job opportunities from 190,000 in 2000 to 140,000 in 2005 of SA's textile industry due to the overflowing of low-priced China's clothing (Jauch et al., 2006: 238).
  - The exported products to China are copper, and iron ore products,--- Africa's imports are based on manufactured products. This trend benefits China to sell its manufactured goods and buy primary products with little added value (Cisse, 2012:3).
  - The destruction of local industries and manufacturers because of Chinese imported cheap goods (Pannell, 2008:713).
  - China's ambitions toward Africa.
  - China's involvement in SA has nothing to do with charity --- it wants money, and wants raw materials (Gumede, 2012:1).
  - China is buying into 'strategic' sectors in the SA economy partially, such as platinum, rare metals, financial sector linked to driving SA's economic development (Gumede, 2012:3).
  - The characteristic of Chinese investments, mimicking Africa's colonial (past), which brought economic growth with little industrialization, broad-based development or new human development opportunities (Gumede, 2012:4).
  - The undermining of labor conditions
  - China's bad record for worker safety and labor practices (Shinn, 2011:6).

- Trade unions and civil society groups' complaints about Chinese companies' undermining of basic workplace rights and environmental standards (Gumede, 2012:4).
- The vulnerability of Africa.
- The absence of open international tenders to compare the quality and cost of China (Lagerkvist et al., 2011:34).

4.2.2. Japan

4.2.2.1. The feature of approach and ODA

The overall trend of Japan’s ODA policies in the past few decades is a good indicator of the progression of Japan's interest in Africa. According to a paper by SATO in 2010, the period from 1954 till the present can be differentiated into five stages, according to the variable direction of its ODA, affected by the international environment and its domestic policies (SATO, 2010:85) (Wild et al., 2011:15-16); as follows:

- 1954-1972: Negligible ODA attention (Concentration on Asia).
- 1974-1980: Beginnings of an increase in ODA (Interest in Africa's resources affected by the First Oil Crisis).
- 1981-1988: Expansion of ODA (Due to pressure from the international community)
- 1989-2000: Prime donor, varying from 15-19 percent to 10 percent of ODA (Political Commitment and Dispatch of Self-Defense Forces).
- 2001-present: Reduction of ODA (Changing Aid Policy)

The characteristics of Japan's ODA through this period have in fact been so unclear that it is fair to state by the late 1980s that "traditionally, the Japanese government does not have any particular African policy" (IWATA, 2012:218). A number of reasons have contributed to Japan’s passive and lackluster ODA response to Africa: its leading actors have been burdened with bureaucracy and weak interests in Africa, its involvement has been reactive and based on requirements from the US, its increased ODA to Africa in the 1980s was in order to avoid a trade conflict with the US, and the fact that Japan’s real interest in Africa is diplomatic rather than economic in all areas except Africa’s natural resources, with a goal of becoming a permanent member of the UNSC(SATO, 2010:67) (IWATA, 2012:218-219).

With 53 UN votes across all African countries, the political power of Africa is still of a sufficient magnitude that Japan could not afford to disregard its importance, particularly given that it had failed in a bid to become a permanent member of the UNSC in April 2005. Just two months before, at the Gleneagles Summit in July 2005, Japan pledged to boost its Japanese aid to $10 billion by 2009 – undoubtedly this was influenced by its ambitions towards the UN (SATO, 2010:67). Due to the political advantages of its African interventions, Japan's pledges have been upheld despite their failure to produce outcomes as substantial or comprehensive as the Chinese government's results. Nevertheless, we have witnessed a change in Japanese business due to the changing global economic situation and declining Western markets with their economic crisis; and African countries have made significant in-roads to sustainable economic development in the 21st century, along with a broad agenda around Africa's environments, discussed in the framework of the TICAD since 1993. These facts together imply that there is a reasonable possibility for Japan to take a more active interventionist role in Africa's affairs in the near future (IWATA, 2012:218-219).

4.2.2.2. The Tokyo International Conference for Africa's Development (TICAD)

TICAD, established in 1993 as the main Japanese platform for Africa's development, has a history that predates FOCAC, and can even lay claim to being the prototype for FOCAC. Moreover, the contents and agenda of TICAD's discussions around African development have also been much more inclusive than those of FOCAC and have even served as a model for FOCAC over the duration of its five meetings from 1993 to 2013, as summarized in table 21 (Aoki, 2013:1).

Table 21: Summary of major discussed contents of TICAD (1993-2013)

TICAD(I-V)	Major Discussed Contents
TICAD I (1993, Tokyo)	・ Strengthening political and economic reforms ・ Emphasizing of the of private sector for sustainable development ・ Reaffirming ultimate regional integration and cooperation goals ・ Relieving of emergency from natural and man-made disaster to constrain development ・ Transferring of Asian development experience to Africa
TICAD II (1999, Tokyo)	・ Social development and poverty reduction: promoting Human Development - Economic development: promoting the private sector - Settling of basic Foundations(good governance, conflict prevention and post-conflict development)
TICAD III (2003, Tokyo)	・ Reviewing the achievements of TICAD process and discussing future direction ・ Achievements of the TICAD process - Raising Awareness of the Challenges Facing Africa - Advocating that "ownership" by African countries of their development process and" partnership "by the international community in support - Expansion of Development Partnership: underscoring of South-South cooperation especially Asia-Africa cooperation ・ A compass for the future of the TICAD process - Leadership and people's participation in the African development process - Peace and good governance\ - Human security - Respect for distinctiveness, diversity, and identity ・ A new partnership: mutual respect and trust
TICAD IV (2009, Yokohama)	・ Boosting economic growth ・ Ensuring human security ・ Addressing environmental issues and climate change ・ Broadening partnership
TICAD V (2013, Yokohama)	・ Boosting economic growth ・ Accelerating infrastructure and capacity development ・ Empowering farmers as mainstream economic actors ・ Promoting sustainable and resilient growth ・ Creating an inclusive society for growth ・ Consolidating peace, stability, democracy, and good governance

Source: Collected from the 'Past TICAD Archive (http://www.ticad.net)' by author

In spite of such a long relative history compared to China, the unvarying nature of the subjects under discussion provides some justification for questioning the sincerity of Japan's forums around the African continent. For this reason, one tends to encounter more negative assessments of Japan's attitudes in Africa than positive, which indicates that the fundamental direction of Japan's policies have been so ambiguous, indifferent and ineffectual that it is easy to argue that their motive is political rather than economic, and self-directed rather than genuinely concerned about Africa's best interests.

4.2.2.3. Evaluation

Reviewing the above facts, it becomes apparent that Japan's sincerity in its declarations at TICAD can be questioned, and it lacks originality as a genuine partner of Africa. The specific wording choices used in TICAD III, such as "ownership" and "partnership", also appear in the OECD-DAC, which suggests that Japan might have borrowed its principles and expressions from the OECD-DAC in which it acts as a member (IWATA, 2012:218-220). Furthermore, a number of voices have pointed out that there has been a lack of tangible outcomes in the Japanese system over the past 20 years, due to the lack of concrete actionable programs and an overabundance of empty rhetoric signaling a practical indifference. If Japan hopes to become a significant contributor to Africa, there is an urgent need for them to clarify their policies and attitudes, and to provide tangible proofs of their authenticity and responsibility (Aoki, 2013:4).

4.2.3. Korea

4.2.3.1. The feature of approach and ODA

The goals of Korea towards Africa are broadly quite similar to those of China and Japan described in the foregoing sections: securing natural resources, expanding their political influence, and establishing economic cooperation. With the exception of Japan's singular political motive to be accepted as a permanent member of the UNSC through African participation, over time the resources procurement and the building of economic cooperation have emerged as the dominant common themes of Asian countries in Africa. However, compared to China and Japan who have been entrenched in Africa for many decades, Korea suffers from a lack of sufficient experience and accumulated knowledge that has hampered its ability to accomplish its two aims. A clear example of Korea's relative immaturity in handling African affairs was provided earlier, in its miscalculation of the feasibility and profitability of securing overseas resources. With respect to building a cooperative relationship for economic development, it is an unfortunate fact that Korea's strategies, which have emphasized either sharing or transferring manufacturing experience with developing countries, have not been able to demonstrate successful outcomes – which indicates that Korea's approach towards Africa is still under constant modification (GLRC, 2011:233-234). In order to understand Korea's awkwardness in dealing with African affairs, it will be useful to review their short history with Africa.

Initiated in the 1960s by a political motivation to compete with NK, Korea's relationship with Africa entered into a stable period since the middle of the 2000s, from which the Korea-African Forum (KAF) has held regular meetings every three years until the present; passing through several stages shown below (Kim, 2012:55):

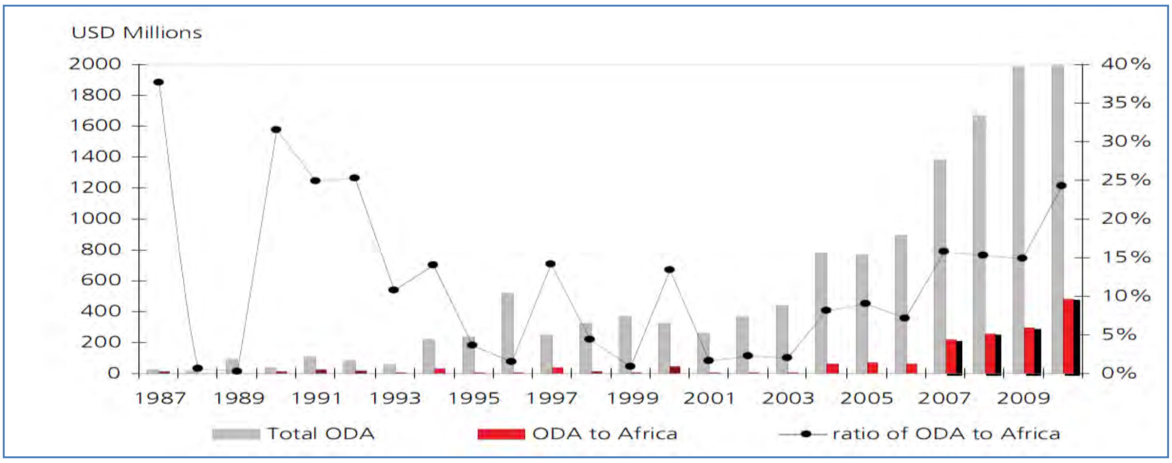
- 1960s - 1991: Seeking to form cooperative relationships with Africa to compete with NK
- 1991 - 2006: Stagnation stage after gaining entry to the UN in 1991
- 2006 - present: Seeking to build new cooperative relationships related to resource diplomacy and African development

Korea's effort to establish a new cooperative relationship was manifested in the "Korea Initiative for Africa's Development (KIAD)", released by the Roh Moo-hyun administration in 2006 as a backbone of the institutional apparatus constituted of the following factors (Kim, 2012:55-56):

- Increasing volume of ODA by three times by 2008.
- Sharing of development experience through inviting 1,000 African officials for capacity building by 2009, dispatching of Korean experts and volunteers, and assisting African governments to devise national development plans by means of holding workshops.
- Setting up Korea-Africa Forum to establish 'The Korea Africa Economic Cooperation Forum (KIAD)' as a committee divided into following three parts: business, government, and academia.
- Promoting Africa's ownership for furthering its social and economic development

The total ODA increased rapidly between 2006 and 2010 from by an average of 29 per cent each year as portrayed in graph 5. This increase also shows that the outcomes of KIAD began to become manifest not long after the announcement of Roh's administration (Kim, 2012:57).

Graph 5: The ODA volume of Korea related to Africa (1987-2010)



Source: Kim, S. 2012. p57

Korea's basic direction with respect to ODA, at least in the rhetoric used to define it, appears barely distinguishable from the discourse of South-South cooperation utilized by China, as they similarly highlight the significance of sharing development experience with developing countries, particularly as the first member of OECD-DAC to overcome the status of aid recipient of OECD-DAD in 2010; and shows their confidence that this model is an effective one to help developing countries through promoting technical cooperation and human resources development (GLRC, 2011:233-234).

4.2.3.2. The Korea-African Forum (KAF)

Similarly to the cases of China and Japan, the debates over determining the agenda for the framework of the KAF are closely related to the direction of ODA, and in a sense serve as a demonstration of Korea’s ODA policy, as outlined in table 22. For instance, each of the items of discussion in the agenda for the first meeting is connected with the basic direction of Korea's ODA at that time; namely, the sharing of development experience.

Table 22: Summary of major agenda of KAF (2006-2012)

KAF(I-III)	Major Discussed Agenda or Declarations of KAF
KAF I (2006, Seoul)	- Potentiality of Africa & Seeking of economic cooperation - Sharing of Korea's development experience with Africa - Discussing the topic of promoting mutual understanding
KAF II (2009, Seoul)	- Reducing tension and building trust on the African continent & the Korean Peninsula - Strengthening inter-governmental cooperation to enhance a beneficial partnership - Korea's commitment to double its ODA flow to Africa by 2012 compared to 2008 - Focusing on sharing development experiences & knowledge to develop human resources - Promoting the exchange of information and experiences in order to achieve the MDGs - Promoting trade and investment between Korea and Africa - Fostering increased cooperation in fields such as railways, ports, roads, electricity, etc. - Strengthening and consolidating the partnerships through the mechanism of regular meetings
KAF III (2012, Seoul)	- Strengthening cooperation at the African continental level by engaging the AU to contribute to the development and integration of Africa - Continuing to support the fight against poverty and efforts for sustainable development to achieve MDGs - Recognizing that Korea's development experience may be of great value in Africa's development - Efforts to share Korea's experience and knowledge for developing human resources - Korean Government's expansion of duty-free and quota-free items for the 48 least developed countries - Promoting investments and sustainable development through an Public-Private Partnership - Emphasizing the development of small and medium scale enterprises for economies and employment

Source: Collected and modified from the homepage (http://forum.mofa.go.kr) by author

While Korea's history with Africa is relatively short, the scope of their agenda, which has broadened significantly since the forum's inception, has become as inclusive as the agendas of China and Japan. While all the Asian nations share similarities in their agendas, the distinctive, consistent characteristic that differentiates Korea from its neighboring countries is its emphasis on the significance of sharing its own development experience according to the basic direction of its ODA.

4.2.3.3. Evaluation

One indicator that Korea's ODA is still not sufficiently matured is the past criticism by a number of scholars, who implied that in reality Roh Moo-hyun's KIAD pays little more than lip service in its commitment to Africa's development (SAIS, 2010:94)(IWATA, 2012:221). Another line of argument has suggested that, on the one hand, Korea remains at a nascent level in its understanding of Africa, having exhibited a profound lack of knowledge about the continent; and has emphasized the need for Korea's principles of inclusive growth to be acted upon in tangible, material ways and not just as empty sloganeering (Kim, Y,2012:2).

If we review these three Asian countries' approaches towards Africa, we can draw some broad implications about their commonalities and differences, and understanding the ways they have used the mechanisms of ODA and their respective forums, through the opportunity and threat components in the SWOT matrix.

4.2.4. Opportunity

Despite a marked absence of noteworthy outcomes, the diverse and comprehensive pledges made by the three Asian nations appear to be sufficiently attractive to have drawn the keen attention of African countries envisioning sustainable growth. Indeed, the overtures made by these Asian countries must be seen as favorable by Africa, as they offer a way to raise the profile and status of African countries to advanced nations. For instance, in the evaluation of China we saw that the pledges offered to Africa represent a considerable opportunity for economic growth.

4.2.5. Threat

Notwithstanding the advantageous elements of Asia's movements towards Africa, a number of threatening elements are also present, and have become increasingly manifest over time. In the case of China, the problem of the trade imbalance is growing into a daunting matter that has exacerbated the very serious unemployment problem in Africa. China's desire to occupy strategic sectors will impede Africa's development in the long-term, and there is some statistical evidence that the erosion of African jobs has already resulted from this relationship. Moreover, the approaches of Japan and Korea have both suffered from an insincere and noncommittal perception that casts doubt on their authenticity. Thus, while we have seen that the partnership between the Asian countries and Africa is becoming enhanced and reinforced in quite a comprehensive manner, the selfishness of the underlying motives and the perceived superficiality may hinder real progress if not addressed. At this point the SWOT Matrix has been completed on the basis of the four analyzed components, from SA as the internal environment and Africa as the external environment, as illustrated in figure 7.

Figure 7: SWOT Matrix analysis of the African business environment

		External Environment	
		Opportunity - Diverse, comprehensive, and favorable pledges related to financial assistance, infrastructure, human resources development and so forth	**Threat** - Trade imbalance detrimental to job creation - Satellization of strategic sectors crucial for economic development - Hollow promises that are basically lip service
Internal Environment	**Strengths** - Abundant Natural Resources - Clear Policy vision with mineral resources for national development plan and strategic framework	**SO** **(Leveraging opportunities through Strengths)** - New design of ambitious and customized model based on abundant natural resources and opportunities	**ST** **(Overcoming threats through Strengths)** - Development of cooperative system to create mutual benefits in a substantial way by using abundant natural resources
	Weakness - Insufficient infrastructure of power, transportation, society, and environment - Shrinking R&D environment, dwindling skill, and weakening educational base	**WO** **(Supplementing weaknesses through opportunities)** - Enhancing of sectoral infrastructure by joining a partner that provides better contract term - Promoting of R&D, skill, and education infrastructure by joining a partner that has comparative advantage	**WT** **(Developing alternatives to avoid worst case scenario)** - Protecting vulnerable infrastructure, sectors from external risk factors by analyzing feasibility and profitability - Promoting downstream industry connected with R&D, skill, and education appropriate for sustainable job creation

Source: Analyzed by author

It will now be appropriate given this important context, to reiterate the central issue raised in the introduction, namely, the question of how African countries should respond to the pressures and opportunities of Asian interest in their mineral deposits.

4.3. Resource Diplomacies: East Asia and South Africa

While the African viewpoint was used to analyze the external environmental factors, since the Asian countries have not limited the scope of their focus to SA, it is still suitable to narrow the focus of the investigation of the internal environmental elements to SA alone, as its regulatory and political environment is the most complex and mature in Africa, and influences the entire continent.

Before we can broach a possible answer to the question, it is worth querying just how much capacity the SA government really has to control its mineral industrial policy effectively in a similar manner to China's enhancement of state control of its mineral sector both domestically through consolidation policies, and internationally through restriction policies on exports for economic development; as reviewed in chapter 2. However, the direction of SA's mineral policies is markedly divergent from China's, in that SA adopted a principle of "choosing and concentrating" instead of selecting a single dominant controlling policy system through nationalization – which has recently been demanded by voices in SA such as the ANC Youth League, the Trade Union Federation (COSATU), and the Communist Party (SACP), who have preferred the development model undertaken by China (Burgess, 2010:14) (Mail & Guardian, 2012). This was confirmed by a speech given by Enoch Godongwana, who stated that "The state will increase state ownership, but only in sectors where it is deemed appropriate"; and furthermore, "any nationalization in the mineral sector would be on beneficiation and identified natural resources including shale and other natural gases, iron ore and coal", at the ANC's elective conference held in Manguang in 2012 (Mail & Guardian, 2012). It appears, to judge by this rhetoric, that SA's top priority will be placed on sustainable job creation to meet the requirements of the basic direction of the mineral policy, as the beneficiation sector is directly linked to the downstream industry. The Amended MPRD Bill of 2013 clarified this through incorporating a definition of beneficiation (MMR, 2013:41) Nevertheless, as illustrated in table 19, the critically vulnerable South African elements such as infrastructure, R&D, and skills, which belong to side stream linkages as shown in figure 6, raise doubts about the viability of the policy direction announced in Manguang to produce substantial outcomes despite a weakening of the side stream linkages.

The current direction of SA's policies, which have only focused on beneficiation and identified natural resources, may indicate that it is not capable of taking an aggressive interventionist role in the matters of the restriction of mineral extraction amounts in comparison with China's REE policy. A sentence in a WTO working paper released in 2010 (WTO, 2010:25) indicated that SA has established no general trade policies for strategic minerals for both exporting and importing nations, with the exception of China. This indicates that SA's mineral policies have a number of critical gaps that inhibit its ability to develop adequate diplomatic responses which can facilitate undistorted trade situations in REEs between importer and exporter nations, apart from its current legislations and provisions to regulate trading volumes, such as a tariff system.

For that reason, it is of crucial importance for SA's policymakers to balance the existing policies across the domestic and international dimensions to reach its policy goals of effective national development, by developing policy instruments through analyzing the diplomatic strategies employed by foreign countries such as China, Japan, and Korea as a way of managing its mineral resources.

The following set of data contains a tantalizing prospect as an answer to the question of which direction SA's policy instruments should be developed in order to create cooperative mineral trading relationships. Table 23 and graph 6 illustrate the figures of trade volumes between SA and Asian countries as well as the items that have primarily been traded between the partners.

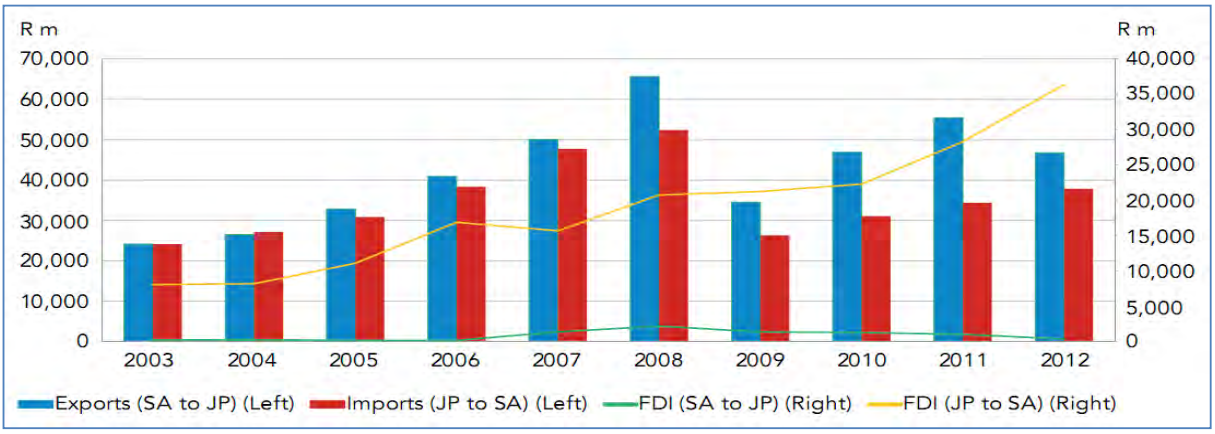
Table 23: Trading trends between Korea and South Africa (2007-2012)

(Unit: US$ million)

Classification	2007	2008	2009	2010	2011	2012.1-4
Export (From Korea to SA)	1,752	1,397	1,082	1,668	2,255	821
Import (From SA to Korea)	1,766	2,159	1,171	2,272	3,105	935

Source: MOFA.2013. The Embassy of the Republic Korea to the Republic of South Africa

Graph 6: Trade & Investment between Japan and South Africa (2003-2012)



Source: Japanese prospectus.2014.p9

The increasing trade volumes over this period indicate that the economic value of SA towards Asia has been reinforced through its position as not only a consumer market to buy commodities such as original equipment components, automobiles, heavy construction equipment, cell phones and goods transport vehicles, but as a crucial provider of mineral resources such as platinum, iron ore, ferro-alloys, copper and aluminum to Asian countries (Japanese prospectus, 2014:9) (MOFA, 2013).

As graph 4 demonstrates however, a similar trend towards a trade imbalance in the trading relationships can be detected between SA and the two Asian countries similar to the situation between China and Africa, which implies that the result of trading could be detrimental to SA from a long-term perspective in that imported commodities from Asian countries could encroach upon SA's labor market, contrary to the direction of its mineral policy.

Nevertheless, the fact that SA is becoming increasingly an arena of competition among countries needing mineral resources provides an opportunity for SA to develop effective policy instruments by leveraging its worth as a resource rich country, as explained below.

The burden on Africa to consider producing an optimal model has been increasing – as seen in a suggestion proposed by Watanabe/Hanatani in TICAD IV that African governments establish and implement country-specific industrial development strategies for prospective growth industries, and to opportunistically take advantage of current favorable gestures from the external environment (Watanabe, 2008:16). This process of establishing an optimal model to create mutual benefits provides an invaluable opportunity for African nations to see the rather insubstantial rhetoric of their policies and official declarations gradually become realized and produce practical outcomes that can be modified and refined over time. Moreover, given SA's position as the leading African mining country with the 5th largest mining industry in the world, it is ideally suited to serve as a representative of the African continent, and its position should not be underestimated as the policies and directions initiated in SA will create ripple effects that could encourage other African countries to form their own rational industrial policies to benefit their economic development over the long term.

Three keywords in particular – competitiveness, comparison, and choice – embedded in the framework of the SWOT Matrix are essential components in creating an optimal model, as they are integral to the business fields in which economic units are engaged in the most effective production outcomes. It is apparent that if we view the aspect of competitiveness in relation to Asian countries' fierce rivalry with Africa, there is a lack of comparison and choice. The lack of comparison and choice in the African environment implies that African policies have not been sufficiently aggressive to counter the threat posed by Asian countries and products effectively. It would be worthwhile therefore to pose the question, "What key defining terms should SA employ in its endeavors to design a new model"? In order for those terms to be employed properly, SA should have a view to developing ambitious and customized models to meet its real business and political conditions, instead of attempting to design a standardized mechanism, in order to respond with flexibility and address the elements within the external environments adequately and with a view to its comparative advantages. An aggressive and open stance with respect to supplying mineral resources will be more effective than a closed, restrictive, and controlling approach, because its plentiful natural resources should be utilized as an inducement to attract the attention of partners. Partners who desire to trade with SA for its mineral resources will be willing to provide much better incentives for trade than other resource rich countries. Accordingly, SA should consider ways in which it can nurture a favorable investment environment to foreign partners through mechanisms such as tax benefits and deregulation while at the same time maximizing its own profits. Models based on the key principles of comparison and choice, which can be arrived at after comparing the approaches of Asian countries in the following portions, could meet the requirements of WO.

Firstly, SA must take the initiative to suggest specific terms of tender around the expansion of social and industrial infrastructure, as well as preferential conditions linked to the supplying of natural resources to countries desiring to participate in a tender. Through this method, SA could induce countries with either development experiences or a notion of South-South cooperation to participate in infrastructural development projects that could produce substantial outcomes.

Secondly, in order to reinforce its weakened R&D, skills, and educational conditions, SA could also suggest terms of contract which contained specific action plans such as the conducting of joint research projects, the initiation of researcher or student exchange programs, and the sharing of educational training programs on the condition that they can provide additional incentives according to the performance of the research conducted – aside from other existing preferential conditions. The view of these partnerships should be to not only produce improved research outcomes, but also to promote the research skills of its academics, and thereby to boost the capacity of SA's domestic minerals industry by inculcating the skills of countries with more advanced technologies in the area of mineral resources such as Japan and China.

Thirdly, although the WO analysis did not specifically highlight the problematic issue of the promotion of downstream industries, this matter is directly connected to the requirement of job creation that was promoted at Manguang in 2012 as being the single highest priority of SA's mineral policy. Thus, the revitalization of SA's manufacturing industries through the use of its abundant mineral resources and the technological advancement of its beneficiation processes must be a significant item on the roadmap of sustainable economic growth for SA. To enable inclusive economic growth through creating job opportunities, SA must forge these mutually beneficial joint ventures with foreign companies related to the steel, vehicle, and materials industry, and advance their mining technologies to bring them up to date with Asian countries. For that reason, Korea or Japan, which both have significant development experience through their own steel, car, and electronic industries, would appear to be the most appropriate partner for SA, since SA can obtain a practical transfer of the techniques needed to strengthen the competitiveness of their domestic industry and enable job creation over the long term.

Solutions to the matrix of ST and WT can be envisaged by examining the answers found in SO and WO – seeking substantial outcomes based on market principles. From the SWOT Matrix above, it is apparent that while we cannot say with definitiveness that these proposed models would produce the most optimal bilateral benefits, nevertheless the elements of comparison and choice are fundamental to facilitate the trade in mineral resources between importers and exporters and must be integrated into any model adopted by Africa in its foreign relations. It is incumbent on Africa that it views itself as more than simply a recipient of the unlimited financial, infrastructural, and educational support from countries with their own political and economic motivation. Rather, Africa must demonstrate a willingness to sovereignly address its internal and external environmental challenges by adding comparison and choice to enable competitiveness, and learn to develop its own strengths to produce sustainable development and growth by promoting foreign investments and partnerships rather than regulatory, protectionist, and restrictive policies.

CHAPTER 5

CONCLUSION

REEs have increasingly become a fundamental component of technologies across a vast spectrum of industrial mechanisms, to the extent that they are becoming a key factor to influence the policies of developed countries.

While we have not yet witnessed the appearance of RN, we have begun to see counterstrategies by nations concerned about their ability to secure a stable supply chain, as a response to the monopolistic attempts of China towards particular minerals, manifested in the shape of regulatory, protectionist, and restrictive mineral policies.

The policy directions of resource-rich countries have focused around the enhancement of mining production, domestic R&D ability, and international efforts to forge beneficial relationships between trading partners on the principle of free trade, as witnessed in the case of the WTO. In contrast, resource-poor countries have adopted a spectrum of efforts such as seeking to diversify their supply lines, the fostering of their recycling industry, the enhancement of research abilities, and the building of flexible stockpiling systems to smooth the procurement of mineral resources. Through lessons gleaned from these endeavors, countries with a lack of domestic mineral resources such as Korea have gained valuable expertise in coping with the inherent turbulence caused by resource-dependency.

Although it is undoubtedly reasonable for countries to prepare a diversity of countermeasures against the possibility of supply shortages of mineral resources, the paramount matter is to build sound relationships to facilitate mutual benefits, since some countries have determined not to adhere to the WTO's exhortation of free trade between traders. In a real sense, the proportion of undesirable relationships appears more dominant than healthy ones, as confirmed previously in chapters 2 and 3.

The initiative to build these relationships does not necessarily depend on the quantity of domestic mineral resources, as evidenced by the fact that China's overseas mineral policies are very aggressive, whereas African countries have proven reticent to take diplomatic initiative towards the three competing Asian countries.

For that reason, a cooperative model cannot be made without mutual efforts and harmony between partners in ways that transcend superficial imbalances of power. As we observed, these disparities would certainly never disappear entirely due to the ways in which they threaten the mutual benefit of relationships if competiveness, comparison, and choice do not operate in harmony. Due to the tension between these essential elements particularly around the factors of comparison and choice, the policy instruments of Africa have failed to produce a convincing cooperative model.

The reform of SA's policy instruments should be extended beyond a limited spectrum of fields in order to address and cover the educational, infrastructural and R&D agendas comprehensively and integrally for each cooperative model; thoroughly fulfilling the conditions of the SWOT Matrix and inspiring sincerity towards potential bidders. If South Africa strengthened its own policy instruments by developing a cooperative model operating organically on the attributes of competitiveness, comparison, and choice, and was willing to stand as a representative of Africa, it could have the capacity to become a formidable trading partner to facilitate equitable mineral and REE policies between Asian countries such as Korea and Africa, and to provide an example to the rest of Africa of the potential to create win-win situations and foster economic growth through the prudent management of mineral resource endowments.

Beyond question, the resultant cooperative model based on the principles outlined above, would contribute to facilitating mineral trading between importers and exporters and to maximizing the domestic benefits to SA. A mineral market controlled by sound trading principles would be a far more attractive prospect to draw partner investors to the country, enabling long-term growth of trading volumes in mineral resources compared to the currently compromised situation caused by distorted policies. Figure 7 described the ways in which SA can bolster its weaknesses for beneficiation, resulting in sustainable job creation. Moreover, SA's trading partners would also enjoy synergistic benefits, as they would not only enable economic growth in SA according to the goals encapsulated in the Opportunity quadrant of the SWOT Matrix, but also secure for themselves a stable supply chain of needed mineral resources.

In conclusion, it is evident that, given the increasing importance of REEs, and the global tensions around their acquisition and stockpiling, it is crucial to develop policies that emphasize mutual beneficiation and cooperation between trading partners, in order to enable resource rich countries to foster economic growth, and to enable resource poor countries to obtain a reliable supply chain of mineral resources.

REFERENCES

African National Congress (ANC). 1955. *The Freedom Charter adopted at the Congress of the People.* Available: http://www.anc.org.za/show.php?id=72[1955, June 26]

African National Congress (ANC). 1992. *Ready to Govern: ANC policy guidelines for a democratic SA adopted at the National Conference.* Available: http://www.anc.org.za/show.php?id=227#D

African National Congress (ANC). 2012. *53rd National Conference RESOLUTIONS.* Available: www.anc.org.za/docs/res/2013/resolutions53r.pdf [2012, December 16]

African Union (AU). 2009. *Africa Mining Vision*. Available: http://pages.au.int/sites/default/files/Africa%20Mining%20Vision%20english_1.pdf: 5

African Union (AU). 2011. *Minerals and Africa's Development.* Available: http://www.africaminingvision.org/amv_resources/AMV/ISG%20Report_eng.pdf: 3, 103

Aoki, K. 2013. *SAIIA POLICY BRIEFING 66: Japan & TICAD Process.* Available: www.saiia.org.za/doc_download/170-japan-the-ticad-process

Bradsher, K. 2009. *China Outlines Plans for Making Electric Cars*. Available: http://www.nytimes.com/business/energy environment/11electric.html (2009.April 10)

Bradsher, K. 2010. *Amid Tension, China Blocks Crucial Exports to Japan*. Availabl: http://www.nytimes.com/2010/09/24/business/global/24rare.html?pagewanted+all.&_r=0 (2010.September 23)

Broadman, H.G. 2007. *Africa's Silk Road China and India's New Economic frontier.* Washington. The World Bank: 1

Burgess, S. 2010. *Sustainability of Strategic Minerals in Southern Africa and Potential Conflicts and Partnerships.* U.S. Air Force Academy, Institute for National Security: 6-12

Cho, R. 2012. *Rare Earth Metals: Will We Have Enough?* Available: http://blogs.ei.columbia.edu/2012/09/19/rare-earth-metals-will-we-have-enough/[2012, September 19]

Chosunilbo. 2011. *Rare Earth Deposits Found in Korea.* Available: http://english.chosun.com/site/data/html_dir/2011/06/30/2011063000823.html[2011, June 30]

Cisse, D. 2012. *Policy Briefing, FOCAC: trade, investments and aid in China-Africa relations.* Stellenbosch University: the Centre for Chinese Studies

Congressional Research Service Library of Congress (CRSLC). 2008. *China's Foreign-Policy and "Soft Power" in South America, Asia, and Africa.* Available: http://fas.org/irp/congress/2008_rpt/crs-china.pdf[2008, April]

Crowson, P.C.F. 2008. *Mining unearthed: the definite book of how economic and political influences shape the global mining industry.* UK: Aspermont

Daily Maverick (DM). 2014. *SA Mining: What an Iraqi in Norway can teach us all.* Available: http://www.dailymaverick.co.za/article/2014-07-25-sa-mining-what-an-iraqi-in-norway-can-teach-us-all/[2014, July 25]

DME. 1998. *White Paper, 'A Minerals and Mining Policy for SA.* Available: http://www.dmr.gov.za/publications/summary/125-white-papers[1998, October]

DME. 2002. *The MPRDA.* Available: http://www.dmr.gov.za/publications/summary/109-mineral-and-petroleum-resources-development-act-2002

DME. 2010. *AMENDMENT OF THE BROAD-BASED SOCIO-ECONOMIC EMPOWERMENT CHARTER FOR THE SOUTH AFRICAN MINING AND MINERALS INDUSTRAL.* Available: http://www.dmr.gov.za/publications/finish/108-minerals-act-charter-and-scorecard

DME. 2011. *A BENEFICIATION STRATEGY FOR THE MINERALS INDUSTRY OF SA.* Available: http://www.gov.za/documents/download.php?f=147564.

DongA.com. 2010. The cooperation to secure REEs between Korea and Japan. Available: http://news.donga.com/3/all/20101127/32899797/1[2010, November 27]

EC. 2008. *Communication from the commission to the European parliament and the council.* Brussels: 6-9

EC. 2010. *EUROPE 2020 A European strategy for smart, sustainable and inclusive growth:* 3-4

EC. 2013. *Report from the COMMISSION to the European Parliament, the council, the European economic and social committee and the committee of the regions, 'On the implementation of the RMI'.*

EC. 2014. *Commission staff working document, 'On the implementation of the RMI'.*

EC. 2014. *Report on CRM for the EU, 'Report of the Ad hoc Working Group on defining CRM'*: 3-5, 33

Energy Economy News (EKN). 2011. *Precise survey on Chungju and Chungcheong deposits in 2012.* Available: http://www.ekn.kr/news/article.html?no=72184[2011, October 12]

Financial News. 2011. Delegation formed by public and private members visiting on three African countries. Available: http://www.fnnews.com/view?ra=Sent0801m_View&corp=fnnews&arcid=111030123411&cDateYear=2011&cDateMonth=10&cDateDay=30[2011. October 30]

Gerber, L. 2012. *The position of the EU in global mineral interactions.* Scotland: University of Dundee

Global Legal Research Center (RLRC). 2011. *Regulation of Foreign Aid in Selected Countries. Washington.* The Law Library of Congress: 233-234

Government Gazette of SA. 1994. *Reconstruction and Development (RDP).* Available: www.gov.za/documents/download.php?f=70427[1994, November 23]

Grimm, S. 2012. *FOCAC's role and functioning.* Available: www.sun.ac.za/ccs [2012, May]

Gumede, W. 2012. *FPC Briefing: Challenges facing SA-China relations.* Available: http://fpc.org.uk/articles/550[2012, May]

Hoatson, M. Jaireth, S & Miezitis, Y. 2011. *The major rare-earth-element deposits of Australia: geological setting, exploration, and resources.* Australia, Department of resources, energy and tourism: 14-20.

Humphries, M. 2012. *REEs: The Global Supply Chain*, Congressional Research Service Report R41347:2

Humphries, M. 2013. *REEs: The Global Supply Chain*, Congressional Research Service Report R41347:1. 5. 7

Hurst, C. 2010. *The Rare Earth Dilemma: China's Market Dominance.* Available: http://www.thecuttingedgenews.com/index.php?article=21786 [2010. November 22]

Hurst, C. 2011. *Japan's Approach to China's Control of REEs.* Available: http://fmso.leavenworth.army.mil/documents/Japan's-approach.pdf [2011, April 22]

Inoue, Y and Gordon, J. 2011. *Japanese rare earth consumers set up shop in China.* Available: http://www.reuters.com/news/video?videoChannel=1003 (2011. August 12)

IWATA, T. 2012. *Comparative Study on "Asian" Approaches to Africa: An Introductory Reflection.* In African Study Monographs, 33(4):209-231

Japan Metal Bulletin. 2010. *NEDO Succeeds in 40% Less Dysprosium Use in Neodymiu m Magnet.* Available: http://www.japanmetalbulletin.com/?p=4237[2010, December 28]

Japanese prospectus. 2014. *Embassy of Japan in South Africa.* Available: http://www.za.emb-japan.go.jp/en/Japan_SA/japanese_prospectus2014.pdf

Jauch, H., Traub-Merz, R. 2006. *The Future of the Textile and Clothing Industry in Sub-Saharan Africa.* Friedrich-Ebert-Stiftung. Etienne Vlok : 238

Jing, Y.C. 2011. *Resolve Falters As Global Prospects Worsen: The 9th GTA Report*. London. Center for Economic Research: 51-53

JOGMEC. 2013. *Annual Report*. Available: http://www.jogmec.go.jp/content/300120179.pdf [2013, March 31]

Kaplan, D. 2011. *South African mining equipment and related services: Growth, constraints and policy.* Department of Economics University of Cape Town. UCT

Kim, D.H. 2011. *The resource war of REEs*, Miraebook

Kim, Philsu. 2009. *The Implications and Securing Strategies on Rare Earth Metals of China and Japan:* 11

Kim, S. 2012. *Korea in Africa: A Missing Piece of the Puzzle?* : LSE. Available: http://www.lse.ac.uk/ideas/publications/reports/pdf/sr016/sr-016-kim.pdf: 54-55

Kim, Y. 2012. *Korea's approach for Africa's inclusive growth: KOAFEC.* Available: www.sun.ac.za/ccs

Lagerkvist, J., Jonsson, G. 2011. *UI Occasional papers, Foreign aid, trade and development, the strategic presence of China, Japan and Korea in sub-Saharan Africa.* Sweden. Stockholm University: 34

Leeuw, P.J.K. 2011. *South African Mineral based model: A plausible option.* Wits University School of Mining Engineering. University of the Witwatersrand: 17

Lum, T., Fischer,H., Gomez-Granger, & J,Leland. 2009. *China's Foreign Aid Activities in Africa, Latin America, and Southeast Asia*, Congressional Research Service Report R40361:1-25

Lynas Corporation Ltd. 2010. *Will there be sufficient rare earths to meet demand from clean energy technology?*: 10

Mail & Guardian. 2012. *Nationalization of mines dead and buried.* Available: http://mg.co.za/article/2012-12-20-nationalisation-of-mines-dead-and-buried[2012. December 20]

Metal's Edge. 2010. *The Rare Earth Dilemma: China's Rare Earth Environmental and Safety Nightmare.* Available: http://fmso.leavenworth.army.mil/documents/China's-rare-earth-nightmare.pdf (2010. November)

MINGINGQ. 2014. *Platinum Mining in SA.* Available: http://www.projectsiq.co.za/platinum-mining-in-south-africa.htm

Minister of Mineral Resources (MMR). 2013. Mineral and Petroleum Resources Development Amendment Bill. Available: http://jutalaw.co.za/media /filestore/2013/06/b015_2013.pdf [2013.May 31]

METI. 2011. *The Situation Regarding REEs.* Available: http://www.tremcent er.org/index.php?option=com_attachments&task=download&id=46 [2011, March]

ME. 2011. *The First Plan of Resource Recycling from 2011 to 2015.* Available: http://www.me.go.kr/home/web/policy_data/read.do?pagerOffset=0&maxPageItems=10&maxIndexPages=10&searchKey=&searchValue=&menuId=92&orgCd=&condition.code=A601&seq=3486/[2011, September]

Ministry of Foreign Affairs (MOFA). 2013. *The Embassy of the Republic Korea to the Republic of South Africa: Korea-South Africa Relations.* Available: http://zaf.mofa.go.kr/english/af/zaf/bilateral/bilateral/index.jsp?sp=/webmodule/htsboard/template/read/engreadboard.jsp%3FtypeID=16%26boardid=6166%26seqno=702322%26tableName=TYPE_ENGLEGATIO[2013. November 15]

Ministry of Government Legislation (MGL). 2013. The law of the resources saving and the recycling fostering. Available: http://www.law.go.kr/[2014. May 23]

MKE. 2010. *Plans for Stable Procurement of Rare Metals. Available:* http://www.mke.go.kr[2010, October]

Molycorp, Inc. 1994. *A Lanthanide Lanthology; Part II, M-Z.*California:33-35

Morrison, W. M. and Tang, R. 2012. *China's Rare Earth Industry and Export Regime: Economic and Trade Implications for the United States*, Congressional Research Service Report R42510:6-22

Newspim. 2011. *The enhancement of REEs stockpiling of KORES.* Available: http://newspim.com/view.jsp?newsId=20110929000243[2011, September 29]

Nieto, A. Iannuzzi, M. 2012. *Supply-and-demand geoeconomic analysis of mineral resources of rare earth .elements in the United States.* Mining Engineering. 64(4):76.

NIMS. 2008. *Japan's "Urban Mines" are Comparable to the World's Leading Resource Nations.* Available: http://www.nims.go.jp/eng/news/press/2008/01/p200801110.html [2008, January 11]

NIMS. 2009. *Overview of Japanese Research Activity on Critical Raw Materials.* Available: *http://www.jst.go.jp/* [2011, November 21]

Kara, H. Chapman, A. Crinchton, T. Willis, P. Morley, N. 2010. *Lanthanide Resource and Alternatives.* Available: http://www.oakdenehollins.co.uk [2010. May 26]

OECD. 2010. *Trends in South African Income Distribution and Poverty Since the Fall of Apartheid.* Available: http://npc.gov.za/MediaLib/Downloads[2010. May 28]

OFFICE of the United States Trade Representative (USTR). 2011. *WTO Panel Finds Against China's Export Restraints on Raw Materials.* Available: http://www.ustr.gov/about-us/press-office/press-releases/2011/july/wto-panel-finds-against-chinas-export-restraints-raw[2011, July]

Osterreichische Forschungsstiftung for Internatioanle Entwicklung(OFSE). 2013. *The EU RMI-scope and critical assessment.* Available: http://www.oefse.at/Downloads/publikationen/eu_raw_materials_BP8.pdf.[2012, September]

Pannell, C.W. 2008. *China's Economic and Political Penetration in Africa, In Eurasian Geography and Economics.* Bellwether Publishing, Ltd. 708-713

Pencht, M. Kaczmarek, R.Song,X.Hazelwood,D.Kavetsky,R.Nannd,D.K. 2011. *Rare Earth Materials Insights and Concerns. University of Maryland. College Park, MD*

Piedra, J. 2012. *Commodity Lead-REEs*. Q3 – 2012 & Q2 – 2012.KPMG:2. Available : https://www.kpmg.com/ZA/en/IssuesAndInsights/ArticlesPublications/Quarterly-Commodity-Insights/Documents/Quarterly%20Commodity%20Insights%20Bulletin_REE%20%20Q3%202012%20and%20Q22012.pdf[2012, October]

Korea Government Policy Briefing (KGPB). 2013. The supporting of industrial field through cooperation between related departments on stockpiling of mineral resources. Available: http://www.korea.kr/policy/pressReleaseView[2013, December 27]

PRC. 2013. *Whitepaper: China-Africa Economic and Trade Cooperation.* Available: http://www.safpi.org/sites/default/files/publications/China-AfricaEconomicandTradeCooperation.pdf [2013, August]

Pui-Kwan, T. 2011. *China's Rare-Earth Industry*. Open–File Report 2011–1042. USGS: 1-3. Available: http://pubs.usgs.gov/of/2011/1042/of2011-1042.pdf

Raquel Quaresma de Lima. 2012. *Strategic minerals and security of supply-the case of niobium: What would be the possible effects of eventual export restrictions applied by brazin and how would it possibly impact the mineral policies of consuming countries?* Available: www.dundee.ac.uk/cepmlp/gateway/files.php?file=cepmlp-car16.[2012, January 2]

Risk & Policy Analysts (RPA). 2012. *Stockpiling of Non-energy Raw Materials*. Available: http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/stockpiling-report_en.pdf [2012, March]

SAIS. 2010. *US-KOREA 2010 YEARBOOK*. Massachusetts. US-KOREA INSTITUTE

SATO, M. 2010. *Japanese Aid Diplomacy in Africa: An Historical Analysis.* Ritsumeikan Annual Review of International Studies. ISSN 1347-8214. Vol.4. pp.67-85

Schüler, D. Buchert, M. Liu, R. Dittrich, S. Merz, C. 2011. *Study on rare earths and their recycling*, Darmstadt, OKO-insititute.v:8.30-45

Seaman, J. 2010. *Rare Earths and Clean Energy: Analyzing China's Upper Hand*. Paris. IFRI: 10-27

Shaw, S. Chegwidden, J. 2012. *Global drivers for rare earth demand*. Roskill. Roskill Information Services.

Shinn, D.H. 2011. *China's Growing Role in Africa: Implications for U.S Policy.* Washington: George Washington University

Shujinan, Z. 2013. *Problems and Countermeasures of Rare Earth Industry in China*, Canadian Social Science. Vol. 9, No. 3, 2013, pp. 9-14

Sibiya, B. 2012. SA *can be the 'world champion' of mining. SA.* Chamber of Mines of SA (CM): 6, 8

Standard Chartered (SC). 2011. *China-Africa trade - Setting the scene for the future.* Available: https://research.standardchartered.com/configuration/ROW%20Documents/China-Africa%20trade%20%E2%80%93%20Setting%20the%20scene%20for%20the%20future_01_04_11_17_31.pdf [2011, April 1]

State Intervention in the Minerals Sector (SIMS). 2012. *Maximizing the Developmental Impact of the People's Minerals Assets: SIMS.* ANC Policy Institute: 24

The Export-Import Bank of Korea (KERI). 2012. *World Nation Handbook.* Available: http://keri.koreaexim.go.kr/keri/bbs/pubb/view.jsp?no=12685&bbs_code_id=1311915013319&bbs_code_tp=BBS_5&code_tp=D02_124&code_tp_up=D02[2012, July 1]

Tiess, G. 2010. *Minerals policy in Europe: some recent developments,* Resources policy 35: 192-193

TODAY'S ZAMAN. 2011. T*oyota Motor Corp. developing new type of electric motor.* Available: http://www.todayszaman.com/news-232778-toyota-motor-corp-developing-new-type-of-electric-motor.html [2011, January 18]

Trading Economics (TE). 2014. South Africa Unemployment Rate. Available: http://www.tradingeconomics.com/south-africa/unemployment-rate

UN. 1962. *Permanent Sovereignty over Natural Resources General Assembly resolution 1808*. Available: http://legal.un.org/ha/ga-1803/ga-1803.html[1962, December 14]

United Nations Conference on Trade and Development (UNCTAD). 2008. World Investment Directory. Available: http://unctad.org/en/pages/publications/World-Investment-Directory.aspx[2008, April 1]

United States Government Accountability Office (GAO). 2010. *Rare Earth Materials in the Defense Supply Chain.* Available: http://www.gao.gov/products/GAO-10-617R [2010, April 14]

U.S. Department of Energy (US DoE). 2010. Critical Material Strategy. Available: http://energy.gov/sites/prod/files/piprod/documents/cms_dec_17_full_web.pdf[2010. December]

USGS. 2008. *Mineral Commodity Summaries*, USA, U.S Department of the Interior: 135

USGS. 2011. *Mineral Commodity Summaries*, USA, U.S Department of the Interior: 18-129

USGS. 2013. *Mineral Commodity Summaries January 2013*, USA, U.S Department of the Interior: 129

US National Research Council. 2008. *Managing Materials for a Twenty-first Century Military*. Available at http://books.nap.edu/

Vulcan, T. 2008. *Rare earth metals: not do rare, but still valuable.* Available: http://www.hardassetsinvestor.com/interviews/1266-rare-earth-metals-not-so-rare-but-still-valuable.html[2008, November 4]

Wall Street Journal (WSJ). 2010. *Rare-Earth Miner in U.S. Tackles China, Its Own Past.* Available: http://online.wsj.com/articles/SB1000142405274870444760457600729092804990 6 [2010. December 20)

Watanebe, M. 2008. *Japan's Foreign Aid Policy in Transition: An Interpretation of TICAD IV.* Available: http://www.grips.ac.jp/forum/pdf08/jaa_0803_fokus_ watanabe.pdf [2008, March]

Wild, L., Denney, L., Menocal, A.R., & Geddes, M. 2011. *Informing the Future of Japan's ODA.* London. Overseas Development Institute (ODI)

Wocke, A., Sing, L. 2013. *Inward FDI in SA and its policy context.* Vale Columbia Center. Columbia University: 2, 6

World Foresight Forum (WFF). 2011. *Rare Earth Elements and Strategic Mineral Policy.* Available: http://issuu.com/aloisclemens/docs/world_foresight_forum_rapport_rare [2011, April 11]

WTO. 2010. *Trade in Mineral Resources, Background paper to the 2010 World Trade Report.* Available: http://www.wto.org/english/res_e/reser_e/ersd201001_e.pdf [2010. January]

WTO. 2013. *Dispute Settlement: Dispute DS394, China — Measures Related to the Exportation of Various Raw Materials.* Available: http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds394_e.htm#bkmk394r [2013, January 28]

WTO. 2013. *Trade profiles of China.* Available: http://stat.wto.org/CountryProfile/ WSDBCountryPFView.aspx? Country=CN&

Xinhua press. 2013. *Experts call for mechanism to fight illegal rare earth mining. Available*: http://www.globaltimes.cn/content/802811.shtml (2013. August 9)

Yan Pei. 2011. *Japanese rare earth consumers move production to China.* Available: http://www.china.org.cn/business/2011-08/17/content_23230719.htm (2011. August 17)

Yonhap News Agency (YNA). 2011. *The conducting of mutual research on manufacturing technology of REEs with China.* Available: http://news.naver.com/main/read.nhn?mode=LSD&mid=sec&sid1=101&oid=001&aid=0005023643[2011, April 21]

Yonhap News Agency (YNA). 2013. *Low rate of success on development business of overseas resources.* Available: http://news.naver.com/main/read.nhn? mode=LSD&mid=sec&sid1 =101&oid=001&aid=0006569756 [2013, October 31]

APPENDIX

Elemental strategy 16 projects

The name of project	Designated Organization	Year
Development of Hot-dipped Aluminum Alloy Coated Steels	Toru Tsuru Tokyo Institute of Technology	2007
Development of the next-generation nonvolatile memory using anodized aluminum film	Giyuu Kido NIMS	
The new function which hydrogen induces in subnano lattice substance	Masuo Okada Tohoku University	
Self-forming Nano-particle Catalyst without Precious Metals	Yasuo Nishihata Japan Atomic Energy Agency	
Development of Barium-based New Lead-free Piezoelectric Materials with Ultrahigh Piezoelectric Property for Piezoelctric Frontier	Satoshi Wada University of Yamanashi	
Development of IiO2-based Transparent Electrode	Tethuya Hasegawa Kanagawa Academy of Science and Technology	
High Performance Anisotropic Nano composite Permanent Magnets with Low Rare Earth Content	Satoshi Hirosawa Hitachi Metals	
Material Design and Processing of Highly-Dispersed Catalyst with Minimum Precious Metal Loadings	Masato Machida Kumamoto University	2008
Nano-hybridized Precious-metal-free Catalysts for Chemical Energy Conversion	Kohei Uosaki Hokkaido University	
Development of Innovative Energy Conversion Systems with Molecular Catalysts Replacing Precious Metals	Yoshinori Naruta Kyushu University	
Ubiquitous Element Strategy for Function Emergence	Hideo Hosono Tokyo Institute of Technology	
Functional design by precise synthesis of silicon oxide compounds	Kazuyuki Kuroda Waseda University	
Design and Processing of Functional Materials with Multi-elements Based on Chemical Potential Diagrams	Tetsuya Uda Kyoto University	2009
Organic Molecular Approach to High-performance secondary Batteries and Mechanistic Elucidation of Charge-discharge Processes	Yasushi Morita Osaka University	
Development of the plantinoid-elements free functional magnetic material by compound interface control	Eiji Kita University of Tsukuba	
Development of Eco-friendly Post Lithium-ion Batteries	Shigeto Okada Kyushu University	

Source: NIMS. 2009. Overview of Japanese Research Activity on critical raw materials