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Problems, Strategy and Implementation in China's Rare Earth Industry

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Abreviations

ACREI	(Association of China Rare Earth Industry) [中国稀土行业协会]
ANT	Actor-Network Theory
CNMM	China Non-Ferrous Metals Mining Group (中国有色矿业集团有限公司)
CCCMC	China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters
CCP	Chinese Communist Party
CISRI	China Iron and Steel Research Institute Group 中国钢研科技集团有限公司
COE	Central government-Owned state enterprise
DSB	Dispute Settlement Body of the World Trade Organization
EIA	Environmental Impact Assessment
EPB	Environmental Protection Bureau at a local level
GAC	General Administration of Customs
GATT	General Agreement on Tariffs and Trade
GNFM	Guangdong Guangsheng Non-Ferrous Metals Group
GDP	Gross Domestic Product
GZRE	Ganzhou Rare Earth Group (赣州稀土集团)
IMEITC	Inner Mongolia Economy and Information Technology Commission (自治区经济和信息化委员会)
LRB	Land Resources Bureau at local level
km	kilometer
km^2	square kilometer
M&A	Mergers and Acquisitions
Mt	Million tons (Megatons)
MEP	Ministry of Environmental Protection
m^2	Square meters
mg/L	Milligram per liter
MIIT	Ministry of Industry and Information Technology
MLR	Ministry of Land Resources
MOC	Ministry of Commerce
MOF	Ministry of Finance
MOFTEC	Ministry of Foreign Trade and Economic Cooperation (对外贸易经济合作部)

Nd	Neodymium
NdFeB	Neodymium-Iron-Boron magnet
NDRC	National Development and Reform Commission
NPC	National People’s Congress
OECD	Organisation for Economic Co-operation and Development
POE	Province-Owned state enterprise
REE	Rare Earth Elements
REI	Rare Earth Information [稀土信息]
REO	Rare Earth Oxides
REOe	Rare Earth Oxide equivalent
RMB	Renminbi (People’s Currency)
SAMR	State Administration for Material Reserves
SASAC	State-Owned Assets Supervision and Administration Commission
SOE	State-Owned Enterprise (including COE and POE)
SPC	State Planning Commission (国家发展计划委员会)
SDPC	State Development Planning Commission (国家发展计划委员会)
SAT	State Administration of Taxation (国家税务总局)
t	tons
t/yr	tons per year
TVE	Township and Village Enterprises
USGS	United States Geological Survey
USTR	United States Trade Representative
WTO	World Trade Organization
XMC	Xunwu Mining Company (寻乌矿业公司)

Short Summary

This book deals with China's policy regarding the rare earth industry. The rare earths, a group of special metals, have gained enormous economic importance in recent years due to their comprehensive application in high technology such as electric vehicles and wind turbines. As China has a global near-monopoly on delivering rare earths, its policy for rare earths has attracted the attention of global and European debates on resource security. In particular, Chinese export restrictions sparked concerns in the large consumer countries including Germany, Japan and the United States.

China's rare earth industry is currently at a profound turning point. The central government initiated a comprehensive policy program in 2005 and intensified efforts in 2009 to significantly restructure the industry. The top-down program is characterized by forceful centralization and coercive enforcement of goals. The measures include, for example, the limitation of rare earth extraction and the reorganization of industrial structure.

Against this backdrop, this book examines the motives, strategy and implementation of the current Chinese policy program. The research focuses primarily on the purpose behind the policy and the measures taken to realize this strategy. A core question regards how actors beyond the government influence the policy process during implementation. The research mainly centers on the time period from 2005 to the end of 2013.

The book's conceptual framework divides the policy process into three elements: problematization, strategy and translation. These concepts are based on elements of social constructivism and actor-network theory. Problematization refers to the process through which actors come to see a certain development as problematic and to believe that a fundamental change is necessary. Based on problematization, strategy encompasses the political goals and instruments that the relevant actor perceives as necessary for solving the identified problems and changing the status quo. Finally, translation is the specific implementation and enforcement of the political strategy, defined as a step-by-step process of translating policy from decision making to concrete local practices.

The research results show that China's government was already increasingly dissatisfied with the development of the rare earth industry in 1996. Two factors in particular led to the government's decision to adopt a new policy: first, the government believed that the rare earth industry would play a key role in high technology applications and that China would be in an advantageous position to use its vast resource abundance to strengthen future competitiveness. However, according to this view, China has not even come close to using this potential, exporting rare earth as raw materials at cheap prices and not as high-value end products that use the rare earths. According to this perspective, China would have to raise the prices for rare

earths and export less raw rare earth in order to make better use of the economic importance of rare earths.

A second factor that contributed to policy change was the mounting concern over the impending depletion of rare earth resources in China as well as the dramatic impact of mining and processing on the environment. The government reckoned that China would lose its advantage of a large resource endowment if extraction and global sales of its rare earths were to proceed at a high pace. In that case, China would not be able guarantee a stable supply to emerging industries in the future through its domestic rare earth sources.

Based on these perspectives, China developed a strategy for tackling these challenges. The strategy was marked by a decisive and pervasive intervention of the central government into the industry. This was a fundamental policy change because the central government had played only a marginal role in regulation of the rare earth industry up to that time. Local governments and private enterprises instead had previously dominated the industry. Through the efforts of the Ministry of Industry and Information Technology as well as the Standing Committee of the State Council, the political leadership enshrined its goals in a formal strategy by 2009.

The strategy focused on four areas: First, the aim was to markedly reduce the number of enterprises in industry and to let a few big state-owned champions prevail. Second, the central government intended to decrease the extraction and processing of rare earths, in particular through a clampdown on illegal mining. Third, the strategy strengthened environmental regulations and investigations for environmental protection. Fourth, the government brought down the export of rare earths through political export restrictions and took more rigorous actions against smuggling.

The research results show that the process of implementation and enforcement of the government's policy has been difficult, despite the centralization of decision-making power and intensive campaigns. Consequently, the policy program has underperformed in most areas to date.

In particular, many local governments below the provincial level, in conjunction with organized illegal mining, undermined large parts of the policy. Sub-provincial governments are in a powerful position due to their responsibility for supervising and enforcing policy measures. Many local cadres used their power to protect the profitable business of illegal mining, either because they have close relationships to the mining enterprises or because they are involved themselves. Despite the success in dramatically decreasing the official mining of rare earths, the central government has failed to contain illegal mining and thus to slow down the depletion of resources.

The Chinese leadership also fell short of success in export policy. China succeeded in reducing exports and smuggling of rare earths through a system of export quotas, licenses and export taxes. However, first and foremost the European Union, Japan and the United States brought the Chinese restrictions to trial at the Dispute Settlement Body of the World Trade Organization and achieved victory. China was forced to lift the core elements of its export restrictions.

The implementation of the strategy has been most successful in industry reorganization. This was made possible through the rather productive partnership with the provincial governments and the state-owned enterprises. However, even within this cooperation, large conflicts of interest emerged and the central government had to compromise with their partners. The provincial governments blocked most attempts by centrally owned enterprises to enter the provincial industries for rare earths. Instead, they promoted reorganization under the leadership of enterprises owned by the provinces. This helped to reduce the number of enterprises in the industry, but the central government had to accept a higher number of national champions and a stronger role for provincial enterprises than it had originally intended.

The government's ambitious policy for a profound change in the rare earth industry has not been very successful so far. As the policy continues, it is still possible that the government will achieve its goals. However, as of mid-2016 this was not the case.

Kurzzusammenfassung

Dieses Buch befasst sich mit Chinas Politik in der Industrie für Seltene Erden. Die Seltenen Erden, eine Gruppe von mehreren Spezialmetallen, hat in den vergangenen Jahren durch weitgehende Anwendungsmöglichkeiten in der Hochtechnologie, wie z.B. in Elektroautos oder Windkraftanlagen, wirtschaftlich an großer Bedeutung gewonnen. Da China der weltweit nahezu alleinige Anbieter Seltener Erden ist, ist besonders Chinas Politik für Seltene Erden in den Blickpunkt globaler und europäischer Debatten um Ressourcensicherheit gerückt. Insbesondere chinesischen Exportbeschränkungen haben für Unmut in großen Verbraucherländern wie Deutschland, Japan und den Vereinigten Staaten gesorgt.

Die Industrie für Seltene Erden befindet sich in China derzeit in einem großen Umbruch. Die Regierung versucht seit 2005 und verstärkt seit 2009 in einem groß angelegten Programm, die Industrie grundlegend neu zu ordnen. Das Programm ist von einer starken Zentralisierung und zwanghaften Durchsetzung von Zielen von oben herab geprägt. Dazu gehörten etwa die Beschränkung der Produktion von Seltenen Erden und die Reorganisation der Industriestruktur.

Vor diesem Hintergrund analysiert das Buch die Motive, Strategie und Umsetzung dieses chinesischen Politikprogramms. Das wesentliche Erkenntnisinteresse ist auf die Fragen gerichtet, was China mit dieser Politik bezweckt und mit welchen Maßnahmen es seine Strategie verwirklichen will. Darüber hinaus ist eine Kernfrage, inwiefern Akteure außerhalb der Regierung den Politikprozess während der Umsetzung beeinflussen. Der wesentliche Untersuchungszeitraum konzentriert sich auf die Jahre 2005 bis Ende 2013.

Der konzeptionelle Rahmen des Buches unterteilt den Politikprozess in drei Elemente: Problematisierung (“problematization”), Strategie (“strategy”) sowie Übersetzung (“translation”). Die Konzepte orientieren sich dabei an der Theorie des Sozialkonstruktivismus sowie der Akteurs-Netzwerk-Theorie. Problematisierung beschreibt den Prozess, durch den einzelne Akteure zu der Überzeugung gelangen, dass eine Entwicklung problematisch ist und grundlegend verändert werden muss. Die Strategie umfasst darauf aufbauend jene politischen Ziele und Instrumente, die aus Sicht des handelnden Akteurs notwendig sind, um die aufgeworfenen Probleme zu korrigieren und eine Änderung des vorhandenen Zustands hervorzurufen. Übersetzung beschreibt schlussendlich die konkrete Umsetzung und Durchsetzung der politischen Strategie – definiert als ein schrittweiser Übersetzungsprozess von der Politikentscheidung hin zu konkreten lokalen Praktiken.

Die Forschungsergebnisse zeigen, dass Chinas Regierung bereits seit 1996 zunehmend unzufrieden mit der Entwicklung der Industrie für Seltene Erden war. Vor allem zwei übergeordnete Faktoren beeinflussten den Entschluss der Regierung, einen Politikwechsel zu vollziehen. Die Regierung war erstens überzeugt, dass die Industrie für Seltene Erden in der Hochtechnologie eine Schlüsselrolle einnehme und China durch seinen Ressourcenreichtum über eine außerordentliche Ausgangslage für die zukünftige Wettbewerbsfähigkeit verfüge. Dennoch habe nach dieser Ansicht China dieses Potential nicht annähernd genutzt und exportiere vornehmlich Seltene Erden in Roh-Form zu billigen Preisen anstelle von hochwertigen Endprodukten, die auf Seltenen Erden basieren. Um die wirtschaftliche Bedeutung der Seltenen Erden besser zu nutzen, so die Problematisierung der Zentralregierung, müssten etwa die Preise für Seltene Erden steigen und weniger Seltene Erden direkt in das Ausland exportiert werden.

Ein zweiter Faktor war die zunehmende Besorgnis über eine herannahende Erschöpfung der Ressourcen von Seltenen Erden in China sowie die dramatischen Auswirkungen des Bergbaus und der Weiterverarbeitung auf die Umwelt. Würde China im gleichen Tempo seine Seltenen Erden abbauen und weltweit verkaufen, so die Raison der Regierung, würde China sehr bald den Vorteil der großzügigen Ressourcenausstattung verspielen und eine ausreichende Rohstoffzufuhr aus eigener Kraft für die Zukunftsindustrien nicht mehr sicherstellen können.

Auf diesen Sichtweisen fußend entwickelte China eine Strategie, die genau diese Herausforderungen anging. Die Strategie war durch einen entschiedenen und durchdringenden Eingriff der Zentralregierung in die Industrie geprägt. Dies bedeutete einen fundamentalen Politikwandel, denn bis zu diesem Zeitpunkt hatte die Zentralregierung in der Regulierung der Industrie kaum eine Rolle gespielt. Stattdessen gaben Lokalregierungen und private Unternehmen den Ton an. Durch das Engagement des Ministeriums für Industrie und Informationstechnologie sowie das Innere Kabinett des Staatsrates gelang es der politischen Führung ab 2009, ihre Ziele klar durch eine formelle Strategie zu formulieren.

Die Strategie fokussierte sich auf vier Bereiche: erstens zielte sie darauf ab, die Zahl der Unternehmen in der Industrie deutlich zu reduzieren und den Bergbau wenigen großen staatlichen Champions zu überlassen. Zweitens war die Regierung darauf bedacht, den Abbau und die Verarbeitung von Seltenen Erden deutlich zu reduzieren, insbesondere durch ein hartes Vorgehen gegen illegalen Bergbau. Drittens beinhaltete die Strategie eine Stärkung von Umweltvorgaben und Umweltuntersuchungen. Viertens verringerte die Regierung den Export von Seltenen Erden durch politische Exportbarrieren und unterband vehementer den Schmuggel.

Wie die Untersuchung verdeutlicht, hat sich die Umsetzung und Durchsetzung der Regierungspolitik trotz der Zentralisierung der Entscheidungsgewalt und der hart durchgreifenden Kampagnen als ein schwieriger Prozess gestaltet. Daher ist das Politikprogramm bislang in den meisten Bereichen an seinen großen Ambitionen gescheitert.

Insbesondere viele lokale Regierungen unterhalb der Provinzebene in Verbindung mit dem organisierten illegalen Bergbau haben große Teile der Regierungspolitik zunichte gemacht. Die sub-provinziellen Regierungen sind durch ihre Verantwortung für die Überwachung und Durchsetzung der Politikmaßnahmen in einer großen Machtposition. Viele lokale Kader haben das ausgenutzt, um das profitable Geschäft mit illegalem Bergbau zu schützen, entweder weil sie gute Beziehungen mit den illegal operierenden Unternehmen pflegen oder selbst daran beteiligt sind. Obwohl die Regierung den offiziellen Abbau von Seltenen Erden drastisch senken konnte, ist es ihr nicht gelungen auch die illegale Produktion zu reduzieren und somit die Erschöpfung der Ressourcen zu verlangsamen.

Ebenfalls gescheitert ist Chinas Führung mit ihrer Exportpolitik. Es ist ihr zwar gelungen, den Export – und auch den Schmuggel – durch ein System aus Exportquoten, Lizensierungen und Exportsteuern zu verringern. Allerdings haben insbesondere die Europäische Union, Japan und die Vereinigten Staaten vor dem Schiedsgericht der Welthandelsorganisation erfolgreich gegen diese Maßnahmen geklagt. China sah sich daher gezwungen, die wesentlichen Elemente seiner Exportbeschränkungen aufzuheben.

Am erfolgreichsten war die Umsetzung der Strategie dagegen in der Reorganisation der Industrie. Dies gelang vor allem durch die Zusammenarbeit mit den Provinzregierungen und den großen staatseigenen Betrieben. Aber auch hier bestanden innerhalb der Kooperation große Interessensunterschiede. Die Zentralregierung musste einschneidende Kompromisse akzeptieren. Die Provinzregierungen blockierten in den provinziellen Industrien für Seltene Erden die Beteiligung von staatseigenen Betrieben, die direkt dem Zentralstaat unterstehen, und förderten stattdessen die Reorganisation der Industrie unter Führung ihrer provinzeigenen Unternehmen. Dadurch verringerte sich zwar die Zahl der Unternehmen in der Industrie, die Zentralregierung musste aber eine höhere Zahl von nationalen Champions und eine stärkere Rolle der Provinzunternehmen als ursprünglich vorgesehen akzeptieren.

Das großangelegte Programm zur Neuordnung der Industrie für Seltene Erden war bislang kein großer Erfolg. Allerdings sind die Maßnahmen auch noch nicht beendet. Nach wie vor besteht die Möglichkeit, dass die Regierung ihre Ziele erreicht. Nach dem Stand von Mitte 2016 ist dies jedoch noch nicht eingetreten.

PART I

1. Introduction

According to an ancient and popular Chinese idiom, there was once a ninety-year old man who was bothered by two mountains in front of his home that blocked his view. He became a laughing stock when he proposed to level the two mountains, but this did not deter him from his goal. The man got his family to chip away at every rock and throw the pieces into the sea. Deeply moved by the old man's determination, the Gods moved the mountains away (Giddens and Giddens 2009, p. 39).

The story shows that anything is possible if one works hard. It could also be understood differently: there is a strong motivation in China to overcome nature and move entire mountains. Nothing could be truer today, as China is digging for valuable minerals across its entire territory. Moving mountains is no longer a miracle in contemporary China, but an everyday occurrence in modern mining. This "war against nature" traces back to the conviction of the Maoist era that "Man Must Conquer Nature" just as communist revolutionary forces reshape society (Shapiro 2001, p. 9).

China is a land of mineral extraction. Mining has been a major foundation of China's impressive economic development since 1978 (Zhu X 2006). The growing economy and intensifying urbanization have demanded huge amounts of material input in order to manufacture a variety of commodities and build up new infrastructure. The myriad cars, roads, buildings, and power stations consume millions of tons of steel, cement, coal and many other minerals and resources. Due to these needs, China is a very resource-intensive economy. The per capita consumption of base metals is relatively low, but measured against consumption per unit of gross domestic product (GDP), resource intensity is high (Roache 2012).

This has caused a strong appetite for overseas mineral resources (Moran 2010). China is the world's largest consumer of copper, aluminium, coal and other minerals (German Institute for Geosciences and Natural Resources 2013a) and China is one of the largest mineral importers. At the same time, China's enormous demand has led to intense domestic extraction and processing of minerals (Wübbeke 2012a). China is a global mining and processing center. The country produces nearly half of all global steel, 45 percent of aluminum metals, and 30 percent of smelted copper. It is the largest producer of several ferrous, non-ferrous and precious metals (World Steel Association 2013, World Aluminium 2013, International Copper Study Group 2012).

The intensive mineral utilization has worked out well for the economic model of the last 35 years. The focus on exports, investment and mass production rendered China's economic rise possible, but its ability to maintain high future economic growth is fading. Growth rates are falling, returns on investment are declining, labor costs are low but increasing, and the environmental impacts have reached an unbearable level (Morrison 2015; Economy 2010).

China debates and advances the transformation of its economy towards innovation-driven development, efficient use of resources and more domestic consumption. The old model is still prevalent, but is blending in with features of the new one (IMF 2013a; Segal 2010; Wilsdon 2007).

This transitory mixture of the two models is particularly relevant to the utilization of minerals. Production and demand for minerals are still at high levels, environmental impacts are severe and most products are of low quality. Simultaneously, more efficient and cleaner production, less intensive consumption patterns and innovative products are spreading throughout industry, decreasing the intensity of resource utilization (Ali 2009; McKay 2012).

1.1. Strong Government Intervention in the Rare Earth Industry

This book aims to understand why and how China carries out and is implementing the transformation of its mining industry. Its emphasis is on the efforts of the central government to transform the industry and it specifically draws on the case of the rare earth element industry (Wübbeke 2013a). The rare earth elements (REE) are a group of 17 metals with common geological occurrence and very similar physical and chemical characteristics. Compared to most other mineral industries such as iron, steel and coal, the industry is comparatively small (Song LG and Liu HM 2012). The REE industry developed rather later than these others, starting around the 1950s and only gaining noticeable economic value since the 1980s (Su WQ 2009).

The REE industry is very important to China. Despite its small size, the industry is essential to the economy and innovation because many high technologies use REE. Highly efficient gearless wind turbines, compact computer hard drives and efficient energy-saving bulbs rely on REE. Many modern electronic devices would be impossible to develop or would suffer significant performance losses without REE (BGS 2011).

Similar to other mineral industries in China, the REE industry has caused tremendous over-extraction and grave environmental pollution since the 1980s. During the 1980s and 1990s, the central government instigated intensive extraction made possible by weak regulation. Its main target was to increase production in order to export REE and earn foreign exchange. Domestic consumption was marginal. This fundamentally changed when the central government initiated a new strategy of strong intervention in 2005 and again intensified efforts in 2009 in order to realize a thorough economic transformation of the industry. Strong intervention replaced the previously weak regulation (Wübbeke 2013a).

This strong intervention is manifested in several ways. The central government has defined a set of new goals for the development of the industry. These include decreasing the high levels of production and exports, reducing the number of enterprises, improving and enforcing environmental standards, eliminating illegal production, and enhancing the use of REE for high technology. The highest state leadership, the Standing Committee of the State Council, assumed the lead in the policy to transform the industry.Governmental organizations have released new industry-related regulations at a very high frequency and the policy measures have intervened more deeply into the practices of the REE industry (Wang JZ 2011).

1.2. Research Questions

Beyond the domestic transformation of the mineral industry, a further international issue, which was first discussed in Organization for Economic Co-operation and Development (OECD) countries, serves as a point of departure for this book:[1] The Chinese government's strong intervention in the REE industry garnered attention beyond China's borders. REE policy in China does not affect the country alone, but also countries across the globe, because China has a near-monopoly on global production of REE. China supplied about 91 percent of global demand in 2013 (USGS 2014). One central measure that created concern was the rigid restriction of Chinese exports. Dependent almost solely on Chinese sources, the major foreign consumers in Europe, Japan and the United States have been very concerned about the possibility that they might be cut off from REE supply. A major outcry in these countries occurred in 2010 when China decided to dramatically cut its exports (Asahi 2010; Bai 2010; Kaufmann 2010; Economist 2010).

The issue of REE supply security entered an already existing general debate over critical materials in the OECD countries. REE have come to be seen as strategic resources. The politicized debate raises an important empirical question: What are China's motives behind reducing exports? This question is important because OECD countries want to understand why they face export restrictions and what conclusions they can draw for their future supply. OECD country practitioners and observers attributed all kinds of motivations to the Chinese policy, ranging from a contribution to an economic development strategy, to geopolitical motives, to environmental protection. Scientifically sound analyses of this development are mostly lacking. This book aims to provide an academic account of the Chinese government's intentions behind Chinese REE policy. To be sure, while the public debate in the OECD mostly revolved around Chinese export restrictions, this study considers in particular the wide range of policy elements aimed at the development of the domestic REE industry – also including export policy.

[1] I refer here to member countries of the OECD but in particular the European Union, Japan and the United States. I do so in order to avoid a dualistic thinking as is apparent in west vs. east or developed countries vs. developing countries.

Based on this debate over Chinese policy, this book deals with the first research question: Why and how has the Chinese central government been carrying out a new strategy of strong intervention in the REE industry since 2005?

To understand the central government's policy, it is insufficient to inquire only into the reasons motivating the strategy behind its actions. Implementation and enforcement are important features of Chinese politics. Being responsible for implementing decisions of the central government, local governments have considerable influence on the actual output of policy. The state capacity to enforce decisions vis-à-vis industrial and other actors is an important determinant of successful policy. During the multi-actor processes of implementation and enforcement the outcome of the central government's policy can markedly change (Naughton 1987).

Based on this issue of implementation and enforcement, this study also deals with the question: How, during the process of implementation and enforcement, are opponents of stricter regulation able to limit the government's success?

1.3. Research on REE

This book is related to two strands of academic research. The major outcry in some OECD countries over the Chinese export restrictions triggered the interest of social science in the political economy of REE. Before 2010, only chemists, physicians, engineers, geologists and economists dealt with the practical aspects of finding, extracting, and managing REE, which for a long time were exotic even in these circles (Szabadváry 1988). Since then, social science research on REE has emerged, paralleling the renewed research interest in critical raw materials. In the field of political and economic research about REE, three research orientations can be distinguished:

The "geopolitical" perspective seeks to understand the global implications of the political use of minerals. It regards REE and other critical materials as new strategic assets with the potential to influence the power game among states (Bilsborough 2012). Some authors refer to REE as potential "conflict elements" (Ting and Seaman 2013) and interpret China's near-monopoly on REE as a deliberate effort to achieve control over and regulate access to strategic resources. This "new mercantilism" in mineral politics strives to deliver advantages over other states (Humphreys 2013). This perspective is close to the scholarly discourse on "resource nationalism" with regard to China's oil demand (Mayer and Wübbeke 2013a). Authors sharing this perspective hold that the Chinese export restrictions could cause an unintended security dilemma (Ting and Seaman 2013).

The "economic" perspective deals with the economic implications of export restrictions. There is considerable research on the reasons for the growing proliferation of raw material export restrictions in resource-rich countries and the implications for consumer states. An important aspect of this research is the compatibility of export restriction with the rules of the World Trade Organization (WTO). Many authors criticize the Chinese export restrictions for distorting trade, discriminating against foreign consumers, violating WTO law and misusing environmental protection as an excuse for other ends (Morrison and Tang 2012; Humphries 2013; Levkowitz and Beauchamp-Mustafaga 2010; Karapinar 2010; Agiatella and Fliess 2013; Hatch 2012; Gu 2011; Kilby 2014; Korinek and Kim 2010; Kim 2010; Fliess and Mård 2012).

Another aspect of the "economic" perspective is related to understanding current and future market dynamics. This concerns supply and demand situations, in-use stocks, life cycles, consumption patterns, and price trends (Du and Graedel 2011a, 2011b, 2013; Nansai et al. 2014; Navarro and Zhao 2014; Massari and Ruberti 2013; Campbell 2014; Lee et al. 2012; Zhang L et al. 2015). Scenarios assess the future supply and demand situation of single rare earths (Alonso et al. 2012). Blending in with the geopolitical perspective, "criticality studies" examine the criticality of single minerals and the economic implications of politically induced supply shortages. These studies assess the degree to which single resources are "critical" based on a given catalogue of criteria and what countermeasures related governments should take. Some studies focus on the implications for particular industries (Buijs and Sievers 2011, 2012; Buijs et al. 2012; European Commission 2010; Hennicke et al. 2009; Erdmann et al. 2011; Silberglitt et al. 2013, National Research Council of the National Academies 2008a; Parthemore 2011f; Graedel et al. 2012; Achzet and Helbig 2013; Tukker 2014; USDOE 2010, 2011; Hoenderdaal et al. 2013; Nieto et al. 2013; Habib and Wenzel 2014). Aiming at increasing supply, several studies deal with developing non-Chinese REE supply chains (Golev et al. 2014) and REE recycling (Binnemans et al. 2013; Sprecher et al. 2014; Rademaker et al. 2013; Seo and Miromoto 2013; Bandara et al. 2014; Elshkaki and Graedel 2014). While these studies assess the relevance of resources in economic terms, they also include research on the implications for military technology (National Research Council of the National Academies 2008b).

In contrast to the international focus of the "geopolitical" and "economic" approaches, the "domestic" perspective considers the domestic situation as it influences China's REE policy (Hurst 2010a; Seaman 2010; Tse 2011; Wübbeke 2013a; Schüler et al. 2011; Hayes-Labruto et al. 2013). It argues that domestic factors can better explain the reasons for China's actions and that the export restrictions are part of a wider set of policies (Rüttinger and Feil 2010). Some of these analyses apply explicit theoretical frameworks (He YJ 2014). With few exceptions, research in OECD countries insufficiently grasps China's domestic REE politics and leaves the huge Chinese language resources untapped. There are no systematic and detailed studies of the specific policies in China related to the motivations behind the central government's policy and its implementation (Wübbeke 2013a; Wübbeke 2015a; He YJ 2014). This study contributes to the third perspective, grounded on the basic assumption that domestic dynamics are central to understanding Chinese actions in REE policy.

1.4. Regulation and Implementation in China

This book is also situated in the research on China's political system. The government's strong intervention in the REE industry is occurring against the backdrop of a decentralized economy and recent re-centralization, a consolidating regulatory state, and the simultaneous existence of state activism and privatization. With regard to the first research question laid out in section 1.2, concepts such as "strategic industry" contribute to elucidating why the central government strongly intervenes in some industries but gives free rein to others (Hsueh 2011). This perspective explains the strategic importance of an industry by its relevance to the national economy and defense industry. However, this research underemphasizes the discursive processes and the multiplicity of other reasons that cause strong government intervention.

A second body of research deals with state capacity and implementation in China (Lampton 1987a). The aim of this research is to understand the capacity of the state to make and implement its decisions. Contrary to the common wisdom of China as a monolithic political body (Goodman 2009), it focuses on a central characteristic of the Chinese political system: There is a multiplicity of influences from various actors outside of the inner elite circles that can change policy outcomes, especially during the process of implementation and enforcement (Naughton 1987). This literature has added important progress on understandings of policy outcomes compared to studies focusing solely on the decision-making of national rulers (Li LCL2010; Schubert and Ahlers 2011; Ahlers and Schubert 2015). A partial shortcoming of this perspective is that some of the studies concentrate predominantly on the lowest levels of administration in counties, towns, and townships. As this book will show, this body of research would also benefit from deepening the understanding of the role of material characteristics of things and technology in the process of implementation. Dealing with these shortcomings, this book gives weight to the entire implementation and enforcement chain and the role of materiality and technology.

1.5. Conceptual Framework

Departing from the research gaps found in these two strands of literature, this study develops its own conceptual framework. The framework leans on actor-network theory and constructivism (Latour 1999, 2005; Callon 1986, 1991; Yearley 1991). The dissertation approaches the REE industry from the view of the central government. The central government's strong intervention into the industry refers to the attempt to fundamentally change industry practices.

The conceptual framework distinguishes three aspects of strong intervention: problematization, strategy and translation.

First, problematization explains the reasons why the central government sees an issue as problematic and opts for strong intervention. Problems do not emerge out of themselves, but emerge from both social processes and material events. For instance, climate change is a problem because there is a high CO_2 concentration in the atmosphere that leads to global warming. But this material fact is not enough for social action: only because scientists, campaigners and politicians also see it as a problem are they willing to act against climate change (Callon 1986, 1987; Yearley 1991).

Second, the framework assumes that strategy is formed within the process of problematization. Strategy provides solutions to the identified problems and designs instruments to achieve these solutions. Problematization and strategy are processes that occur mostly within the Chinese central government, although influences from other actors are possible (Callon and Law 1982).

Third, while problematization and strategy are mainly about the reasoning and planning within the central government, translation, equating to implementation and enforcement, refers to the process of putting these plans into practice through the support of other actors and changing core industry practices. This requires cooperation with other actors and the utilization of instruments to carry the strategy from the national level to local conditions. This is a protracted process since many actors whose cooperation is necessary have their own interests and can change or resist the strategy. The central government and cooperative actors that support the central government can respond to this resistance by readjusting their strategies (strategic readjustment). This leads to an interaction of resistance and strategic readjustment. Translation, more than problematization and strategy, influences the outcome of policy. While these three aspects of policy can take place at different points in time, they often occur in parallel and influence each other (Latour 1999, 2005).

1.6. Design of the Analysis

The aim of the study is to explain the reasons, strategy, implementation and enforcement of strong intervention in the REE industry. Drawing on the above-mentioned conceptual framework, the research firstly analyses the motives (or "problematization" in theoretical terms) that led to the decision of the central government to formulate a new strategy of strong government intervention in the REE industry. Problematization and strategy serve as concepts to answer the first research question of why and how China carries out this strong intervention. Second, the research analyzes the implementation and enforcement (or in theoretical terms, the "translation") of the new strategy and the changes to policy that occur through this process. The concept of translation answers the second research question of how the central government implements and enforces its policy and how other actors come into play.

By its design, the research is empirically-driven. The main purpose is to thoroughly understand the politics of REE in China. This book provides a sample case for understanding the transformation of the Chinese minerals industries as described in section 1.1. Moreover, the book limits itself to a single case because there is a particularly large gap in knowledge about the Chinese REE and minerals industries. This also defines what this study does not consider: it does not carry out a cross-country or cross-industry comparison.

The dissertation is rooted in a culture-theoretical view of science. This means that understanding the empirical world in its entirety is more important than explaining single causalities (Reckwitz 2000). The book is based on a conceptual framework that provides a general structure for grasping the empirical world and understanding how policy is constituted. The framework penetrates the empirical field with a holistic view that pays attention to the field’s entire dimension and relations. It provides a lens which tells the researcher where to look (Friedrichs and Kratochwil 2009). However, it does not follow a deductive-nomological model that puts forward and tests a set of theoretical hypotheses and operationalizations (King et al. 1994). This means that the research starts with an open framework that makes no a priori assumptions about the empirical field. Theory is of secondary importance as it should only help to structure the research, not to provide pre-given assumptions. Instead of hypotheses, this introductory chapter presents a set of findings, which are the result rather than the departure point of the research. The book also does not strictly apply actor-network theory and constructivism, but selects only those elements of these theories which it deems relevant for the conceptual framework (Friedrichs and Kratochwil 2009).

1.7. Scope of the Analysis

The study focuses on the Chinese REE industry. The REE industry, as defined by the Chinese government, includes upstream and downstream sectors. The upstream sector refers to mining, processing, separation and metals reduction. The downstream sectors are the intermediate consumption of semi-finished products such as permanent magnets, phosphors, hydrogen storage, ceramics and glass (Xu GX 1995). As the strong intervention mostly focuses on the stages from extraction to metals reduction, this book will mainly deal with the upstream sector and only occasionally glimpse the downstream sector.[2] Focusing on domestic REE policy means that the dissertation considers the international development of the REE industry and the actions of other countries only insofar as they are relevant to China. The WTO dispute

[2] For a better understanding, chapter 3 will present a complete description of the REE industry including the downstream sectors.

over Chinese export restrictions is part of the dissertation because it directly relates to domestic policy (WTO 2014a, 2014b). The book focuses on four core practices of the REE industry: the organization of industry structure referring to the dynamics of number and size of enterprises (industry organization), mining and separation of REE and their conservation (production), environmental protection, and export (see figurefigure 1-1).

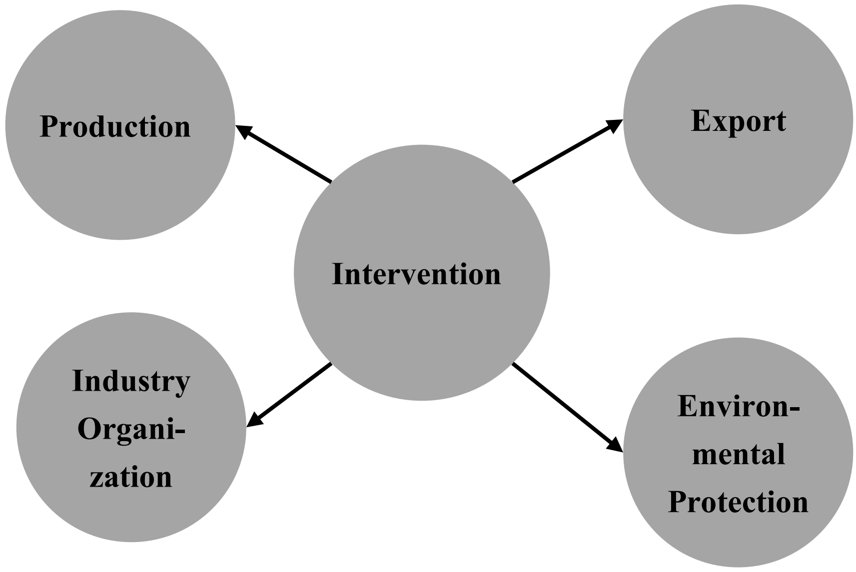

Figure 1–1: Strong intervention and the REE industry practices that the intervention seeks to change.

Although the process of intervention and implementation is still ongoing, the analysis only considers events up to December 2013 when the collection of empirical data ended. However, the dissertation sometimes goes beyond this timeframe in order to put the strong intervention into context. In particular, the historical chapter and the chapter on problematization go back to earlier years. As there were very important developments in the WTO dispute settlement case regarding China's export restrictions in 2014 (WTO 2014a, 2014b), the dissertation also includes these more recent developments.

1.8. Relevance

This book contributes to empirical, political and theoretical discussions. On an empirical level, there is an appalling lack of knowledge about the political management of the minerals industry in China beyond coal and steel. To date, there exists no comprehensive English-language analysis of REE policy in China (Greenovation 2014). This book provides in-depth insights into Chinese REE policy and sheds light on the transformation of the minerals industry in general. An extensive study of Chinese-language sources supports the empirical research.

The focus on domestic mineral politics is very important because China is the largest producer and global supplier of many crucial minerals (Roache 2012). Political decisions in China directly influence the countries to which it exports materials (Silberglitt et al. 2013; UK Department for Environment, Food and Rural Affairs 2012; German Ministry of Economy and Technology 2010; European Commission 2008; German Parliament 2013; US Congress 2013; US Department of Energy 2011). In particular, critical materials studies will benefit from analyses of single cases of political resource management in mineral exporting countries (European Roundtable of Industrialists 2013). This study cautions criticality studies to be more attentive to the domestic policies of producing countries.

The study also provides relevant information for political practice. OECD countries currently pay a great deal of attention to REE. REE supply has the potential to affect relations between countries, especially between China on the one hand and the EU, Japan and the United States on the other (Rech 2015). The unofficial ban on Chinese REE exports to Japan in 2010 and the completed WTO dispute over Chinese export restrictions have fundamental implications for the global political and economic order (Ting and Seaman 2013). If Chinese actions over REE can have such an immense impact, it is necessary for OECD politicians to have accurate information about Chinese intentions and strategies. Misperceptions of Chinese policy could lead to suboptimal policy choices in OECD countries.

On a theoretical level, this book adds to research on regulation and implementation in China. Scholars of China studies have recognized that state intervention and capacity vary markedly by industry. Industry-specific characteristics apply only to a limited degree to the entire political economy (Kennedy 2005). Research on state intervention and capacity has focused on steel-making (Taube and in der Heiden 2010), coal (Su FB 2004; Wang SG 2006; Wright 2007), energy (Andrews-Speed 2004), water (Lampton 1987b), cotton (Alpermann 2010), telecommunications (Li G 2008, Gao P and Lyytinen 2000), finance (Heilmann 2005) and the automotive industry (Gallagher 2005). The REE industry is a further case for industry-centered research that is particularly interesting due to the recent change from weak industry management to strong intervention since 2005. This transition calls for an analysis of the processes behind the emergence of a strategic industry.

In addition, the study offers a complete view of the policy implementation chain that shifts between macro and micro levels. This is in contrast to implementation studies, which mainly focus on one level of the administration. The combination of research on state activism and implementation with the cultural program of actor-network theory and constructivism offers a new perspective for China studies. The use of actor-network theory in political science and China studies is relatively new. There are only a few works which use these approaches in the context of Chinese politics (Gao P 2005; Poell et al. 2014; Wübbeke 2013b).

1.9. Findings

This book presents seven major findings with regard to the two research questions and the transformation of the Chinese mining industry.

First finding: the aims of industry policy and sustainability are the main motives behind strong intervention. Geopolitics does not play a role in the general strategy.

The dissertation finds that two factors led to strong intervention. The problematization by the central government identified a lack of economic competitiveness and unsustainable utilization of resources as the two core sets of problems facing Chinese REE policy and industry. With regard to competitiveness, the central government opines that the prices of REE should be higher; that big national mining enterprises should control REE resources;[3] and that the downstream sector should be more innovative and focus on high-quality products (State Council 2012a).

With regard to sustainability, the central government wants to avoid the rapid depletion of REE resources and to minimize the environmental impact of the industry. There are close interrelationships between the two sets of problems. For example, the preservation of resources is intended to supply sufficient resources for and guarantee the competitiveness of future industrial activities (State Council 2012a). Geopolitical reasons, which might aim to gain political and military advantages over other countries, are not a motive for the general strong intervention by the central government.

Second finding: the strong intervention evolved slowly through the development of an informal strategy, but gained momentum thereafter.

Intervention was initially limited, but became more widespread and deeper with time and followed a long period of reliance on informal strategy until 2009. When the central government shifted to a strategy based on formal government documents in 2009, the government intervened more forcefully and centralized relevant decision-making powers (Wang JZ 2011). The involvement of the Standing Committee of the State Council was crucial to coordinating government efforts. After 2009, intervention was characterized by a strong, thorough and unprecedented deep involvement of the state in REE industry practices (State Council 2011).

The State Council's intervention was based on a broad set of specific policies and regulatory instruments: for instance, the central government used extraction targets and export quotas to regulate the volume of REE mining and trade; industry reorganization plans and

[3] Before 2010 the industry was characterized by a fragmented industry structure with many small enterprises.

accession requirements promoted the formation of a concentrated industry structure; and new emissions standards enhanced environmental protection. The wide set of measures shows the close cooperation between ministries (State Council 2011).

Third finding: despite some achievements, strong intervention has only succeeded in producing real improvement in a few areas.

The strong intervention of the central government faced huge challenges with regard to implementation and enforcement. Despite the State Council's strong intervention, its targets have yet to be achieved and are unlikely to be easily reached in the future. The central government has been particularly determined in its intervention, but various actors and other factors have considerably weakened the policy outcomes.

The success of intervention varied in relation to different practices in the REE industry. With regard to resource conservation, the intervention managed to decrease official production levels, but illegal mining is still very common (China.com 2013a). Environmental protection in some large enterprises has improved, but the environmental impacts are still severe in general. REE prices temporarily rose, but then dropped substantially (Lynas 2013a). The biggest achievement concerns exports: China considerably reduced smuggling and the amount of exports (see chapter 11). However, a big challenge for China is the WTO ruling that China's export restrictions violated international law (WTO 2014a, 2014b). With regard to industry concentration, the government was successful in concentrating mining in the hands of a few enterprises, but had to concede a certain level of influence to the provinces.

Fourth finding: a broad set of actors resisted the government's policy.

The weak outcome of the government's intervention is due to the resistance of many actors (see Table 1–1). The actors involved vary slightly depending on the practice in question. First, local governments used their central role in implementation to significantly change policy outcomes. This represented resistance and cooperation at the same time because many local governments generally backed the central government's strategy, but tried to influence the policy outcomes according to their own interests. For example, the provinces supported the central government's policy to concentrate the industry, but some of them tried to keep state-owned mining enterprises out of their provinces. Similarly, sub-provincial governments carried out actions against illegal mining, even though they themselves were partly involved in these activities. The activities of sub-provincial governments have been more problematic than those of provincial governments in relation to implementation and enforcement. Many actors directly resisted the central government's policy. Private enterprises opposed industry concentration. Illegal miners were quite successful in evading the intensified actions of the state against illegal mines. Both state-owned and private enterprises intensified environmental efforts.

Actor / Practice	Provincial Governments	Local Governments	State-Owned enterprises	Private Enterprises	Illegal Traders/Miners	Villagers	International Governments
Industry Organization	✱		✽	✳			
Resource Conservation		✱			✳		
Environmental Protection		✱	✳	✳		✳	
Export					✳		✳

Table 1–1: Cooperation with and resistance against the central government by actors (top) and industry activities (left). ✽ = Cooperation with the central government; ✱ = Cooperation and Resistance; ✳ = Resistance against the central government.

Fifth finding: strategic readjustments have mostly been unsuccessful.

The central government and its partners reacted to resistance by other actors. However, their strategic readjustments have mostly been unsuccessful. The central government created new regulatory instruments, carried out intensive campaigns, restricted material flows of mined REE minerals to private REE separation plants, and employed technology to try to force other actors to comply with its strategies. The strategic readjustments have been most effective against private enterprises, which resisted industry reorganization, and against the smuggling of REE. Through technological improvements and campaigns, some local governments were able to contain illegal mining in some areas. The problem has not, however, been fundamentally solved.

Sixth finding: technology and material characteristics were key factors determining whether the central government or resisting actors were successful. The material characteristics of REE inhibited implementation and enforcement.

The dissertation found that technology and the material characteristics of things were central to the interaction between the central government's implementation efforts and the resistance of various actors. The results show that material characteristics often constituted a barrier to successful implementation and enforcement. For example, the widespread material distribution of REE deposits makes monitoring more difficult and facilitated illegal mining. However, technological instruments could also help enhance government policy.

Seventh finding: the REE case shows that the central government is determined to fundamentally transform the mining industry.

The massive resources that the central government has put into these efforts indicate that the transformation of the mining industry is, in general, possible. However, given the challenges of implementation and enforcement, transformation is a time-consuming and protracted process that will not lead to substantial results in the next decade under present conditions.

The case of the REE industry shows that transformation of the mining industry towards greater efficiency, greater sustainability and greater competitiveness is possible. If the central government caries out intervention, it can have a huge impact on the industry. However, the difficulties of implementation and enforcement show that the government has not yet found the right mechanisms to promote that transformation within the next few years. Even if great efforts are made, change is not immediately achievable. This implies that the Chinese mining industry will stick to the traditional pattern of resource-intensive and low-quality production for at least the next decade. It will at best see a gradual transformation.

1.10. Structure of the Book

The dissertation is divided into four parts: Part I provides a theoretical foundation and basic information on the Chinese REE industry. Part II answers the first research question by focusing on problematization and strategy. Part III answers the second research question by focusing on implementation and enforcement. Part IV is the conclusion.

Part I consists of three chapters. Chapter 2 develops the conceptual framework for intervention, chapter 3 follows with an introduction to the Chinese REE industry, chapter 4 concludes part I with an overview of the relevant actors.

Part II has three chapters. Chapter 5 provides a historical description of the Chinese REE industry and government policy from 1927 to 1996. While this chapter is not a central part of the analysis, it provides a backdrop to clarify the distinction between weak regulation in the 1980s and 1990s in comparison to the policy after 2005. Chapter 6 analyzes the problematization of the central government which has been visible since 1996 and chapter 7 continues with an overview of the central government's new strategy of intervention.

Part III examines the process of implementation and enforcement with regard to four practices: industry organization, resource conservation, environmental protection and export. It is divided into six chapters, each dealing with the implementation and enforcement of particular practices. There are chapters on industry reorganization (chapter 8), resource conservation (chapter 9), and environmental protection (chapter 10). The analysis of exports is divided into two chapters on smuggling (chapter 11) and international trade disputes (chapter 12). Each of these chapters provides an answer to the second research question on implementation and enforcement.

Chapter 13 of part IV finally serves as a conclusion, discussing the results and giving an outlook.

2. Conceptual Framework

2.1. Introduction

This chapter elaborates the conceptual framework of this study. As stated in the introduction, the research aim is twofold: the first research question asks why and how the Chinese central government has been carrying out a new strategy of intervention in the REE industry since 2005. The second research question asks how, during the processes of implementation and enforcement, opponents of stricter regulation are able to limit the government's success.

By conceptual framework, this study refers to a set of meta-theoretical and substantial concepts that provide the researcher with the instruments to collect and analyze empirical information in a structured way. The concepts contain a number of interrelated assumptions about the emergence and formulation of a policy, as well as its implementation and enforcement. The conceptual framework is explicitly different from a theory: the assumptions are meant to help better understand the empirical world, but they do not presuppose the outcomes of research. The aim is not to construct or to test hypotheses and causal relationships between variables.

The conceptual framework integrates actor-network theory and social constructivism (Latour 2005; Yearley 1991). It aims to explain the central government's policy of changing the core practices of the REE industry according to its own ideas. These practices encompass industry organization, production (mining and separation), environmental protection, and export. The intervention is conceptualized as a three-step process: problematization, strategy, and translation. The framework assumes that the decisions in favour of intervention are taken within the process of problematization. Strategy provides goals and instruments to solve the identified problems. While problematization and strategy are about the central government's own plans, translation (through implementation and enforcement) refers to putting these plans into practice through the support of other actors. The conceptual framework is also based on research about China's political system. This research is not directly part of the framework, but an important point of reference and an important source for deciding on the design of the concepts.

The chapter sets out with an overview of China-related research (2.2), turns to the meta-theoretical foundation (2.3) and then elaborates the substantial assumptions for analyzing the government's intervention in the REE industry (2.4).

2.2. Economic Transition and the Political System

2.2.1. Introduction

There are several elements of China's political and economic systems which have influenced the formulation of the conceptual framework applied here. These include:

- the dynamics and fluid character of the political system that relies very much on informal institutions and processes;
- the rise of the regulatory state and the variance of regulatory activity in different industries;
- the multi-actor process of policymaking and implementation;
- the reality that policy is not fixed after it is first decided upon, but open to implicit and explicit reformulation by many actors during the process of implementation and enforcement.

These elements will be covered in the following subsections.

2.2.2. Characteristics of the Political and Economic System

China is ruled by a socialist and authoritarian system that is very different from Western democracies (Dreyer 2015). The Communist Party monopolizes political power, is closely intertwined with state institutions, and employs ideology to shape society (Brown 2012). As the Party concentrates decision-making power in the Politburo and retains control over all state institutions, there is only a formal and very unbalanced division of power among the executive, legislature and judiciary (Saich 2011). During the Mao era, economic policy was characterized by centrally planned resource allocation and strict top-down instructions (Walder 2015; MacMillan and Naughton 1992).

During the Chinese economic reform era, which started under Deng Xiaoping in 1978, the Chinese leadership allowed greater influence from the market and private entrepreneurship, but retained government control over the economy (Yueh 2010; Huang YS 2008; Naughton 1995). The economic transition was characterized by the liberalization of many economic areas such as the deregulation of prices, the expanding private sector, reform of state-owned enterprises (SOE), and integration into a globalized economy. The free market practices blended in with state control in some economic areas (Yueh 2013; Brandt and Rawski 2008; Naughton 2007, Chapter 4). Although China has liberalized more and more parts of the economy, China maintains its state capitalism (Tsai and Naughton 2015).

In contrast to the liberalization of the economy, China's political system did not reform or open up to more democracy, freedom of speech, or pluralism. Despite inner changes to the Party such as the opening to entrepreneurs and increasing but small opportunities for social participation, the Chinese Communist Party did not and does not want to retreat from power. The country remains a one-party communist state (Fewsmith 2013; Shambaugh 2008).

However, the facets of the political system differ markedly from those during Maoist rule more than thirty years ago. The state has shifted from a more totalitarian to an autocratic regime.[4] The reform of the economic system and economic politics led to the emergence of the regulatory state, which steers the economy by rules, instead of by command and control (Hsueh 2011; Yang DL 2004a; Pearson 2007). However, the institutional framework of the state and institutional responsibilities for policy areas have constantly changed with the restructuring of several ministries (Dreyer 2015).

Although policy processes have been increasingly formalized, the official institutions often conceal the real but often informal and opaque decision structure within the Party and the state (Saich 2011; Lieberthal and Oksenberg 1988; Lieberthal 2004). This situation of informal policymaking and constant institutional flux makes analysis of Chinese policy very difficult. The organizational structures of the state "hide as much as they reveal about where real power lies in the system" (Saich 2011, p. 142-143).

China is a one-party state, but it is not a monolithic political body (Goodmann 2009; Mertha 2009). The political system has become reliant on an increasing number of actors both within and outside the state. The Party reserves the power to make the final decisions, but in many cases political outcomes result from negotiations among political actors, creating a so-called "negotiated state" or "deliberated state" (Fewsmith 2013; Saich 2000). As political power has increasingly been decentralized, the provinces in particular have been closely involved in policymaking. But this has not necessarily weakened state capacity because the central-local rivalry is not a zero-sum game between the two levels of government (Wang CC 2015; Li LCL 1997; Chung 1995;). However, decentralization has resulted in the establishment of implementation as a key issue of policy. Local governments can profoundly change or delay the introduction of a policy at the local level during implementation (Li LCL 2010; Göbel 2011; Aken and Lewis 2015; Lampton 1987b).

[4] Whether the Chinese political system is totalitarian or authoritarian is contested in the scholarly debate. Some authors argue that the contemporary system inherited many of the totalitarian elements of the Mao era (Guo SJ 2000). For a contrasting view see Saich 1992. While it is true that several aspects of totalitarian rule have remained in contemporary China, such as the monopoly of power of a single party, there are also changes, such as a partial retreat of the Party and the state from economy and society, and the role of ideology. Due to these and other changes, this study considers the Chinese system as authoritarian or post-totalitarian (Cabestan 2004).

2.2.3. Regulatory State

With the growing importance of the private sector, the ability of the state to directly control markets through state-owned enterprises diminished. Instead of command and control mechanisms, China built up a new system of market regulation. The regulatory state creates a regulatory environment that aims at providing a "level playing field" for all market participants (Naughton 2007). The system, however, is different from American or European regulatory states as the regulator itself is not independent (Pearson 2015). The scope and mode of regulatory activity is not equal among industries. Rather, understanding economic and regulatory activity involves looking into the specific characteristics of single industries. While certain industries are highly regulated and deemed as strategic, non-strategic industries operate without much government interference (Kennedy 2005). The conceptual framework considers the REE industry a strategic industry with its own specific regulatory environment.

Research on the regulatory state in China deals with the question of why the central government highly regulates some industries but gives free reign to others (Hsueh 2011). Hsueh (2011) writes that the government intervenes in industries with "strategic value." Regulatory activity levels are high if an industry is important to internal and external national security and central to the entire national economy. Other factors such as the complexity of technology, as well as the design of governance institutions and state-business interaction shape the kind of government intervention (Hsueh 2011). This research into industry-specific regulation is relevant to this book, as it similarly seeks to understand the reasons for government intervention.

2.2.4. Influence of Societal and Economic Actors

The Party and the central government remain the central actors in policymaking and determine to what degree participation in different fields is possible. However, during the era of reform and opening since 1978, the Chinese state has partly withdrawn as an active market participant from society and the economy. Societal and economic actors have greater leverage to decide on their own conduct of affairs than they did in the past. A broader group of societal and economic actors than is sometimes acknowledged participates in the political system and influences the outcomes of policy, though only as long as social actors align with the framing and interests of the Party (Hildebrandt 2013; Teets 2013, 2014).

The diffusion of power among a broader range of actors has been described as "fragmented authoritarianism" (Mertha 2009; Lieberthal 1992). The basic argument of fragmented authoritarianism is that "authority below the peak of the Chinese political system is fragmented and disjointed" (Lieberthal 1992, p. 8). The central government therefore deals with a number of actors in the conduct of policy. Among these are local governments, enterprises, civil society, experts, and scientists. Enterprises are important economic actors and some can have an important impact on policymaking (Steinberg and Shih 2012). Industry associations, even though under state control, increasingly function as vehicles to channel industries' interests towards the state bureaucracy. State-owned enterprises generally have much stronger influence than private firms through administrative and political channels and informal connections. But opportunities to exert influence have also increased for private and foreign-invested enterprises (Steinberg and Shih 2012; Unger and Chan 1995; Kennedy 2005; Brødsgaard 2012).

Since the 1980s and 1990s, elements of a civil society have also emerged (Teets 2013, 2014). The number of non-governmental organizations (NGOs) has increased rapidly and in some areas of society, such as environmental protection, NGOs have achieved a certain strength and limited influence on political outcomes (Hildebrandt 2013). Yet restrictive rules constrain the independent practices of NGOs (Shi-Kupfer and Heilmann 2016; Shih et al. 2016). Societal organizations therefore have to find ways of negotiating the state spaces of free action and influence on policy (Saich 2000).

The opening of the decision-making process to policy input outside of the government and the complexity of new challenges have given rise to an influential role for experts and scientists. In particular, semi-official research institutes and elite universities have great relevance in agenda setting, decision making and implementation. Examples of this relevance can be seen in foreign policy, environmental protection and climate change, where experts have had some influence on action (Wübbeke 2013c; Zhu XF 2009, 2011).

2.2.5. Decentralization

In addition to the growing opportunities for participation for societal and economic actors, reforms led to a stronger position for local governments. The conceptual framework has to take into account that local governments have considerable influence on policy decisions and implementation. In the course of economic reform, the Chinese central government has pushed forward a process of economic and political decentralization, in particular with regard to fiscal responsibility (Zheng Yongnian 2007; Jia et al. 2015; Wu and Wang W 2013; Chung 2000). The provinces and provincial leaders, and especially the economically flourishing east coast provinces, have emerged as crucial actors in the Chinese political system. They are important to the implementation of central government policies and have discretion in relation to the introduction of various initiatives and local experiments (Heilmann et al. 2013; Cheung 1998; Lin 1998).

Decentralization was deliberately enacted by the central government to promote "development power" at the expense of "centralizing power" (Chung 2000). Compared to the "iron fist" of the totalitarian state under Mao Zedong, the post-Mao Chinese state chose a middle road in implementing policy according to the will of the central government while leaving room for local initiatives (Heilmann et al. 2013; Heilmann 2008; Yang DL 2004b).

Decentralization relieves the central government of the immense processing and communication efforts that were characteristic of the planned economy, and allows for the adoption of policies that meet local needs and improve economic efficiency. This process has contributed to the rapid economic growth of recent decades (Jalil et al. 2014, Oi 1992, Qian YY and Xu CG 1993; Chung 2000). The local "experiments under hierarchy" also fed experience into new policies at the central level (Heilmann 2008). This greater local autonomy allowed provinces to better represent and defend their interests against central state policies. The influence of the provinces made implementation of policies a central issue in Chinese political systems, as provinces significantly influence policy outcomes during the implementation stage. Local protectionism is a negative effect of decentralization that affects economic efficiency, referring to the phenomenon that each province tries to support its economy and is rather protective against the enterprises and commodities of other provinces (Huang JL 2013; Lee 2002; Breslin 1995).

Political decentralization led to a struggle over resources between the central government and local governments. There have been efforts at re-centralization, for instance, with regard to the distribution of fiscal resources (Naughton 2007, p. 101). Especially under the new administration of President Xi Jinping, the central government has been pushing for a fundamental recentralization (Ahlers et al. 2013). Through the Party's nomenclatura system and the cadre responsibility system, the Party and the central government can wield enormous power over state-owned enterprises and governments one level down in the administrative system in order to achieve their goals (Brødsgaard 2012; Landry 2008). Absolute recentralization through coercive measures had not been an option until the beginning of the Xi Jinping administration (Blackwill and Campbell 2016; Ahlers et al. 2013; Naughton 1987). The central government is in a "centralizing paradox": "whether to continue to tolerate local variation for the sake of decentralization or reassert central control at the expense of decentralization" (Chung 2000, p. 11).

An important topic of research concerns the question over the disintegration of China and state capacity. It has been argued that the central government is no longer able to reassert full control over the entire political system. Through the reform, local governments gained control of many resources: "They [the local governments] do not depend on the central government for any of their critical resources; all they need is *permission* to use them" (Naughton 1987, p. 76). The strength of the central government vis-à-vis the local governments incited a lively debate in the 1990s and 2000s about centrifugal forces, a helpless central government which might collapse and a country which might break into single independent units (Walder 1995; Segal 1994; Jenner 1992). While some authors argue that state capacity in general has strengthened and decentralization did not occur at the expense of the central government, others see a mixture of strong and weak state capacities (Alpermann 2010; Edin 2003; Naughton and Yang DL 2004).

2.2.6. Implementation

Whereas the absolute disintegration of the Chinese political system is unlikely, decentralization has resulted in an "implementation bias," which means that the implementation stage at the local level has become equally or even more important to policy outcomes than decision -making at the central government level (Naughton 1987; Göbel 2011). In order to understand policy in China, it is necessary to look not only at the central level, but in particular at implementation at the local level (Li LCL 2010). Implementation is the translation of a policy that has been decided on by policymakers at the central level into concrete practice at the local level. Whether lower levels of government will implement policies in the form expected by the central government is not a given (Göbel 2011; Lampton 1987b).

Implementation, especially at the level of counties, townships and villages (Schubert and Ahlers 2011; Ahlers and Schubert 2015), is critical for putting central government policy into practice. In particular, environmental policy in China is haunted by implementation challenges (Vermeer 1998; Economy 2010). Most central government regulations and directives are very general and leave the provinces and sub-provincial governments space to adjust policies to local conditions. As central-local relations are non-zero sum, deviation from the official policy is not necessarily a matter of non-compliance but can be an adjustment to local conditions (Göbel 2011; Li LCL 1998). Depending on local government interests and available regulatory instruments, there can be selective implementation. Some local governments are uncooperative and decide not to implement a policy or to delay its implementation markedly when the policy does not fit with their interests (Heilmann 2008; O'Brien and Li LJ 1999; Göbel 2011).
Saich (2011, p. 235) says that implementation:

> determines the nature and success of a policy reform initiative and implementation may lead to an outcome quite different from that intended and anticipated by analysts and policy-makers. Implementation in China does not simply follow a linear model where policy is implemented in stages and ends either in success or failure.

Implementation is a very dynamic process through which the original policy can "be altered or reversed at any stage in its life cycle by the pressures and reactions of those who oppose it" (Grindle and Thomas 1991, p. 126). As policy in China is not totally fixed after it is decided upon at the central level, the policy and implementation game can have an impact on the concrete outcome of the policy (Lampton 1992, pp. 57-58).

2.2.7. Implications for the Conceptual Framework

This short overview of the Chinese political and economic systems has pointed out several important factors that the conceptual framework takes into consideration. First, it must be recognized that the Chinese political system is dynamic and fluid. Institutions are often unstable and decision processes informal and opaque. Processes are more important than formal institutions. Second, the framework should not strive for an explanation of general politics and economics but rather for an industry-specific explanation of policy. Third, although the central government is still the key actor in policymaking, the framework should integrate the interaction between many heterogeneous actors during policymaking, implementation and enforcement. Fourth, the process-oriented framework should consider that policy is never fixed, but always open to reformulation, in particular informal reformulation by actors that are not directly involved in policymaking but wield their influence during implementation.

2.3. Meta-Theoretical Background

2.3.1. Culture Theoretical Assumptions

This chapter will carve out the meta-theory and the specific assumptions of the framework on policymaking and implementation. The purpose of the conceptual framework is to structure the empirical research into the factors underlying the central government's increasingly forceful intervention in the REE industry since 2005 through the introduction, formulation, implementation and enforcement of policy. The framework looks at the REE industry from the perspective of one particular actor: the central government. Although this is a government-centric view, the conceptual framework emphasizes that the central government is only one actor in a large network – and not necessarily the most powerful actor.

The framework used in this study is rooted in cultural theory[5] (Reckwitz 2000). Cultural theory is a meta-theory which assumes that social actions constitute society. In contrast to views centered on the *homo oeconomicus* and the *homo sociologicus*, cultural theory does not regard interests and norms as key explanatory factors, but rather the result of social life. According to this view, society is in constant flux; structures and interests are relatively unstable. Once the patterns of social actions change, social structure and interests change as well (Reckwitz 2000).

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[5] Cultural theory is a meta-theory that provides axiomatic positions on ontology, epistemology and methodology. It has to be distinguished from the other meta-theories of *homo economicus* and *homo sociologicus*. The most important difference is that cultural theory draws neither on interests nor society to explain action but looks at the processes that constitute society. The difference of substantial theories in this meta-theory specifically concerns which processes constitute society and how stable society is (Reckwitz 2000).

In the specific case of intervention into the REE industry, this means that the practices of the industry are always subject to change. Moreover, policy – which aims at changing existing practices – can itself change during the process of implementation, even when the central government has already formally decided upon policy. To add substantial theoretical content into this meta-theory, the framework draws on elements of actor-network theory and social constructivism[6] (Latour 1993, 1999, 2005; Schatzki et al. 2001; Yearley 1991). The aim is not to rigidly apply one of these theories, but to adopt a pragmatic approach that makes best use of theory to understand the empirical world.

2.3.2. Actors and Policy

Different from most substantial theories based on cultural theory, the conceptual framework of this book draws on actor-network theory to focus on networks of actors instead of other units of analysis such as discourse or practice (Reckwitz 2002; Barnes 2001; Schatzki 1996, 2001). Callon (1986), one of the major proponents of actor-network theory, described the attempt and strategy of an actor to change a practice, which is a patterned and recurrent form of action. Strategy in this sense does not refer to a maximization of pre-given preferences but the achievement of goals that emerge out of discursive and physical processes. Intervention is therefore an actor's attempt to change a practice. A good example would be the central government's aim to turn the practice of environmental pollution into environmental protection.

Actor-network theory has a broad understanding of actors as being any human being or an aggregated organization of human beings, such as a "ministry" or an "enterprise" or groups of organization.[7] Actor-network theory does not presuppose the importance or potential influence of actors and does not cluster them according to a pre-assumed range of power such as is found in dichotomies like state and non-state. Potentially any actor can have an important effect on policy (Latour 1999).

Policy is the result of an effort to sustain or to change a set of practices. This definition entails that policy is a network effect, meaning that not only decision makers but potentially any actor in a network can affect policy. Policy is a process that is never ending. It does not stop with the promulgation of a law or a directive, but is also produced through actors beyond the government: "policy is being made as it is being administered and administered as it is being made" (Anderson 1975: p. 98). Power is not a given in policy. Even if one actor such as the central government is institutionally endowed with power and authority over all governmental

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[6] By social constructivism I do not refer to Durkheimian sociology that uses concepts of structure and norms to explain individual or group actions. Rather, I refer to approaches that look at the production of constructs, which is common for discursive approaches and inter-subjectivity (Reckwitz 2000).

[7] Actor-network theory also includes "things" as actors, but this research framework does not take this position. However, it gives much weight to the role of material conditions in policy (see below).

units in China, there is no guarantee that it can practically wield this power in making policy. Power is the result of a successful implementation of policy, not the other way around (Latour 1986).

2.3.3. The Argument for Cultural Theory

Applying a combination of actor-network theory and social constructivism to the analysis of the Chinese political system is promising for several reasons: First, the Chinese economic reform undertaken in China since 1978 has followed a very unsteady and contingent process in which actors, relations and interests have changed frequently. As cultural theory concentrates more on processes than on finished concepts, such as structure and institution, the approach provides theoretical tools for grasping such dynamics.

Second, the multi-actor implementation of policy in China is very complex. Besides formal structures, there are many informal factors that shape the realization of policy goals. Implementation should not be simply thought of as a top-down process. Actor-network theory allows the researcher to see implementation as a process that goes beyond administrative hierarchies.

Third, social theory, including research on public policy, underestimates the role of technology and material conditions. As the subsequent analysis will show, industrial policy very much relies on the help of technology and its success depends on how it deals with material conditions. Actor-network theory provides concepts for integrating the role of technological devices and the material characteristics of things, such as the influence of mineral characteristics on policy implementation, into the analysis.

2.4. Assumptions for Policy Intervention

Based on this meta-theoretical foundation, this section develops specific assumptions for the central government's policy intervention in the REE industry. It seeks to provide a framework for understanding the attempt by one actor – in this case the central government – to change a given set of practices employed by the REE industry in a direction corresponding with its governmental interests. As Figure 2–1 shows, the industrial practices of concern are: industry organization, production, environmental protection and exports. The section below will explain in detail that this intervention rests on a problematization of the REE industry's practices that has taken hold inside the central government. To implement this strategy, the intervention has to rely on the mediation of many other actors and instruments. The framework calls this process "translation." During translation, policy can markedly change. Actors that have not been part of strategy formulation can still influence the policy outcome.

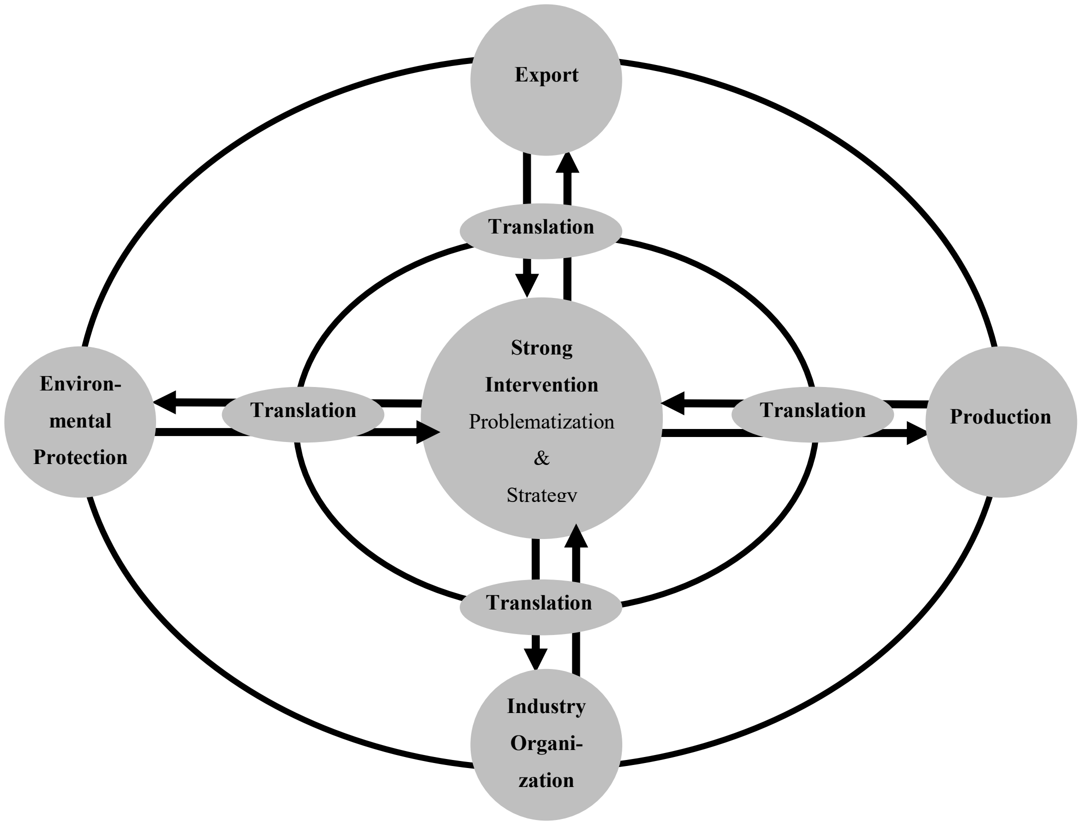

Figure 2–1: Intervention by the central government in the REE industry (Author's illustration).

The framework is inspired by Callon's (1986) study on the efforts by a team of scientists to preserve a population of scallops, which had been intensively exploited by fishing. The scientists aimed to change the existing practice towards more sustainable fishing. In order to achieve this, they needed to find ways to implement their aims with regard to the practice of fishing. Inspired by this study, the conceptual framework develops three stages of policy: problematization, strategy, and translation (implementation and enforcment) of policy.[8] These stages will be explained in the following three sub-sections.

2.4.1. Problematization

This study defines problematization as the process through which an actor formulates problems with regard to a set of practices and arrives at the conviction that these should be changed. The assumption of problematization is that problems do not emerge from themselves, but through social processes of sense-making. Problematization is the basis for the formulation

[8] This is different from the stages and terms used by Callon (1986). He speaks of problematization, interessement, enrolment, and mobilization.

of strategy and translation. Therefore, to analyze why an actor behaves in a certain way, understanding problematization is essential.

This concept follows social constructivism: "the mere fact that these were objective circumstances which constituted a potential problem was not enough for a 'social problem' to emerge... No one would now argue that the objective conditions in themselves promote awareness of a social problem" (Yearley 1991, p. 49). The aim of research is then to understand how particular "issues have come to be seen as an objective social problem" (Yearley 1991, p. 49).[9] The argument is that the Chinese central government defines the problems of the status and development of the REE industry which convinces it that the relevant practices need to be changed.[10]

The social construction of problems does not imply that problems are not real in a physical sense. For example, the CO_2 accumulation in the atmosphere *is* real. However, it becomes a political issue particularly through social processes. Problematization is connected to discourse analysis approaches: practice does include discursive elements, e.g. communication and text, but rather goes beyond them through its emphasis on material factors. For example, climate change is currently on the political agenda because of the physical presence of global warming *and* the social perception that this matters. As another example, if a problem arises regarding the pollution of the REE industry, this is an interplay of human reasoning – the social process – and, for instance, the hazardous effects of pollutants – the physical reality (Latour 2004).

Although this study follows a government-centered view on problematization, other actors, for instance local governments, enterprises and science, also play a role in problematization. In particular, expert communities participate actively in raising attention and interpreting newly emerging issues and in this way influence problematization (Wübbeke 2013b). In the course of science-policy interaction, scientific objectivity itself can become subject to political contestation. For example, the scientific contestation over whether there is climate change is also a political contestation over whether countries will transform their energy systems. Objective scientific contestation becomes political contestation (Jasanoff 2004: 14).

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[9] A financial crisis and an environmental catastrophe become crises only through their framing as such by actors. For instance, the fact that Germany defined the explosion of the nuclear reactor in Fukushima in 2011 as a problem to the development of the nuclear industry and decided to eliminate its nuclear capacities, whereas France and other countries continued as before with their nuclear policies, points to different problematizations of different actors (Wittneben 2012; Jahn and Korolczuk 2012). As a consequence of different problematizations, actors choose different action paths. There are many examples of the construction of problems, for instance climate change is perceived only as such through scientific research and intense campaigning. Moreover, acid rain was perceived as a problem only after protracted social problematization discourses on acid rain (Methmann et al. 2013; Pettenger 2007; Wilkening 2004).

[10] This definition of problematization is different from Callon's (1987, p. 204). Callon understands problematization more as the definition of the identities of the self and others. However, he underestimates the processes involved in the social production of problems.

2.4.2. Strategy

Strategy is a plan to overcome the problems that have been identified during the process of problematization. Based on problematization, the initiator of a strategy defines his or her interests which then guide the actions taken in order to change the existing practices (Callon 1987, p. 208; Callon and Law 1982, p. 618). Strategy includes goals, as well as the methods and instruments used by those implementing the strategy to achieve those goals. The strategy provides an overarching roadmap for changing the respective practices and is specified through concrete goals, against which the success of the strategy can be measured.

Strategy includes not only the definition of an actor's interests, but also the positioning of other actors and the self (Davies and Harré 1990). The initiator of the strategy identifies some actors as the allies of an intervention, while it positions others as barriers. For instance, the Chinese government sees small miners as impediments to its policy. The government wants to weaken these actors' access to REE. The framework calls these actors "unwelcome actors."

In addition, the strategy for changing existing industry practices often involves a high degree of centralization. The designer of a strategy, in this case the central government, seeks to establish itself as the central and most powerful actor in a network of actors. Moreover, it seeks to present change to current practices through the strategy as an inevitable step (Callon 1987). In the case of the REE industry, this means that if the orderly development of the industry is to be restored and maintained, this can only be achieved with the intervention of the central government. The framework calls this process "centralization."[11]

Strategy, interests and actor positions are never fixed. As problematization is a continuous process, interests change during the process of policymaking. As will be discussed in the next section, "strategic flexibility" and "strategic readjustment" are two examples of changing existing strategies. Strategy often rests on some form of official document which draws together a set of single policies into one strategy. It is also possible that the initiator pursues an informal or implicit strategy that is not defined through an official central plan.

The analysis of the dissertation focuses especially on the problematization and strategy of the initiator, in this case the central government. However, any actor has its own problematization and strategy. The analysis of the dissertation will consider, in less detail, the problematizations and strategies of other actors as well. Moreover, it is important to note that strategy does not refer to action. It is a mindset and a plan to do something rather than action itself.

[11] This is similar to Callon's (1987) concept of the obligatory point of passage.

2.4.3. Translation

Translation refers to the step-by-step implementation of a policy. Although strategy is mostly formulated at a particular place in the network, in this case the central government, it aims at change elsewhere in the network. Translation thus needs to make connections between strategy and the practice which the government has targeted for change. Translation is neither an easy nor an automatic task. Each translation needs to establish a translation chain that carries on policy from the level of strategy to that of practice (see figurefigure 2-2).

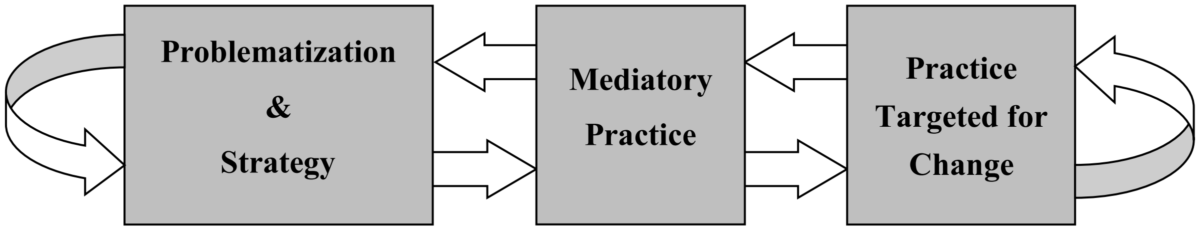


Figure 2–2: Circulation of policy along the translation chain between national practice and the targeted practice (author's illustration).

The work of mediators is essential to translation. Mediators are actors and instruments that translate policy into local practice through mediating practices. Mediators are more than just passive and mute carriers of policy. They potentially transform the meaning of a policy: "Mediators transform, translate, distort, and modify the meaning or the elements they are supposed to carry" (Latour 2005, p. 39). Due to the effects of mediation, the character of the policy formulated within the offices of the central government can look quite different from the policy that arrives at the local level. Mediating actors can be potentially any (group of) human being. With regard to the following analysis, these are in particular government agencies of the administrative hierarchy – the provinces, cities, counties and townships – as well as enterprises.

Moreover, strategy can also be inscribed in material instruments, called inscriptions. This study distinguishes three types of inscription (Callon 1986): First, regulatory instruments are official texts that specify the operation of a strategy by defining detailed steps to be taken and giving instructions to mediating actors. Sometimes, regulatory instruments are not inscribed in texts but are embodied in patterns of action.

Second, technologies are instruments which are shaped, constructed and arranged in such a way as to embody a strategy. This could be technology such as machinery and electronic devices. For instance, surveillance cameras in a mining area can translate the strategy of resource conservation to the local level because they help to identify illegal miners that contribute to loss of resources.

Third, a strategy can be inscribed in the direction of flows of materials. The most prominent flow of things is money, but in particular in the field of mining, flows of natural resources and raw materials can play an important role. By deciding on the direction and extent of a flow, an actor can promote the change of a practice.

These three types of inscriptions are instruments used by actors to achieve a certain solution. But they might not work as hoped, might betray their creator or user, transform policy in a way not intended or be hijacked by other actors.

In addition to mediators, there are actors and instruments which are not directly involved in the translation of strategy, but which are part of the targeted practice that is to be changed. These actors and instruments can also influence translation and the outcome of policy. They might do so by simply ignoring a policy or pretending to comply. Beyond the function of things as instruments, the geology of a mining area, the composition of a deposit, and the production technology are physical conditions that can have a large transformative impact on policy.

From the view of the initiator of the strategy, in this case the central government, the change of policy during translation does not need to be unwelcome or unintended. Policy always requires a certain discretion on the part of mediators and targeted practices. The government might, in a deliberate transformation, even encourage mediating actors to adapt the policy to their local needs. In the Chinese political system, experiments by local administrative units are an important source of inspiration for central government policy. The central government might not even be the primary initiator of a policy, but might instead only respond to progressive local governments (Heilmann 2008). Giving attention to the non-zero sum character of translation and the role of local discretion, I will call this flexibility during translation “strategic flexibility.”

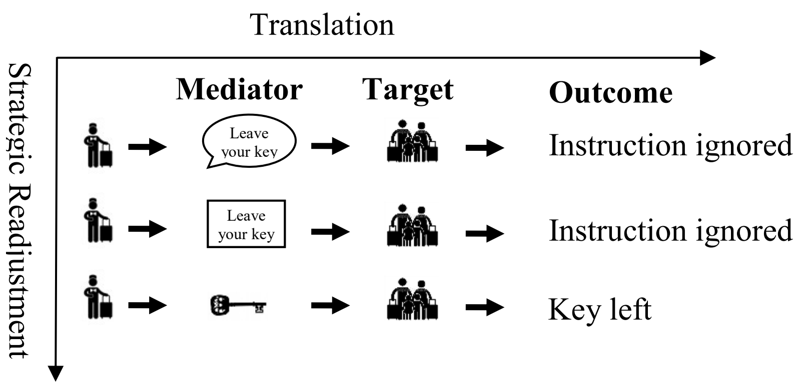
Translation is a two-directional process. Policy flows from the national to the local level, as well as back from the local level to the national, for instance in the form of feedback, information or de facto policy changes. Policy therefore “circulates” along the chain of translation: it is translated but also transformed. The central government decision makers are not the only ones to shape the characteristics of a policy.

An example to illustrate this abstract discussion (see Latour 1999; Wübbeke 2013b) might be that of a city government that initiates a rule against driving too fast. It aims to regulate the local practice of driving. The rule “do not drive too fast” is the policy. The mere rule is arguably not enough to bring cars to drive slower. There are mediators involved, such as the police officer keeping track of car speeds. While the government defines the initial policy, mediation and local practices also have influence on policy. Car drivers might still decide to drive too fast when no police officer is present and therefore turn the policy from “don’t drive too fast” to a de facto “don’t drive too fast, but it is ok if you drive too fast.” Or the policeman might keep track of speed only at busy morning hours but sleep at noon. All these actors can have an impact on how policy is practically enacted.

Mediation can also be delegated to instruments. For instance, the policeman might be replaced by a speed bump or a speed trap. The change of mediators also implies a change in the form of policy. Compared to the simple sentence "do not drive too fast," the speed bump enacts a new script of translation: if you drive too fast, you will feel a physical barrier. "The driver modifies his behavior through mediation of the speed bump: he falls back from morality to force" (Latour 1999: 186). Instruments, however, can also undermine the translation chain. For instance, a speed bump can be worn out and cars may speed as normal.

Translation involves a dynamic process of interaction between facilitating factors and barriers. Due to their different problematization and strategy, some mediators or participants of the targeted practice might resist the translation of a policy. The strategy initiator or allies might in turn adjust their strategy in order to find an appropriate answer to the resistance. The conceptual framework calls this dynamic "resistance," in which some actors attempt to change or hinder the translation of the strategy, and "strategic readjustment," where the initiator or its partners attempt to counter this resistance through the adoption of new methods in order to ensure the smooth translation of the strategy. There can be several rounds of resistance and strategic readjustment.[12]

Bruno Latour (1991) gives the example of a hotel manager who wants the customers to leave their keys at reception to avoid the chance that the key might be lost (see Figure 2–3). At first, the manager might have a strategy of saying "leave your key," but customers easily resist the translation. They might just ignore the manager's words. It could be quite exhausting for the manager to always be reminding customers to leave their keys. Thus, the hotel manager might inscribe his strategy in an instruction sign that says "leave your keys." This is a new mode of translation and a new mediator, but customers might still ignore this. In his next strategy re-adjustment, the hotel manager might attach a heavy object to the key so that customers have no choice but to leave the key as they do not want to carry the heavy weight with them.



[12] Callon (1982) speaks of "re-interessment."

Figure 2–3: The translation chain at each stage of strategic readjustment based on Latour's example of the hotel key (Latour 1991) (author's illustration).

2.5. Design and Methodology

The design of the study is based on a cultural perspective of science and a pragmatist approach to theory and methodology. Cultural metatheory, described above, emphasizes the comprehension of the empirical world in its entirety. This holism aims at grasping the whole set of connections and elements of a given social space (Reckwitz 2000). This is in stark contrast to positivist theory, which aims at building and testing single causalities between variables. From a deductive-nomological perspective of positivism, the researcher should derive a set of hypotheses from substantial theory (King, Keohane and Verba 1994).

In contrast to positivism, cultural meta-theory claims that hypotheses, which are explicitly developed prior to research, unnecessarily limit our grasp of reality (Smith 2004). Rather, research should be as open-minded as possible and should not put forward a hypothesis that is then tested through a study. Theory should not prescribe hypotheses but only provide a framework that loosely guides research. Instead of being hypothesis-driven, research should have a strong orientation toward exploration and should follow an inductive approach. The researcher should arrive at a number of key findings at the end of the research process instead of following pre-determined hypotheses. This research design does not establish a set of hypotheses. As presented in the introduction, the dissertation instead provides a number of key findings drawn from the empirical research.

While this approach can be described as inductive, it is not entirely so. The research process is rather what is commonly referred to as abductive (Friedrichs and Kratochwil 2009). Abduction is a combination of deduction and induction. Using this approach, theoretical assumptions and empirical research are developed and improved at the same time. With each step forward in empirical research, theory is updated to the new findings. This creates a continuous interplay between the theoretical and empirical work.

The collection and interpretation of data relied mainly on documents. Conducting of interviews on the topic of REE was difficult during the time of the research between 2010 and 2013. As REE was a highly politicized issue during this time due to domestic campaigns targeting the REE industry and the intense dispute with major trade partners, most Chinese actors were either not willing to give interviews on REE or did not give substantial information when they were interviewed.

Therefore the strategic choice employed for this research was to base findings mainly on information collected from written texts. Documents give only limited accounts of actors' perspectives and not all important documents are publicly available in the opaque Chinese political system. However, the analysis of all kinds of available documents showed that most political documents are public and that a lot of the debate and frictions within the political realm and within the REE industry can be ascertained from texts. Texts are a reliable source of information in most cases.

The collection of data followed an extensive search for documents between late 2010 and the end of 2013. This study relies on three types of document: First, official documents from the central government, as well as the provinces, cities, and townships. Most of these documents are publicly available. Some strategy documents such as the draft for the “Special Plan for the Development of the Rare Earth Industry (2009-2015)” were not available, although some information about their content was leaked. Locating written data was most difficult at the sub-provincial level, but more documents were available in some cities.

Second, newspapers from among state private media were important. These included central state agencies such as Xinhua or Party newspapers such as the People’s Daily as well as privately run and economically oriented newspapers and journals. The state control of media puts constraints on the availability of information. For instance, conflicts between and within government institutions as well as details about backdoor decision making are rarely reported. Conversely, plenty of information can be found on illegal mining, environmental pollution, and mergers and acquisitions. This makes a certain distortion of research unavoidable. Yet many press reports write critically about the achievements of the government’s REE policy and opposing views can also be raised in public. Therefore, the media can be important in identifying and analyzing the processes, obstacles, and conflict lines of policy.

Professional and scientific journals are the third source of information. There are plenty of journals that deal with the metals and REE industries, for example the *Rare Earth Information* of the Chinese Rare Earth Society and the *China Metals Bulletin*. These are partly published by government agencies and semi-official research institutes. They give detailed insights into the industry and the positions of enterprises.

2.6. Conclusion

This chapter outlined the conceptual framework of the dissertation. Based on actor-network theory and constructivism, the framework provides the tools to understand why and how the central government is changing the practices of the REE industry and how this is being implemented.

The intervention of the central government in the REE industry encompasses three stages: problematization is the definition of problems that the central government associates with the industry and which should be solved through the intervention. Strategy is the definition of interests, goals, positions and instruments used to change industry practices.

Translation then refers to the implementation and enforcement of strategy. In order to translate strategy, the central government has to rely on mediating actors and instruments. However, these mediators, as well as the participants in the targeted practices, can resist the central government's policy and interrupt the translation chain. The central government and its allied actors in turn can adapt their strategy to the resistance in order to find new methods of translation and to ensure that local practices are successfully changed.

3. The Rare Earth Industry

3.1. Introduction

This chapter describes the Chinese REE industry in order to provide the necessary knowledge base for the analysis of chapters 6 to 12. The REE industry is divided into the upstream and downstream sectors (see figurefigure 3-1). The upstream sector includes the mining of minerals, the processing and liberation of REE concentrates from the minerals, the separation of single REE and reduction to metals. The downstream sector refers to the consumption of REE by intermediate products. In particular information and environmental technologies critically rely on REE. This chapter shows that China has a near-monopoly in the REE upstream sector and is also the largest consumer of REE for intermediate products.

This chapter sets out with a general overview of REE and their global distribution and production (3.2). It then describes the Chinese upstream (3.3) and downstream (3.4) sectors. Finally, it examines the role of REE exports (3.5).

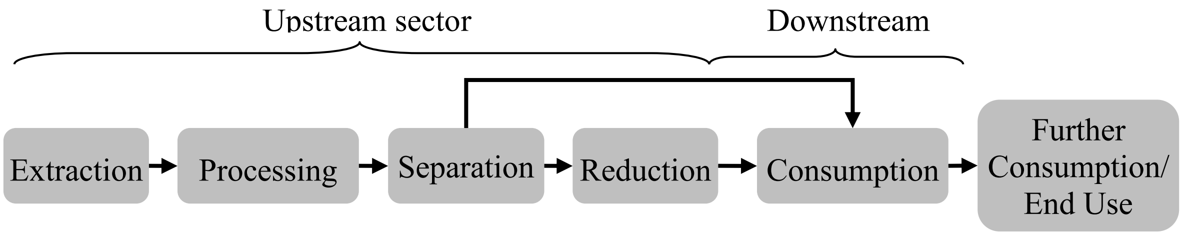


Figure 3–1: Simplified value chain of the REE industry.

3.2. The Rare Earth Elements

3.2.1. Rare Earth Elements and Minerals

The rare earth elements (REE) are a group of 17 metals. These contain the 15 elements of the lanthanides group, named after the element lanthanum, plus yttrium and scandium. The REE are grouped together because they occur in the same minerals and have similar physical and chemical attributes.

There are two groups of REE (see Table 3–1): light rare earth elements (LREE) and heavy rare earth elements (HREE),[13] based on their relative atomic weight. The elements lanthanum, cerium, praseodymium, neodymium, samarium, europium and gadolinium are LREE. Terbium, dysprosium, holmium, erbium, thulium and ytterbium are HREE. Although yttrium and scandium are lighter than the LREE, they share more characteristics with the HREE (Gupta and Krishnamurthy 2005). This distinction is not only relevant to chemistry and geology but also to the REE industry.

	Element	**Atomic Number**	**Symbol**		**Element**	**Atomic Number**	**Symbol**
LREE	Lanthanum	57	La	**HREE**	Terbium	65	Tb
	Cerium	58	Ce		Dysprosium	66	Dy
	Praseodymium	59	Pr		Holmium	67	Ho
	Neodymium	60	Nd		Erbium	68	Er
	Promethium	61	Pm		Thulium	69	Tm
	Samarium	62	Sm		Ytterbium	70	Yb
	Europium	63	Eu		Lutetium	71	Lu
	Gadolinium	64	Gd		Scandium	21	Sc
					Yttrium	39	Y

Table 3–1: The REE elements and some of their attributes. Source: BGS 2011.

REE do not occur in their metallic form in nature, but are bound in minerals as rare earth oxides (REO).[14] Among the 250 minerals with large REE concentrations, only nine have a REO content above 50 percent (see annex table 14-1).

The richest REE minerals are bastnäsite (75 percent REO content), monazite (65 percent), parasite (61 percent) and xenotime (61 percent). Bastnäsite, monazite and xenotime are the most mined REE minerals. Each mineral has a different composition of REEs: xenotime contains large concentrations of yttrium and other HREE, whereas monazite and bastnäsite are rich in cerium, lanthanum, neodymium and other LREE (BGS 2011).

[13] LREE are also called the cerium group and HREE the yttrium group. Some Chinese sources distinguish a third group, middle REE (MREE). The LREE Samarium, Europium and Gadolinium are considered MREE (Liu GH 2007, p. 2). This book sticks to the distinction of LREE and HREE.

[14] The quantity of REE is specified in REO equivalent (REOe) because REO is the most common form of REE. All REE quantities given in this study are expressed in REOe unless otherwise stated.

3.2.2. Resources and Reserves

Contrary to their name, REE are not "rare" but very abundant in the earth's crust.[15] LREE are more common than HREE. Cerium, the most common REE, is the 27th most abundant element on earth. This is a bit less than copper, zinc and nickel, but more than lead and tin. The LREEs lanthanum and neodymium are also very common. However, praseodymium, and thulium are rare, but still more common than gold, platinum or silver. Only promethium does not exist in a natural form on earth (Webelements 2013).

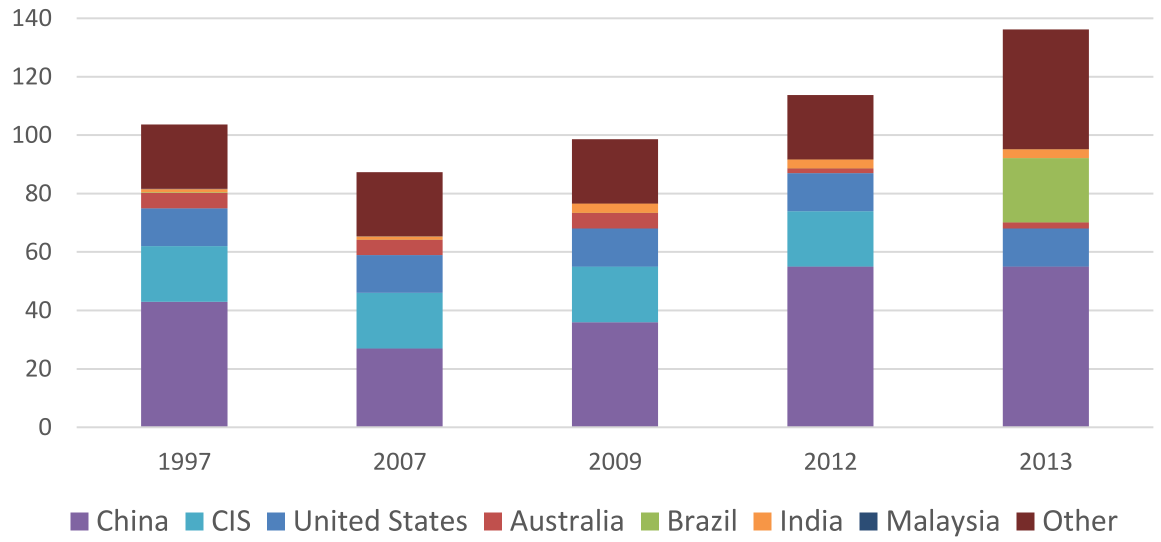


Figure 3–2: REE reserves by country in million tons in 1997, 2007, 2009, 2012 and 2013. CIS = Commonwealth of Independent States (including Russia). CIS reserves for 2013 are included in "Other." Sources: USGS 2014.

While REE are very abundant on earth, REE resources and reserves are much less common.[16] Due to the low concentration of REE, only a few deposits are suited to profitable extraction. Due to new exploration activities, REE reserves have steadily increased in the last decade (see Figure 3–*2*). The United States Geological Survey (USGS) estimated global reserves to be 140 million tons (Mt) REO in 2013 (USGS 2014). In 2013, China's reserves of 55 Mt accounted for 38 percent of global reserves. Due to new discoveries, Brazil has the

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[15] 18th century chemistry considered rare earths as oxides which are irreducible at red heat by hydrogen or carbon, also called "earths." They were "rare" because only a few rare earth deposits were known at this time. Even though "rare earths" are neither rare nor earths, the name continues to be used today (Szabadváry 1988; Trifonov 1963).

[16] A resource is the amount of an element available for economically feasible extraction, now or in the future. Reserves refer to identified resources that can be extracted under current economic and technological conditions (USGS 1980).

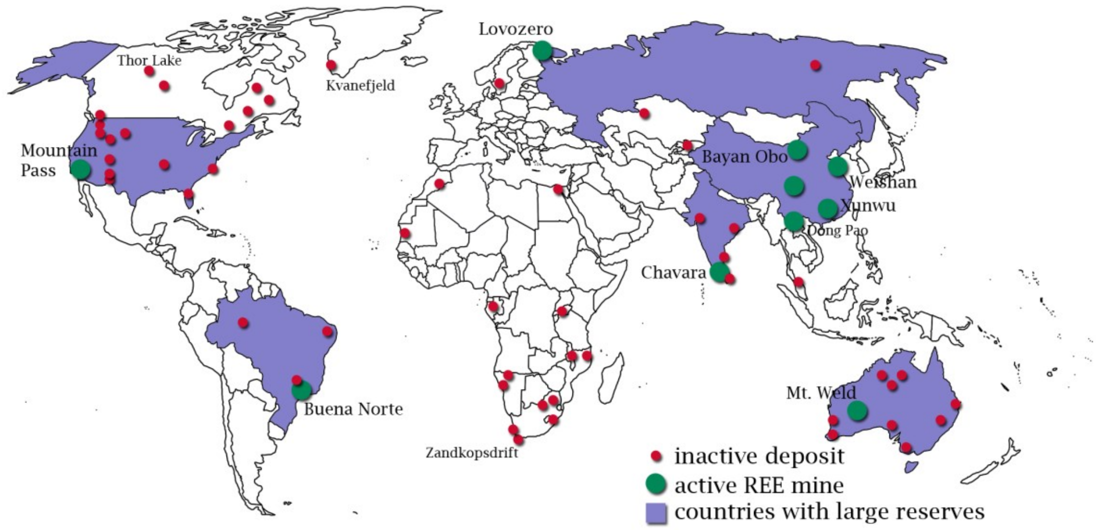
second largest known REE reserves of 22 Mt. The Commonwealth of Independent States (in particular Russia) and the United States follow with 19 Mt and 13 Mt, while India (3.1 Mt) and Australia (1.6 Mt) also have large reserves (USGS 2013a).

At current extraction levels, these reserves would not be depleted for several centuries. However, if the rate of extraction grows rapidly and reserves do not increase further, REE reserves could be exhausted in the first half of the 22nd century. Although there is no immediate physical shortage of REE, there has been a lack of investment in REE mines outside China. However, many new mines are currently being developed outside China. Because most non-Chinese mines primarily contain LREE, a global shortage of HREE is possible in the current decade (Hatch 2011; Elsner 2011; Hatch 2013).

3.2.3. Global Deposits

REE deposits are scattered around the globe (Simandl 2014; see Map 3–1 and annex table 14-2).[17] A USGS overview identified about 760 global REE deposits (Oris and Grauch 2002), but few are active mines. Most active REE mines recover REE as a byproduct from mining other primary metals such as iron, titanium, niobium or uranium.

The American Mountain Pass mine is one of the few mines extracting REE as a primary resource. It used to be the world's largest mine. Production ceased in 2002 as a result of Chinese competition and environmental problems, but recommenced in 2010. Mountain Pass currently produces 4000t annually, much less than the 20,000t extracted in the 1980s (Molycorp 2012, 2013; USGS 2013a).



Map 3–1: Selected global REE deposits (author's illustration).[18]

[17] The Chinese mines will be presented in more detail below.

[18] A more complete map of global deposits can be found at USGS 2013b.

Mt. Weld in Australia is another large non-Chinese mine with a production of 2000t. The operator Lynas ships the REE concentrates to its processing plant in Kuantan, Malaysia, for smelting and separation. The project was delayed due to protests by local people against the possible environmental impacts of the processing plant (USGS 2014; Lynas 2013b; Schmidt 2013).

Further mines extract REE at Buena Norte in Brazil and Chavara in India (Campbell 2011). The Russian mine at Lovozero on the Kola Peninsula mines REE as a byproduct of the mineral loparite, which is processed at refineries in Kazakhstan and Estonia (Gupta/Krishnamurthy 2005, S. 122).

Geological explorations have assessed non-conventional reserves in the deep-sea mud in the Pacific Ocean. According to reports by Japanese scientists, these reserves could be much bigger than current land-based reserves, but extraction is costly and the political division of the ocean area is unclear (Kato et al. 2011). In addition, some scientists proposed carbon-bearing rocks in Russia as a source of REE (Klyucharev et al. 2013). There are many mines being developed, for example in Greenland and Canada (Technology Metals Research 2013).

Recycling of REE is not yet a major source of supply, because less than one percent are recycled from end-of-life products (Binnemans et al. 2013; Tanaka et al. 2013). Recovery is difficult and unprofitable because end products use REE in small quantities. But since 2010, many enterprises and scientists have worked on recycling from batteries, magnets, electronic components and other end-of-life products. Some of these processes could recover 80 percent of the elements. If recycling becomes more common, it could become an important supply of REE (USGS 2011; Binnemans et al. 2013; Sprecher et al. 2014; Rademaker et al. 2013; Seo and Miromoto 2013; Bandara et al. 2014; Elshkaki and Graedel 2014).

3.2.4. World Production

China is the world's largest miner of REE (see Figure 3–3). In 1992, China replaced the US as the largest producer of REE and since then, production has been increasingly concentrated in China, rising from around 33 percent of global production in 1992 to 85 percent in 1999 and 97 percent in 2005. As of 2010, China produced 97 percent of global REE, with only minor non-Chinese production in Malaysia, Brazil and India (USGS 2010). Due to a decline in Chinese extraction and new projects abroad, the Chinese share dropped to 91 percent in 2013 (USGS 2014).

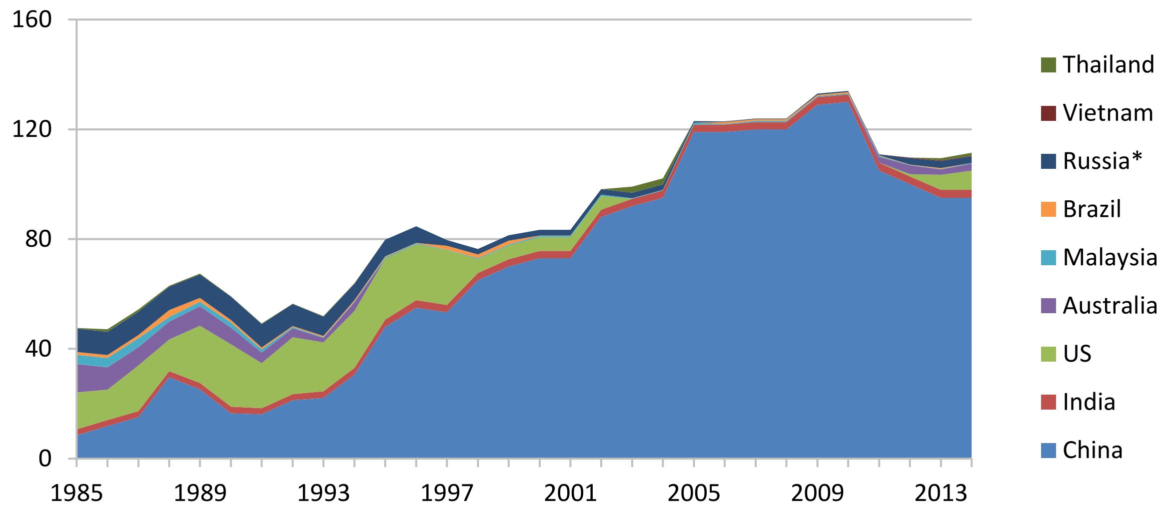


Figure 3–3: REE production by country in thousand tons from 1985 to 2014. "Russia" also includes the Commonwealth of Independent States: USGS 2014, various years.

3.3. The Upstream Sector

This section describes the upstream sector of China's REE industry. The upstream sector includes four steps: mining, processing and liberation, separation, and metals reduction.

3.3.1. The Size of the REE Industry

REE mining does not have as important a role for the Chinese economy and society as do coal and steel. The steel industry accounts for 10 percent of GDP (Song LG and Liu HM 2012, p. 9). Coal and iron mining have industrial output values of 1 trillion and 144 billion RMB respectively. The REE industry has an output value of only 0.8 billion RMB. Even compared to most small ferrous and non-ferrous industries, the output value is low (see Table 3–2). The entire REE industry, including the upstream and downstream sectors, had an output value of 85 billion in 2011 and 77 billion in 2013 (NDRC 2012; MIIT 2014).

Yet their essential function in a range of high technology products make REE a strategic industry of national economic relevance (MIIT 2012a; Zhao et al. 2011). Moreover, the REE industry is a key pillar of some local economies (Tao C 2011, p. 76).

	Enterprises	Employees in 1000s	Extracted volume in Mt of ore	Output value in billion RMB (mining only)
Coal	14357	3911	2893	1059
Iron/Steel	4250	388	673	144
Rare Earth	110	2	10.5	0.8
Tungsten	149	40	15.9	5.5

Lithium	14	3	133	0.8

Table 3–2: Enterprises, employees, volume of mined ore and output value for selected mining industries in China in 2011. Source: Wübbeke 2013b, p. 388.

China extracted more than 85,000t of REE in 2013. Production increased from 20,000t in the early 1990s to more than 129,000t in 2009 (see Figure 3–4). Extraction grew very quickly in the latter half of the 1990s and the mid-2000s. Due to government policy, production levels have decreased since 2009.

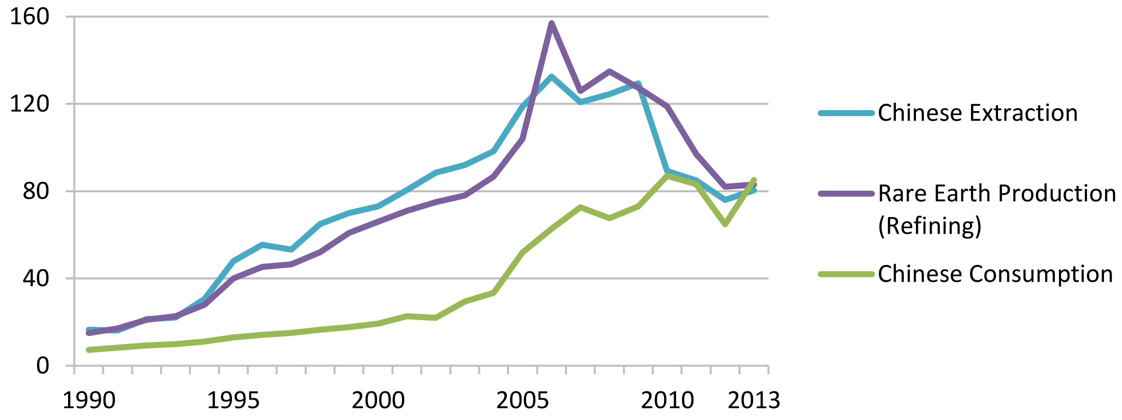


Figure 3–4: Chinese production of REE concentrate, refining, consumption and exports in thousand tons from 1978 to 2013. Source: Wübbeke 2013a, p. 386 and NDRC 2014.

3.3.2. Mining in China

Chinese REE deposits are located in the "north" and "south". Most LREE can be found in three provinces of the "north". The largest deposits are in Inner Mongolia, with 84 percent of national reserves, followed by Shandong with 8 percent and Sichuan with 3 percent.[19] The deposits of the "south" extend over Fujian, Guangdong, Guangxi, Hunan, Jiangxi and Yunnan. Athough the southern reserves are relatively small, they are very valuable due to their high HREE content (Table 3–3) (Cordier et al. 2010).

Due to its massive reserves, Inner Mongolia is the largest producer of REE. With a production of more than 47,000t, it accounted for 59 percent of national extraction in 2013. Despite their small reserves, the southern provinces used to be the country's second largest region for REE production. Between 2005 and 2010, the region accounted for about one third of national production. In 2005, it produced nearly as much as Inner Mongolia – 44,000t. Due

[19] Sichuan and Shandong are not "northern" provinces, but the Chinese sources label them as "north" in contrast to more southern deposits.

to the recent government policy, extraction in southern China dropped to about 7000t in 2013 (11 percent of national extraction). Sichuan produced almost 26,000t in 2013 (34 percent) (see Figure 3–5).

	Prospective Reserves in Mt REO	**Verified Reserves in Mt REO**	**Industrial Reserves in Mt REO (% of China's reserves)**	**Extraction Target (2014) thousand t**	**Mining Rights (2012)**
Inner Mongolia	>135	106	43.5 (84 %)	59.5	2
Shandong	>13	12.7	4 (8 %)	2.6	1
Sichuan	>5	2.4	1.5 (3 %)	25	7
Southern Deposits	>50	8.4	1.5 (3 %)	17.9	
	Among these:	Jiangxi	36 %	9	45
		Guangdong	33 %	2.2	3
		Fujian	15 %	2	5
		Guangxi	10 %	2.5	1
		Hunan	4 %	2	1
		Yunnan	2 %	0.2	2
Guizhou	>1.5	0.07	-	-	-
Other				-	
Total	>206.75	127.7	52	105	67

Table 3–3: Chinese REE reserves, production and mining rights by province. Source: MEP 2009, p. 3; MLR 2014.

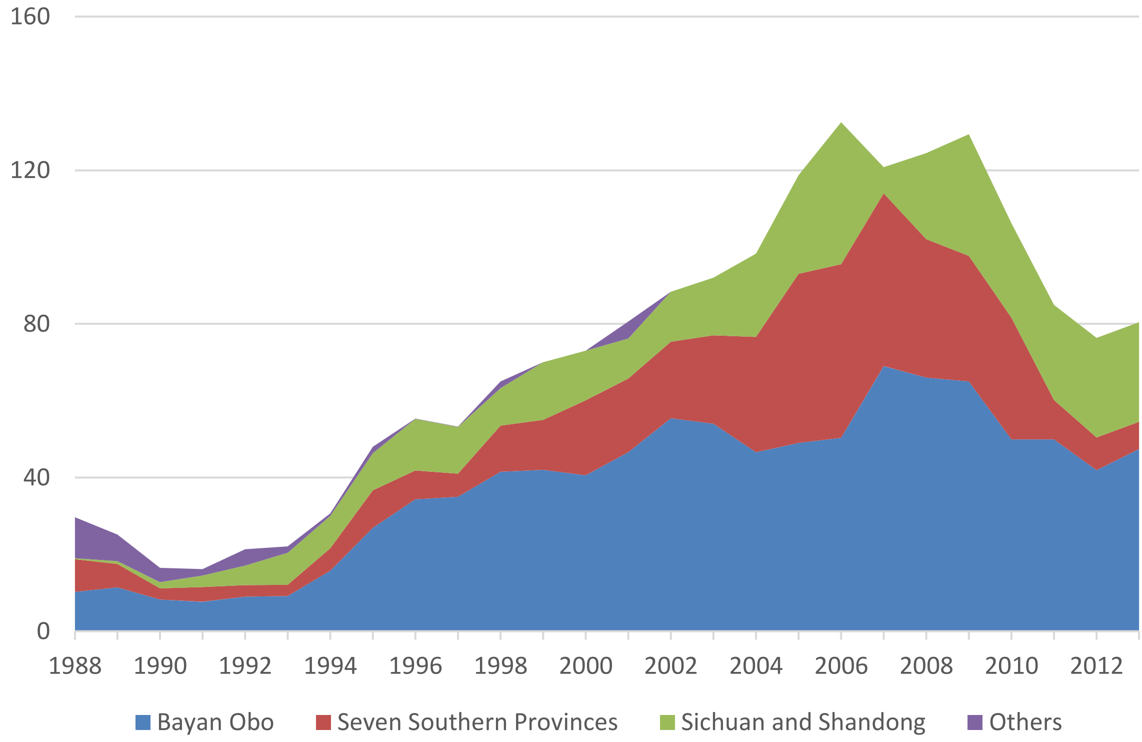


Figure 3–5: Chinese production of REE by region from 1988 to 2013 in thousand tons. Sources: Su 2009, NDRC 2010, 2011, 2012, 2013, 2014.

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Map 3–2: Chinese REE deposits (author's illustration).

Bayan Obo (Inner Mongolia)

The huge reserves of Inner Mongolia are concentrated in the open-pit mine at Bayan Obo[20] (see Figure 3–6).[21] The world's largest REE mine extends 18 km from west to east and 3 km from north to south. Bayan Obo is an iron mine with LREE as a byproduct (Yuan ZX et al. 1992). The LREE occur in a mixture of bastnäsite and monazite minerals (Baogang Bayan Obo Iron Mine Information Center 2008).[22] Inner Mongolia Baogang Rare Earth High Technology (hereafter "Baogang"), a subsidiary of the province-owned steelmaker Baogang Group, holds the two mining rights for Bayan Obo (Drew et al. 1990; Wu CY 2008; Xu GX 1995).

Figure 3–6: The Bayan Obo open-pit mine (left) and sedimentation ponds in Fujian (right) (Sources: Dijk 2011; Tang XZ et al. 2012).

Liangshan (Sichuan)

The Yi Autonomous Prefecture of Liangshan[23] hosts China's second largest active LREE mining area with 1.5 Mt of REE reserves. The LREE deposits are located in Mianning county[24] and Dechang county.[25] The bastnäsite minerals generally contain less phosphorus, sulfur, titanium, and thorium than Bayan Obo minerals. Sichuan Jiangtong Rare Earth Ltd.[26] owns the

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[20] 白云鄂博

[21] The mining takes place in the main and east pit. The western pit has so far been spared from legal mining due to higher taxes and production costs.

[22] The major REE-containing rocks are fluorspar-type iron-REE rocks and magnetite-type dolomite REE rocks.

[23] 凉山彝族自治州.

[24]冕宁县. Here in particular in Maoniuping village (牦牛坪村) as well as Sanchahe (三岔河) and Baozi Village (包子村).

[25] 德昌县. Here in Dalucao town (大陆槽乡).

[26]四川江铜稀土有限公司.

most important mining licenses in Mianning. It is the largest miner in Sichuan with an approximate annual extraction of 15,000t (Zhao L 2010; Wei N 2008; Xu 1995).

Weishan Lake

The LREE bastnäsite deposit at Weishan Lake[27] in Shandong province has very large industrial reserves. The 4 Mt account for eight percent of national reserves. However, the underground mine has only marginally produced REE since 2001 and is currently under reconstruction. The mine has been unprofitable because the minerals have to be mined underground, which is too costly. The state-owned China Iron and Steel Research Institute Group owns the mining rights for Weishan Lake (REI 2009; Sina.com 2010a).

Southern China

The unique ion-adsorption clays in southern China contain high HREE concentrations. The southern provinces have REE industrial reserves of 1.5 Mt, about 80 percent of global HREE reserves. In contrast to the north, the southern deposits are highly dispersed and have a lower ore grade. Jiangxi and Guangzhou each account for one third of southern REE reserves. Fujian makes up 15 percent, Guangxi 10 percent, Yunnan 4 percent and Hunan 2 percent (Su WQ 2009). In addition to the HREE, the southern provinces are also abundant in LREE. The most common method for extracting REE from the clays is in-situ leaching (Su WQ 2009).[28]

The largest Southern REE deposit is located in Ganzhou city (赣州),[29] Jiangxi. As of 2005, Jiangxi produced approximately 8000t of REE. In 2014, Jiangxi had an extraction target of 9000t. The largest miner is the Ganzhou Rare Earth Group[30] (Peng 2006; Meng QJ 2012; Rao ZH and Feng SJ 2007; MLR 2014).

Guangzhou became a large REE mining province in the last decade. In 2005, Guangzhou produced 15,000t of REE, even more than Jiangxi, but mostly LREE. The province had an extraction target of 2200t in 2014. The three mining licenses for the province are located in

[27]微山湖.

[28] Traditional tank and heap leaching methods excavate entire hills. The common in-situ leaching recovers the REE directly at the deposit through electrolyte solvent injected at intervals into wells at depths of up to 5 meters. The lixiviant, an ammonium sulfate or ammonium nitrate, releases the REE from the host rocks through ion exchange. The in-situ leaching method has less impact on the environment and a higher recovery rate than traditional leaching methods (Li C 2011, Ruan C and Jun T 2009).

[29] Here in particular in Xinfeng (信丰县), Longnan (龙南县), Xunwu (寻乌县), Dingnan (定南县) and Anyuan (安远县) county.

[30] 赣州稀土集团.

Meizhou city (梅州市),[31] Heyuan City (河源市)[32] and Shaoguan city (韶关市).[33] The Guangdong Rare Earth Group owns most of the mining rights (Peng and Qing 2006). Fujian has an extraction target of 2000t (HREE), Guangxi 2500t (LREE), Hunan 2000t (LREE), and Yunnan 200t (HREE) (MLR 2014).

3.3.3. Processing and Liberation

After mining, the minerals are processed and liberated from the gangue. The processing methodology depends among other factors on the type and nature of the deposit, the recovery of other valuable minerals, the gangue, composition of the REE minerals, and social and environmental aspects (USEPA 2012).

Figure 3–7: Monazite concentrate; neodymium carbonate, cerium chloride, terbium oxide (from left to right). Sources: Guangxi Qinzhou Jinlianda 2013; Jiangsu Guosheng REE 2013.

Beneficiation is the liberation of REE minerals from the waste rocks through physical processes. It produces a concentrate with an REO content of 50 to 70 percent (see Figure 3–7 for monazite concentrate).[34] The process separates REE from other materials through magnetic separation and flotation.[35]

Chemical treatment further purifies the REE concentrate. The main products are mixed REE compounds such as sulfates and chlorides, depending on the end-use application (see Figure 3–7). Because the region around Bayan Obo lacks the sufficient water resources

[31] Here Pingyuan County (平远县) and Dapu county (大埔县).

[32] Here Zijin county (紫金), Heping county (和平县) and Longchuan county (龙川县).

[33] Here in Xinfeng county (新丰县).

[34] The concentrate still contains large amounts of iron, calcium, fluorine, phosphorous, silicon dioxide, and thorium (ca. 0.12 percent). Whereas ores from Bayan Obo and Liangshan need physical beneficiation, in-situ leaching of ionic REE delivers concentrates directly suited for chemical treatment. The complicated structure of Bayan Obo ores makes processing very difficult (Wen G, Liu YF, and Fan XB 2009; Che LP and Xu YF 2006).

[35] Magnetic separation uses the different magnetizability of various materials in order to sort out the iron ores magnetite and hematite. Flotation uses the different water repellency to separate materials (BGS 2011, Che LP and Xu YF 2006; Huang XW, Zhang YQ, and Li HW 2011).

necessary for water-intensive beneficiation, the raw material is transported by rail to the Baogang beneficiation plants at Baotou city. Ninety percent of processing operations in Baotou use the sulfuric acid method to treat the concentrate (Liu 2007; Huang 2011). Besides the mining companies, there are also many non-mining enterprises engaged in REE processing and liberation (Che and Yu 2006).

3.3.4. Separation

Some applications require pure individual REE. After processing and liberation, a part of the sulfates and chlorides are therefore separated into individual REE, such as neodymium and cerium. Chinese separation factories use solvent extraction to separate REE (see Figure 3–7) (Xie F et al. 2014).[36]

The most common products are oxides, sulfates, and chlorides. The most separated REE are lanthanum, cerium, neodymium and yttrium oxide (from 1986 to 2011). HREE account for less than one fourth of oxide production. The Chinese separation industry has the capacity to handle 200,000t of REE concentrate. The mining regions in Bayan Obo and Baotou, Liangshan, and Ganzhou are also centers of REE separation. There are, moreover, separation facilities in the non-mining provinces of Jiangsu and Gansu, and fewer facilities in Shandong and Shaanxi (see Table 3–4) (Ma RZ 2012).

[36] Solvent extraction uses the different solubility of various REE to separate them (British Geological Survey 2011; USEPA 2012; Liu 2007; Huang 2011).

Province	Separation Target in 1000t (in %) (2012)
Inner Mongolia	35 (39%)
Jiangxi	13 (14%)
Sichuan	11 (12%)
Guangdong	8.5 (9%)
Jiangsu	8.4 (9%)
Gansu	7 (8%)
Shandong	2.6 (3%)
Fujian	2.5 (3%)
Shaanxi	1.6 (2%)
Hunan	0.8 (1%)
Guangxi	-
Yunnan	-
Total	90.4

Table 3–4: Separation target by province. Source: Ma RZ (2012).

The separation industry is very scattered.[37] Before 2010, there were approximately 170 separation enterprises. The largest enterprises are located in northern China. Baogang, the largest mine operator, has a separation capacity of 15,000t (MEP 2009, Zhou X and Han XY 2010).

3.3.5. Metal Reduction

Some applications including hydrogen storage, magnets, and magnetostriction require REE as pure metals. Metals are reduced from the oxides, chlorides and other elements still contained in the single REE products. Metals can be produced as single REE metals or as mixed REE metals (mischmetal).[38] Metal reduction is achieved through electro-winning or thermal reduction. China can produce individual REE with up to 99.9999 percent purity. Only a few of the REE are produced as single metals (Li 2007; Gupta and Krishnamurty 2005).

The most frequently reduced REE metals are neodymium, neodymium-praseodymium alloys, mischmetal and lanthanum. The industry also produces smaller amounts of scandium, terbium and dysprosium metals. China currently has a metals production capacity of 40,000t. The production of metals is concentrated in Baotou and Ganzhou (see Table 3–5). The largest producer is Youyan Rare Earth New Materials with a production capacity of 10,000t. Although

[37] For a detailed list of large separation and refinery enterprises see annex table 14-4.

[38] Mischmetal is a mixture of REE that corresponds to the composition of the original mineral.

Sichuan is a major extraction and processing center, it has virtually no metal production (Zhou X and Han XY 2010; for a list of companies see annex table 14-5).

Province/Region	**Production**
Ganzhou	9587
Inner Mongolia	8790
Northeast China	1500
Northwest China (Gansu)	1280
Jiangsu (Xuzhou)	1050
Sichuan (Leshan)	700
Hunan (Yiyang)	150
Total	23057

Table 3–5: Actual metal production in t of metal in 2009. Source: Zhou X and Han XY 2010.

3.4. Downstream

The REE downstream sectors refer to the consumption of REE in the manufacture of intermediate products and their use in industrial processes. The downstream sectors include many applications. The following section presents the structure of downstream consumption and focuses in particular on three major applications: permanent magnets, phosphors and polishing powders.

3.4.1. Consumption Structure

The most important application of REE is permanent magnets, accounting for 20 percent of global consumption in 2011 (see Figure 3–8). Permanent magnets require in particular neodymium, praseodymium and small amounts of dysprosium and gadolinium. Metal alloys and catalytic converters are the second and third most important fields of application, accounting for 20 and 16 percent of consumption respectively. Catalytic converters use cerium, metallurgy mainly uses cerium and lanthanum. Further important applications are polishing (11 percent), glass (6 percent) and ceramics (6 percent). Phosphors account for only eight percent of consumption in terms of quantity, but are important in terms of value because they use expensive HREE (Goonan 2011, p. 3; Kingsnorth 2012).[39]

[39] For a detailed overview of REE use see annex figure 14-1 and table 14-3.

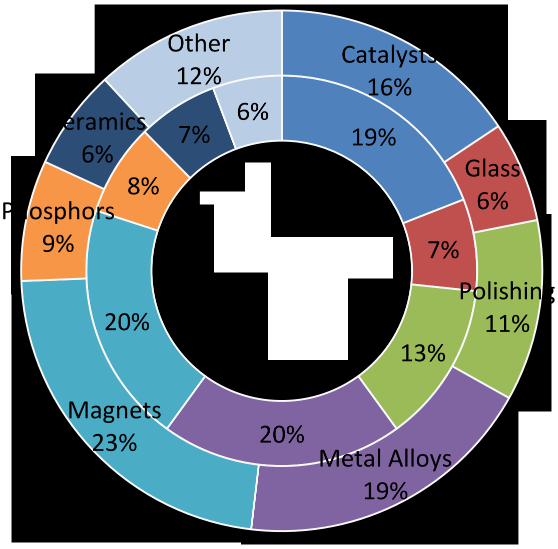

Figure 3–8: Global consumption of REE in 2011 (inner circle) and forecast for 2015 (outer circle). Source: Kingsnorth 2012.

China consumed about 70,000t of REE in 2011, which is about two thirds of global consumption. Japan (17 percent of global consumption), the US (10 percent) and the EU are also large consumers (see Figure 3–9).[40] China dominates all intermediate applications, in particular magnets, metal alloys and polishing materials. Even for catalytic converters and phosphors, its market share is above 50 percent. The dominance is least obvious in ceramics (Kingsnorth 2012).

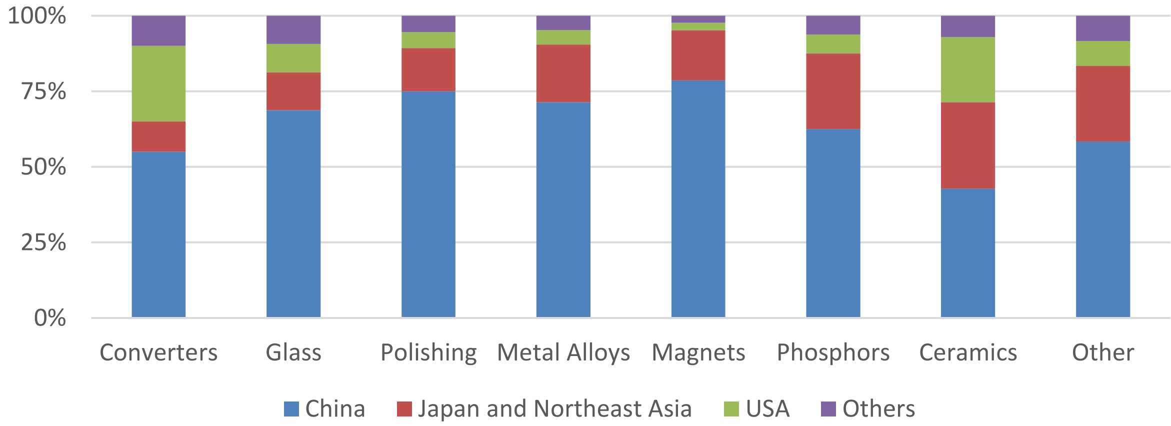

Figure 3–9: Composition of consumption by country and application in 2011. Source: Kingsnorth 2012.

[40] The data for Japan includes numbers for northeast Asia including South Korea. There are no individual statistics for the EU.

China's REE demand has been continuously growing. Compared to 1000t in 1978, consumption rose to 87,000t in 2010, an annual growth of 260 percent. Consumption grew fastest between 2004 and 2007 (see Figure 3–10). Traditionally, metallurgy and the chemical industry have been the most important applications in China. The skyrocketing consumption after 2004 is due to the rising demand from "advanced materials." Advanced materials made up 72 percent of demand in 2012, compared to 8.6 percent in 1995 (NDRC 2013).

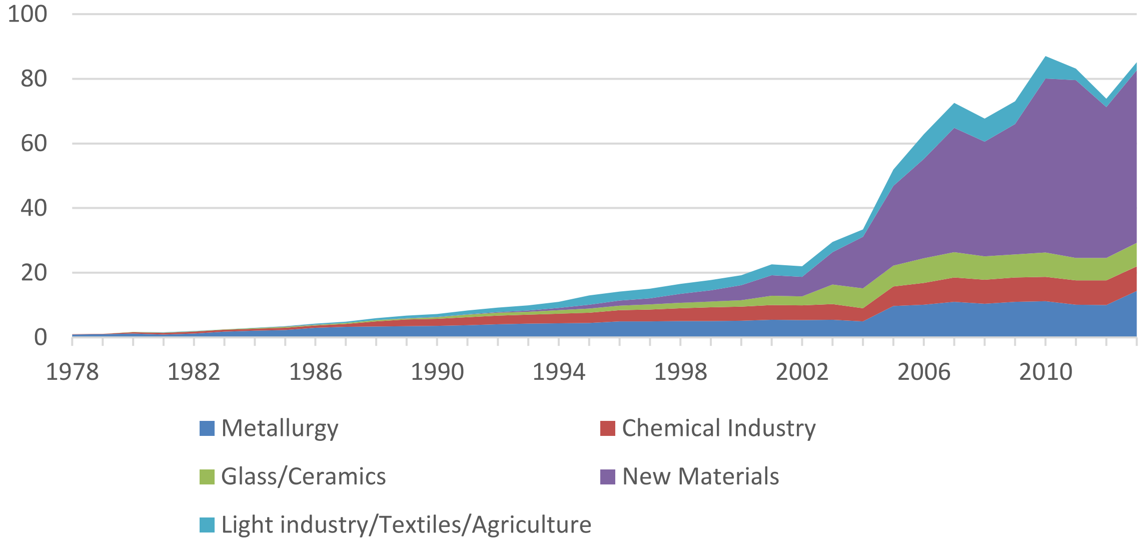

Figure 3–10: Chinese Consumption of REE in thousand tons by sector from 1978 to 2013. Source: Su WQ 2009, p. 141 und Lü Bin et al. 2011; Xu 1995, p. 22; NDRC 2007-2014.

Advanced materials describe a group of new applications in high technology. These are permanent magnets, phosphors, LCD polishing, catalytic converters and batteries. Most of this demand comes from permanent magnets, accounting for 62 percent of advanced material consumption from 2005 to 2013 (see Figure 3–11).

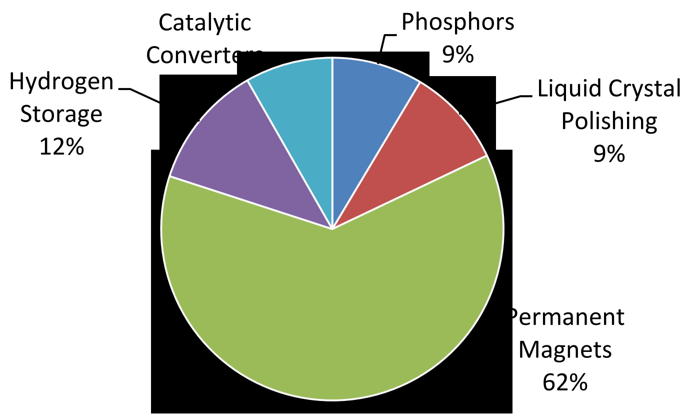

Figure 3–11: Structure of REE consumption by advanced materials from 2005 to 2013. Source: Su WQ 2009; NDRC 2008-2014.

3.4.2. Permanent Magnets

Permanent magnets are the most important application for REE and are essential to many high technologies. Neodymium-based magnets (NdFeB) are the strongest permanent magnets[41] and have revolutionized many applications. They are the most efficient transmitter between mechanical and electrical energy. Highly efficient wind turbines use NdFeB-based generators. Electric vehicles, energy-efficient washing machines, oil pumps and compressors rely on NdFeB-based motors.

Due to their efficiency, NdFeB can be smaller than other magnets but maintain high performance and precision. Small NdFeB motors make miniaturized electronic devices possible, such as modern mobile phones, headphones, MP3 players, small hard disk drives, DVD drives, and small notebooks. High-end printers, electric power steering (EPS) and anti-lock braking systems (ABS) also use high precision NdFeB motors (Chen J 2012).

China is the world's largest producer of NdFeB magnets. It accounted for 80 percent of the world market in 2010, followed by Japan. There is only marginal production outside of China and Japan.[42] Japan was the largest producer in the late 1990s, but China enormously stepped up production starting in 2002 (Research in China 2010; Chen J 2012).

The industry is very fragmented. There were about 130 NdFeB producers in China in 2009 (Rao XF et al. 2009). The largest Chinese NdFeB manufacturer is Zhongke Sanhuan[43] with NdFeB production capacities of 12,000t (Jiang L and Yu XJ 2009; Feng RH et al. 2012; Wang Y 2012; Rao XF et al. 2009).[44]

China dominates the NdFeB market in terms of quantity, but it is weak regarding high-performance NdFeBs. Japan dominates this market segment (Feng RH et al. 2012, p. 166). Leading Chinese enterprises have caught up with their foreign peers in recent years and can

[41] NdFeB consist of roughly 30 percent Nd, 70 percent iron and traces of boron and optionally the HREEs dysprosium, terbium and praseodymium. NdFeB possess a coercivity (which indicates the ability not to demagnetize if an external magnetic field is applied) five time as high as the strong barium-ferrite magnets. They have at least a six times higher maximum energy production than aluminium-nickel-cobalt magnets. Before the NdFeBs were commercialized, another type of REE magnet was in use, the samarium-cobalt magnet. However, this magnet has less coercivity and less maximum energy production than NdFeB magnets (Liu 2007, p. 153-154).

[42] The German Vakuumschmelze and its Dutch subsidiary Neorem are the only large non-Asian producers.

[43] 中科三环

[44] For a list of companies see annex table 14-6.

now produce high-performance NdFeBs, but most enterprises still focus on low-end magnets (Chen J 2012).

3.4.3. Phosphors

Phosphors[45] are an important application of HREE, in particular yttrium, europium, terbium, cerium and lanthanum. In the 1970s, the introduction of the color TV stimulated demand for REE-based phosphors. Today, energy-saving bulbs consume about three-quarters of REE-based phosphors. Further applications are light-emitting diodes (LED), liquid crystal displays (LCD) and plasma display panels (PDP) (BGS 2010, p. 19; Wu H 2008; China Rare Earth Phosphor Association Net 2011).

China was a marginal producer of REE phosphors until the 2000s, but reached a production of 3800t in 2006, more than half of global production, and about 4300t in 2013 (Wu H 2008). The Chinese phosphor powder industry is concentrated in Guangdong, Zhejiang and Jiangsu, close to the energy-saving bulb factories (Jiangxi Golden Century Advanced Materials; Liao XG 2011; Wang Y 2012).

China's largest producer is the Cantonese Jiangmen Keheng with an annual production of nearly 900t in 2007 (Ministry of Commerce, Wu H 2008, Yan HZ 2012, Tian ZY 2012).[46] Leading Chinese companies can produce high-quality phosphors. However, they generally lag behind Japanese and other foreign producers in terms of quality. China is dependent on re-imports of Japanese high-quality phosphors (Zeng SB 2003; Wu H 2008).

3.4.4. Polishing powder

The glass and optical industries use cerium for high-quality chemical polishing. Cerium is superior to alternative polishing materials (Liu 2007, p. 261).[47] The most important application is the polishing of LCDs. In addition, mobile phone displays, LCD screens, glass

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[45] Phosphors have the characteristic of phosphorescence. They continue to glow for a certain time after being exposed to a light source. This glow can continue for several hours.

[46] For a list of large REE phosphor producers see annex table 14-7.

[47] Compared to polishing rouge (iron oxide), silica or zirconium, cerium does not leave tiny scratches on the glass, is faster, does not leave rust color on the polished material, has a higher polishing rate per polishing powder used and reacts chemically with the glass during polishing. In particular, cerium-based polishing materials have an appropriate hardness, strong cutting force, fast results, high accuracy, and can be used for a long time (Kang QZ and Ren LH 2012).

optical discs, optical filters and normal plate glass are polished with cerium (Dou N 2011a, 2011b).

China is the world's largest producer of REE polishing powder. Production increased from 8000t in 2008 to 15,000t in 2010 and is mainly located in Baotou and Gansu. The joint venture Baotou Tianjiao Qingmei REE Polishing Powder[48] is China's largest producer with a capacity of 5,000t (Dou N 2011a, 2011b; Kang QZ and Ren LH 2012).[49]

The quality of Chinese powders lags behind that of foreign competitors. Although some Chinese companies can produce high-value powders and there is a trend towards higher value, Japanese companies in particular are much more advanced. Highly functional polishing powders for some LCDs, optical lenses, and precision devices still have to be imported from Japan. Japanese and Korean companies often purchase Chinese low- and middle-grade powders and turn them into high-value material (Yan HZ 2012, Xie LY 2010).

3.4.5. Other Applications

Besides magnets, phosphors and polishing powder, there are many other applications for REE. Petrochemistry uses lanthanum and cerium for petroleum cracking. Cerium in catalytic converters allows a higher operating temperature and greater efficacy, and makes it possible to reduce the use of expensive platinum. Alloys with cerium, lanthanum, neodymium or mischmetal improve the characteristics of steel and non-ferrous metals. Only 0.1 percent of REE can raise the robustness, heat resistance, abrasion resistance, or corrosion resistance of steel (Angerer et al. 2009, p. 311; USGS 2011; BGS 2010, p. 16). Terbium, samarium, dysprosium, and gadolinium are especially useful for magnetostriction[50] (Gupta and Krishnamurthy 2005, p. 38). Lanthanum is a component in nickel-metal hydride batteries, but these are inferior to Lithium-ion batteries.

3.5. Exports

Exports of REE are an important source of revenue for the Chinese REE industry and at one time export volumes of REE upstream products were continuously increasing (see Figure 3–12). Exports grew from 450t in 1979 to 16,000t in 1994 and peaked at 57,400t in 2007. This

[48] 包头天骄清美稀土抛光粉有限公司

[49] For a full list of polishing powder producers see annex table 14-8.

[50] Magnetostrictive materials change their length or volume on a micro-scale if an external magnetic field is applied. They are transducers of kinetic and magnetic energy. The alloy of terbium, iron, and dysprosium, called Terfenol-D, has the highest known magnetostriction (100 times higher than nickel) (Gupta and Krishnamurthy 2005, p. 38).

represents an average annual growth of more than 22 percent. Exports grew fastest in the latter half of the 1990s and accounted for a very high share of the domestic refinery production of REE. In the 1980s, China exported between 30 and 50 percent of its REE. The percentage of exported REE reached a peak of 82 percent of production at the turn of the century. Then the exported share decreased step by step to 45 percent in 2007. The decline of the relative export share is associated with China's rise as the world's largest intermediate consumer of REE.

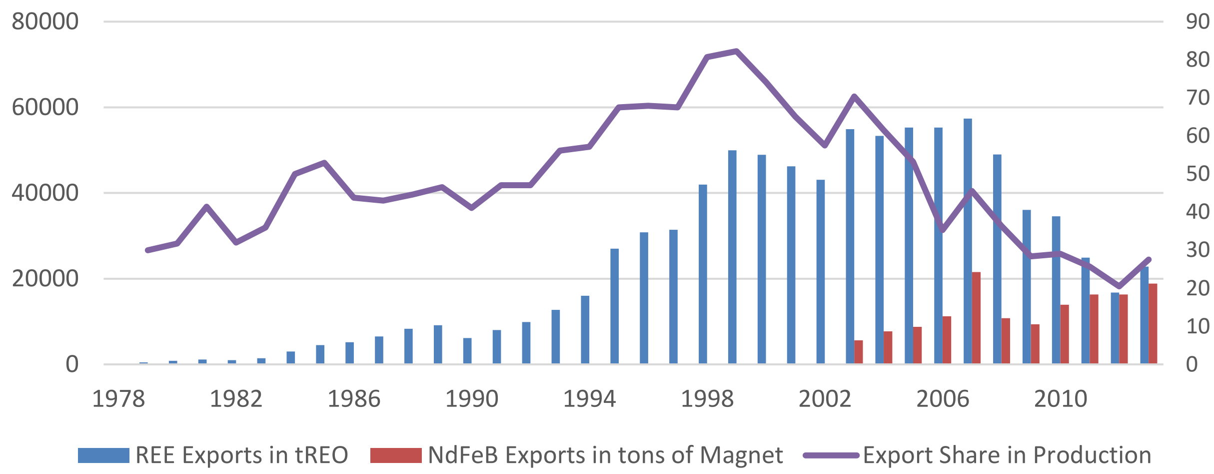

Figure 3–12: Exports of REE products (raw products and metals) and of REE-based permanent magnets (left axis) and the share of exports in domestic refinery production from 1979 to 2013. Source: Su 2009, p. 155; Xu 1995; NDRC 2008-2014.

From 2007 exports declined in absolute terms due to the central government's export restrictions. Exports decreased from 57,400t (2007) to 16,793t (2012). The steepest drop in exports occurred in 2011 and 2012, falling by 28 and 33 percent respectively. The share of exports in domestic production decreased to 22 percent in 2012.

At the same time, the export of REE downstream products has been increasing. Figure 3–12 shows the exports of permanent magnets: between 2003 and 2012, the export volume of NdFeB permanent magnets nearly tripled from above 5600t to more than 16,300t. Before the beginning of the economic crisis in 2007, exports were even above 21,500t. The increase in these exports shows that the value and sophistication of REE products was increasing.

The main destination for REE exports is Japan, although its share decreased from 49 percent in 2006 to 34 percent in 2013 (see Figure 3–13). The second largest consumer is the United States with a share of 32 percent in 2012. Other large export destinations include France, the Netherlands, Italy, Germany, and South Korea. Much export also goes to Hong Kong.

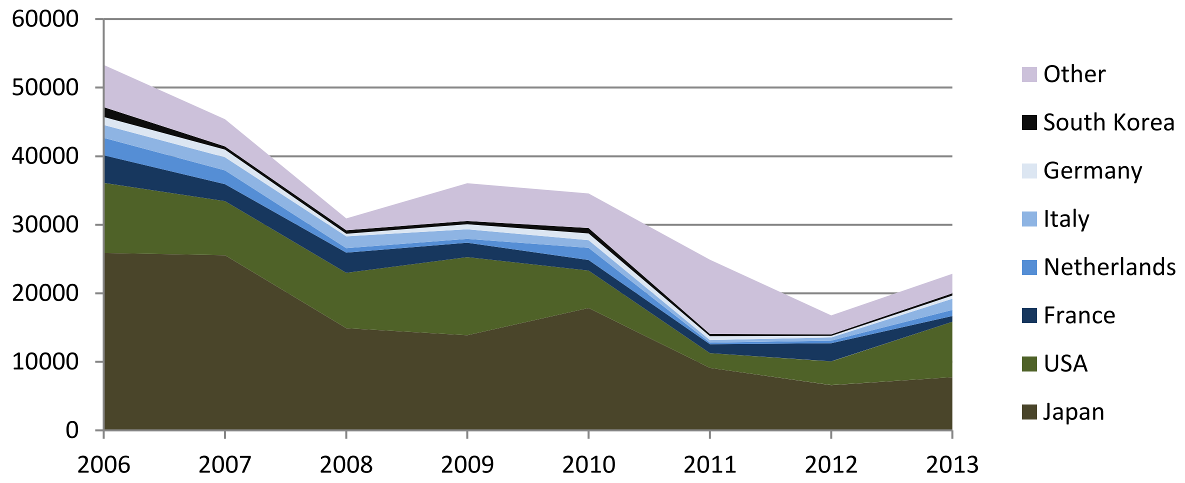

Figure 3–13: REE exports by destination from 2006 to 2013. * South Korea Estimated for 2008 by author. Sources: NDRC 2009-2014.

3.6. Conclusion

This chapter has shown that REE are a group of metals essential for many semi-finished products and manufacturing. Although REE deposits are distributed all over the globe, production is nearly monopolized by China. Within China, REE deposits and mining are concentrated in three regions: Inner Mongolia, Sichuan and seven southern provinces, in particular Jiangxi and Guangdong. The northern deposits, i.e. Inner Mongolia, Sichuan and Shandong, are rich in LREE, whereas the southern deposits are richer in HREE. Separation and metals purification are also located in these regions, although there are other production sites and users in other regions. Export has always played an important role for China's REE industry.

4. Actors

4.1. Introduction

The purpose of this chapter is to give a short description of the actors that are relevant to policymaking and implementation in the REE industry and the analysis of the later chapters. There are five main types of actors. These will be presented in the following order: Section 4.2 presents the central government, including the Standing Committee of the State Council and the ministries. The following section 4.3 gives an overview of the local governments, including provincial and sub-provincial administrative levels. The chapter then turns in 4.4 to the role of state-owned and private enterprises, and concludes in section 4.5 with a discussion of scientific institutions as well as civil society and the media.

4.2. Central Government Actors

A dozen central government ministries are involved in REE policy, largely similar to the political management of other metals. The variety of ministries involved leads to a fragmentation of responsibilities and competences. This fragmentation, which sometimes leads to confusion and competence struggles, is a typical feature of Chinese politics.[51]

The most relevant ministries in the metals mining and processing industry are the National Development and Reform Commission (NDRC), the Ministry of Industry and Information Technology (MIIT), the Ministry of Commerce (MOC), the Ministry of Land Resources (MLR), the Ministry of Environmental Protection (MEP), and the State Administration of Taxation (Lin et al. 2011, p. 39). Table 4–1 presents an overview of these ministries and their functions with regard to the REE industry.

Agency	**Abbreviation**	**Responsibilities**
State Council		General strategy
Ministry of Industry and Information Technology	MIIT	Inter-departmental coordination; industry planning and supervision; international cooperation
National Development and Reform Commission	NDRC	Technology commercialization, industry planning; investment; strategic reserves
Ministry of Land Resources	MLR	Resource management and conservation, geological environment
Ministry of Commerce, Customs Administration	MOC	Export and import management of raw materials

[51] In other policy areas such as climate change, some 20 ministries participate in policymaking (Yu HY 2008).

Ministry of Environmental Protection	MEP	Chemical environment
State-owned Assets Supervision and Administration Commission of the State Council	SASAC	Management of central government-owned enterprises
Ministry of Science and Technology	MOST	Science Plans
Ministry of Foreign Affairs	MOFA	Diplomatic aspects of resource trade

Table 4–1: Central government agencies and their responsibilities in REE policy.

4.2.1. The Lead Agency

Each policy field has a lead agency which coordinates the activities of various agencies. A common coordination mechanism is Leading Small Groups (领导小组). These are loose and temporary groups which bring together related ministries and are often headed by members of the Standing Committee of the State Council. They meet regularly to decide on the general strategy and particular tasks of the policy field. The offices are located within the State Council or the lead agency (Lieberthal 2004, pp. 194-195). In 1975, the State Council set up a Leading Small Group for Rare Earths, but shut it down in 1994. There is currently no leading group for REE.

Since the 1990s, the Rare Earth Office (稀土办公室), as part of the NDRC Department for the Raw Materials Industry, has coordinated REE policy. The office's central tasks are planning activities for the industry, regulation of export and extraction, collection of information, international cooperation, and inter-ministerial coordination (CRE 2009).

With the central government's intervention into the REE industry, the State Council set up the "Inter-ministerial Coordination Mechanism for Rare Metals" (稀有金属部际协调机制办公室) under the leadership of the MIIT in 2009.[52] The head of the MIIT Raw Materials Department is concomitantly the head of the coordination mechanism's office. The involved ministries include the NDRC, the Ministry of Finance, the Ministry of Public Security, the MLR, the MEP, the MOC, and other ministries. The group is of a looser form than the leading groups.

[52] The coordination mechanism does not only deal with REE but also other metals such as gold, tungsten, and antimony.

From 2011, its main purpose has been to organize actions against illegal mining (MIIT 2010a; People's Daily 2012).

The NRDC was the leading agency for the metals industries and REE until 2008. In the course of the government reorganization of 2008, the industry department of the NDRC was, together with its coordination and management responsibilities for the mining industry, transferred to the newly built MIIT (Wen LW 2008). The Rare Earth Office (稀土处) is now subordinate to the MIIT Department for Raw Materials (原材料司). The leading personnel of the office were also transferred from the NDRC to the MIIT (Jiang D 2011).

REE coordination work has been weakened through these reforms as the new REE office only has the status of "office" (处), whereas the previous office at the NDRC had the status of "department" (司). As the Rare Earth offices (稀土办) of the provinces also have "office" (处) status, but many leaders of state-owned enterprises are vice ministers, and other ministries are involved through their departments (司), coordination of REE policy by the lower-rank MIIT Rare Earth Offices is made more difficult. (China Times 2011; MIIT 2016).

Although the NDRC has given away its competences in the mining industry, it still is an important player. It is involved in the innovation and commercialization of policy for technologies containing REE. It approves investment projects in mining and processing and is responsible for the circular economy. Especially at the provincial levels and below, the provincial NDRC equivalents still have a large impact on the industry (China.com.cn 2013c).

4.2.2. State Council

The Standing Committee of the State Council is the inner cabinet of the Chinese government. It is headed by the Prime Minister, currently Li Keqiang and previously Wen Jiabao. The State Council gives general policy guidelines, but is less involved in the everyday practices of industry management. It is an often informal but important policy initiator and leader when state leaders become aware of problems. With regard to the REE industry, the State Council released a guiding document in 2011 (State Council 2011). Political documents from the State Council have a higher political authority than political decisions by ministries. Due to the awareness raised by state leaders and the strategic guidance through the 2011 document, the State Council has been the driving force behind the general planning of the current REE policy, whereas the MIIT has been responsible for specific industry planning and coordinating involved ministries (State Council 2012a).

4.2.3. Ministry of Land Resources

The Ministry of Land Resources (MLR) is responsible for managing the use of land, minerals, and maritime resources and guarantees their protection. The ministry coordinates the exploration of national territory for new resources and manages the registration and compilation of national reserves. The most important instrument of the MLR in the mining industry is the National Mineral Resources Plan (MLR 2008a). The resource plan specifies targets and measures for the exploration and extraction of single minerals. The MLR also sets annual production quotas for some minerals (MLR 2009a). It administers the issuance of mining rights as far as they concern the competences of the State Council. With regard to REE, resource conservation is an important concern for the MLR, in order to avoid REE being excessively extracted or rapidly depleted. The MLR moreover deals with the effects of mining on the geological environment and the restoration of old mining areas (MLR 2010a).

4.2.4. Ministry of Commerce and the General Administration of Customs

The Ministry of Commerce (MOC) and the General Administration of Customs (GAC) regulate the export and import of commodities. These two organizations determine the instruments of export control: the export quotas, export licenses, and export taxes. The GAC deals with everyday export procedures and controlling smuggling (MOC 2013, 2012c).

4.2.5. Ministry of Environmental Protection

The Ministry of Environmental Protection (MEP) is responsible for protecting the environment during mining and processing operations, especially in relation to the emissions of liquid, gaseous, and solid pollutants. Instruments used by the ministry include environmental regulations for production processes, emissions standards, environment impact assessments for new and extending projects, and the examination of the environmental records of exporting enterprises (MEP 2011a, 2011c). The ministry used to be a rather weak agency, but its role has been continually growing and its status was elevated from an administration to a ministry in 2008 (Gang C 2009, pp. 18-22, 153).

4.2.6. Other Ministries

Other central government agencies important to the REE industry are the State-owned Assets Supervision and Administration Commission of the State Council (SASAC), which administers central government-owned enterprises; the Ministry of Science and Technology, coordinating national science and technology policy; and the Ministry of Foreign Affairs, which had to smooth the waters in the international trade dispute over REE. Other ministries, such as the Ministry of Finance, the General Administration of Taxation, the Ministry of Supervision and the Ministry of Public Security, are also occasionally involved in various policy measures.

4.2.7. The Communist Party

The Chinese Communist Party (CCP) is the ruling Party of the People’s Republic of China. In the one-party state, the CCP has a monopoly on power and force. The Party is closely intertwined with the government, bureaucracy and the state economy. No important decision on industry policy can be made without the Party. The fact that the president and the premier of the government are at the same time the chairman and the vice-chairman of the Party shows that the government is controlled by the CCP. The Party’s penetration of the government and society is visible at all levels. Through the nomenclatura system, the Party exerts power over government positions and many economic and social units have Party committees. The position taken here is that the Party and the state are so deeply intertwined that there is no reason to separately analyze their roles. The assumption is that all major decisions taken by the state are essentially taken by the Party, be it in informal Party sessions or within government bodies. Therefore, the actions of the State Council and central government ministries are not only those of the state, but also of the Party (Lieberthal 2004).

4.3. Local Governments

4.3.1. The Administrative Structure

The government administration in China is divided into five levels: 1) the central government; 2) provinces, autonomous regions, and municipalities under the central government; 3) autonomous cities; 4) counties; and 5) townships and towns. Villages are officially not a separate level of government administration in the Chinese political system (Saich 2011, p. 180-181).

4.3.2. Provincial Level

The provinces are the next administrative unit below the central government. There are four types of administration at the provincial level. Besides the provinces, there are autonomous regions, which are regions with a high proportion of minority population and some special administrative characteristics; the municipalities, which are cities directly administered by the central government; and special administrative regions, namely Hong Kong and Macau.

The administrative rank of provincial governments is equivalent to that of a ministry of the central government. This makes it difficult for central government ministries to impose administrative decisions on provinces since in Chinese politics equal units have no administrative jurisdiction over each other (Saich 2004, p. 158; Lieberthal p. 169-174).

There are many provincial units relevant to REE politics. The most important ones are the Autonomous Region of Inner Mongolia, Sichuan province, Jiangxi province and Guangdong province due to the size and value of their REE reserves. Further provincial units with sizeable REE deposits are Fujian province, the Autonomous Region of Guangxi, Yunnan province and Hunan province. Some other provinces, such as Hubei and Jilin also have some deposits. Moreover, due to REE processing and separation facilities and downstream industries, further provinces are of relevance. These include in particular Zhejiang province, Jiangsu province, Shaanxi province, Gansu province and the municipalities Beijing and Shanghai. All in all, about 16 provincial units are important to REE politics. Among these, eight are of greater relevance due to their relatively large REE deposits. There are provincial REE offices in at least 26 provinces (CRE.net 2014).

The administrative structures of the provincial governments more or less mirror the structure of the central government. The provincial people's government is headed by the governor, who is concomitantly Party secretary of the province. There is also a provincial people's congress. The provincial Economy and Industry Commissions and their Raw Materials Offices (原材料处) are responsible for provincial industry management and coordination similar to the MIIT at the national level. At the same time, some provincial Development and Reform Commissions, the provincial equivalents to the NDRC, have retained their administrative units for REE management in the form of REE offices. There are also provincial Land Resource Bureaus (资源厅) and Environmental Protection Bureaus (环保局), which receive administrative orders from central government ministries but are funded by the provincial and local governments (Economy 2010).

The provinces implement government policy but are also allowed to pursue their own policies and devise regulations. In accordance with the national plans, provinces have promulgated their own provincial plans, which are based on national policies but also specify provincial targets and strategies. Many provinces created provincial 12th Five-Year Development Plans for the REE Industry or similar plans (see Table 4-2) (Guangdong Province 2012; Fujian Province 2012; Jiangxi Province 2012a, 2012b; Hunan 2012; Inner Mongolia 2012). Besides these industry-specific plans, REE relevant strategies are also included in general industry plans (see for example Sichuan Province 2010). The provincial Land Resource Bureaus create plans for mineral resources in accordance with the National Mineral Resource Plans. These plans also include provincial targets for the production of REE. Other policies, such as production plans, industry consolidation, mine closure, and environmental policies are also transmitted through province-level rules. As will be shown in the analytical part of this study, the provinces also control the issuance and transfer of mining rights (Lin et al. 2011).

Year	Plan	Province
2011	Ganzhou City Rare Earth Rectification Working Plan (赣州市稀土整治工作方案)	Jiangxi
2011	Working Plan for the Rectification and Elimination of Rare Earth Upstream Enterprises (自治区稀土上游企业整合淘汰工作方案)	Inner Mongolia
2011	Notification on Further Promoting the Work of Rectification and Elimination of Rare Earth Upstream Enterprises (关于进一步做好整合淘汰稀土上游企业工作的通知)	Inner Mongolia
2012	12^{th} Rare Earth Industry Development Plan (内蒙古自治区《十二五》稀土工业发展规划)	Inner Mongolia
2012	12^{th} Rare Earth Industry Development Plan (江西省稀土产业"十二五"发展规划)	Jiangxi
2012	Fujian Province Action Plan on Strengthening the Production and Scientific Development of Rare Earth Resources (2012-2015) 福建省加强稀土资源保护 科学开发稀土资源行动方案（2012—2015 年）	Fujian
2012	Opinion on Promoting the Rare Earth Industry Rectification in Guangdong (关于推进我省稀土行业整合的意见)	Guangdong
2012	12^{th} Rare Earth Industry Development Plan (稀土产业"十二五"发展规划)	Hunan
2012	Implementing Opinion on Promoting the Sustainable and Healthy Development of the Rare Earth Industry (关于促进稀土行业持续健康发展的实施意见)	Guangxi

Table 4–2: Major REE industry-specific plans by provincial units.

4.3.3. Sub-Provincial Level

The sub-provincial level of government encompasses three formal administrative levels: prefecture, county and township. The prefecture level includes in particular prefecture-level cities and autonomous prefectures. These are the administrative units directly below the provinces. There are many prefecture-level units directly involved in REE politics. With regard to REE mining, the most relevant ones are Baotou city (Inner Mongolia), Liangshan Autonomous prefecture (Sichuan), Ganzhou city (Jiangxi), Sanmin city and Longyan city (Fujian), several cities in Guangdong and other provinces (see Table 4–3).

Province	Prefecture-level governments with rich REE deposits
Inner Mongolia	Baotou
Sichuan	Liangshan Autonomous Prefecture

Jiangxi	Ganzhou
Guangdong	Meizhou Shaoguan Heyuan Maoming
Guangxi	Hezhou Wuzhou Chongzuo
Yunnan	Yuxi Dehong
Hunan	Jianghua
Shandong	Jining

Table 4–3: Prefecture-level jurisdictions with REE mining activities.

Some of these jurisdictions do not have legal REE mining licenses, but despite this a lot of illegal mining takes place within them. Moreover, there are many prefecture-level cities where mining does not take place but where there are relevant REE processing and separation facilities as well as downstream industries. These include, among others, Ningxia city (Gansu), Leshan city (Sichuan), Zibo city (Shandong) and Yangzhou city (Jiangsu). The most relevant for the analysis of this study are the cities of Baotou and Ganzhou as well as the cities in Guangdong and Fujian.

The administrative structure of the municipal governments is similar to that of the central government and the provinces, though somehave special characteristics. In Ganzhou city for instance, the Mineral Resources Management Bureau[53] has taken over the local responsibilities of the Land Resources Bureau (Ganzhou 2008).

Cities are the implementers of both national and provincial plans and regulations. They are moreover the main actors responsible for monitoring and enforcing national and provincial policies. Besides their function as mediators of policy, they also have a certain leverage to devise their own policies. The cities approve many concrete REE projects and issue other forms of licenses (MLR 2009a).

Below the cities are two further levels: counties, including county-level cities, and townships/towns. At each level there are also specific types of political structures, such as banners (county level in Inner Mongolia) and autonomous counties. The counties are subordinate to the prefecture-level cities and the townships/towns are subordinate to the respective counties. There are many counties and townships/towns relevant to the REE industry and as there are so many, they will not be detailed here. In the subsequent chapters, however, some cities and counties will be analyzed in more detail. The major tasks of the counties and

[53] 赣州市矿产资源管理局

townships/towns is to implement the policies of the superior administrative level. Whereas the cities plan and coordinate monitoring and enforcement, the counties and townships/towns are the main units expected to carry out these actions (MLR 2009a).

Finally, villages are not a formal level of the Chinese administration but are closely related to the policies of the counties and townships/towns. Each village has a village head and Party secretary. Although they do not have a formal role in REE politics, they are highly relevant to the local implementation of policy and the de facto interaction with miners.

4.4. Enterprises

There are broadly speaking four types of enterprise in the Chinese economy: central state-owned enterprises, local enterprises, private enterprises and foreign-invested enterprises. The largest REE enterprises in China, which are exclusively state-owned enterprises, are owned by either the central governments or provincial governments. As explained in chapter 3, however, these are only the tip of the iceberg of a largely fragmented industry (see table 4-4).

Enterprise	Ownership	Registered Capital (in million RMB)	Income (in million RMB)	Net Profit (in million RMB)
Baogang REE[a]	Province-owned	2422	5257 (2010) 11500 (2011) 9242 (2012)	750 (2010) 3478 (2011) 1500 (2012)
Ganzhou Rare Earth Group[a]	City-owned	500	530 (2010) 2915 (2011) 1532 (2012)	20.2 (2010) 1103 (2011)
Minmetals[a]	Central-owned	981	7636 (2011) 4018 (2012)	1026 (2011) 266 (2012)
CNMC[a]	Central-owned	1100	927 (2012)	166 (2011) 54.8 (2012)
Chinalco [b]	Central-owned	200	2000 (2012)	131 (2012)
Sichuan Jiangtong/Jiangxi Copper[a]	Province-owned	1000	703 (2012)	278.3 (2012)
Fujian Rare Earth Group[b]	Province-owned	681	884 (2012)	526 (2012)
Guangdong Rare Earth Group (Guangsheng)[b]	Province-owned	249	2380 (2012)	87 (2012)

Table 4–4: Registered capital, income and net profit of selected REE mining enterprises. For enterprise groups, the relevant subsidiaries have been considered. Because data for some firms is available only for comprehensive affiliates that do not only deal in REE, the comparability of the data is limited. [a]= only REE business included; [b]=REE business and business relating to

other rare metals included. Source: Zhou Z 2013.

4.4.1. Central State-Owned Enterprises

Central state-owned enterprises (COE) are managed through the State-owned Assets Supervision and Administration Commission (SASAC) of the State Council. The COEs are integrated into the administrative systems of the Chinese state and the Party has administrative control over the enterprises through nominating the leading personnel (Brødsgaard 2012). The CEOs of the enterprises are Party members, have long careers in the political-economic system and are often well connected in the government. They have additional positions within the state or the Party, such as membership of the central committee or the National People's Congress and the Consultative Conference. There are many examples of the Party exerting direct influence on the activities of COEs. For instance, some observers have interpreted Chinalco's bid for Australian enterprise Rio Tinto, one of the largest iron ore producers, as something directly ordered by the State Council (McGregor 2012, pp. 57-61).

However, the reform of the state-owned sector has also brought many changes to the role of state-owned enterprises. The most important changes were that these enterprises came, to a large degree, to be responsible for their own budgets and modern management structures were strengthened. The boards of directors gained in decision-making power vis-à-vis the Party committee through the managerial responsibility system of the Enterprise Law. In the course these reforms, many COEs suffered deficits and many went bankrupt. COEs today act in many ways like modern business enterprises and often follow market rules. In many regards, for these enterprises economic concerns are more important than political motives (Saich 2011, pp. 281-293).

The COEs can be considered to be partially independent actors in the political economy of China which at times may pursue strategies that go against the plans or wishes of government ministries. An example is the relatively strong position of oil companies, which out of their concern for profit and competitiveness have acted against the policies of the National Energy Agency.[54] The independent foreign investment decisions of oil companies on occasion even contradicted Chinese foreign policy. Due to their close connections to the Party and the state, the leaders of the COEs are influential political players (Downs 2009, pp. 74-82).

[54] However, this position has been undermined under recent anti-corruption efforts and the custody of leading oil managers under the Xi Jinping administration (Jacobs 2013).

COEs are rather new to the REE industry. There is a handful of COEs engaged in the REE industry and three are of particular relevance (Liu ZA 2014). Minmetals, one of China's largest mining enterprises for nonferrous and rare metals, has some past experience in the REE industry. Chinalco, China's largest producer of aluminium, has also extended its business into the REE industry. The third important COE is the China Non-Ferrous Metals Group (CNFM). These three enterprises have good access to the political elite. Zhou Zhongqu, the CEO of Minmetals, is a member of the Consultative Conference and at the same time head of several industry associations. Xiong Weiping, CEO of Chinalco, is also member of the Central Commission for Discipline Inspection of the Communist Party (People's Daily 2011a).

4.4.2. Locally-Owned Enterprises

Besides enterprises owned by the central state, there are enterprises owned by provincial and sub-provincial governments. The Chinese state uses the term township and village enterprises (TVE, 乡镇企业) to describe the public enterprises owned by governments at the township and village level. TVEs had an important function in promoting economic growth during the early reform era (Saich 2011, pp. 271-281).

Within their provinces or sub-provincial areas, provincially-owned enterprises and TVEs are of central importance and have considerable influence. By the 1980s and 1990s, TVEs were the most important actors in the REE industry. Like private enterprises, however, they were the losers of the increasing number of industry reorganization efforts. There are currently very few TVEs left in the REE mining industry, though TVEs still own some mining rights in Sichuan in particular. A greater number continue to operate in separation. The only city-level enterprise engaged in mining is the Ganzhou Rare Earth Group (GZRE), which is an outgrowth of Ganzhou Rare Earth Mining. The GZRE is one of the most important REE mining companies in China, and the largest producer of HREE (Li PL 1984; Lang YH and Rong DH 1992; Rui HC 2005, pp. 54-58; Fu 2004, p. 232).

Whereas TVEs have lost influence, there are several province-owned enterprises (POE) highly relevant to the REE industry. Most of these have been reorganized as enterprise groups on top of existing provincial mining enterprises. Among these are the Guangdong Rare Earth Group, which holds assets of the Guangsheng Non-Ferrous Metals Group, and the Fujian Rare Earth Group, which owns Xiamen Tungsten and its mining rights (Guangdong Province 2012; Fujian Province 2012).

Among all province-owned enterprises, the Baotou Steel Group (short: Baogang) takes a paramount position. Baogang was founded in the 1950s to develop the rich iron resources of Bayan Obo and it also produces REE from the ores. Through Baogang Rare Earth High

Technology[55] and its subsidiaries, Baogang produces about half of Chinese REE and is the largest REE enterprise in terms of registered capital, income and profit. Although the leadership of Baogang has no administrative role in the central state, it is an influential enterprise due to its role in the industry (Su WQ 2009).

4.4.3. Private Enterprises

Similar to TVEs, private enterprises used to be important players in the REE industry. In the 1980s and 1990s, southern China in particular experienced a big increase in REE mining by private enterprises. Various rounds of industry reorganization, however, have mostly crowded out private enterprises from the industry. Today, there are only a few private enterprises left in mining, although there are more in separation (MEP 2009). As they are mostly of very small size and have weak contacts with the central government, they do not play a role in policymaking. However, through their contacts with local governments they can still be important in the implementation of policy.

The Hong Kong-based China Rare Earth group[56] used to be one of China's largest private REE enterprises in mining, separation and the downstream industry until it was acquired by the central state-owned Minmetals (CNMC Albetter Albronze 2011). Currently the only private enterpriseinvolved in mining is the Ganzhou Ludong Rare Earth Group,[57] which holds mining rights in Jiangxi and Fujian. It is also a large REE separator in Jiangxi (Ganzhou Qiandong 2014).

4.4.4. Foreign Enterprises

There are also some foreign-invested enterprises active in the REE industry. Due to the prohibition of foreign investment in REE mining, these are involved only in separation and downstream industries. Among these are Rhodia, a subsidiary of the Belgian Solvey Chemical Group, and the now bankrupt American REE mining enterprise Molycorp. Moreover, there are many more foreign enterprises investing in downstream production facilities, for instance the German company Osram, which is investing in LED production, and many Japanese enterprises such as Mitsui Chemical and AGC Seimi Chemical in polishing powder production. Although some foreign enterprises have joined the Association of China Rare Earth Industry, they have

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[55] 包钢稀土（集团）高科技股份有限公司

[56] 中国稀土控股有限公司

[57] 赣州虔东稀土集团

a very limited influence on national strategy and implementation (MEP 2009; Zhou X and Han XY 2010, Liao 2011; Liao XG 2011; Wang K 2012; Wang K 2012; Net Ease 2011; Jiangxi New Materials Golden Century Materials 2011; Dou N 2011a, 2011b).

4.5. Scientific Actors

In addition to these actors, scientific institutions are important players. The Chinese Society of Rare Earths[58] is the national scientific organization that brings together various scientists and experts (Chinese Society of Rare Earths 2016). The research institutions are normally closely connected with the industry, either because they have been created by REE enterprises or because they themselves own enterprises active in the REE industry. Some of them are involved in the drafting of relevant regulations. Besides basic and applied research and their economic activities, they also have some impact on agenda-setting and policymaking (see table 4-5).

The Baotou Research Institute of Rare Earths (BRIRE, 包头稀土研究院), which has 700 researchers and belongs to the Baogang Group, is China's largest research institution dealing with REE. Since its inception in 1962, the institute has organized about 1,700 projects under the "973" and "863" science plans and provincial and municipal research programs. Due to the role of Inner Mongolian REE, the institute has significant national importance (BRIRE 2016).

[58] 中国稀土学会

Name of Institute
Beijing General Research Institute for Nonferrous Metals (北京有色金属研究总院)
China Enfi Engineering Company
Changchun Institute of Applied Chemistry of the Chinese Academy of Sciences (中国科学院长春应用化学研究所) (including the Rare Earth Resources Utilization State Key Laboratory and the Rare Earth and Thorium Clean Separation Technology Centre (稀土及钍清洁分离工程技术中心))
Baotou Research Institute of Rare Earths (BRIRE, 包头稀土研究院)
Ganzhou Research Institute for Non-Ferrous Metals (赣州有色冶金研究所)
State Key Laboratory of Rare Earth Materials Chemistry and Applications (稀土材料化学及应用国家重点实验室) of Peking University
Jiangxi Research Institute of Rare Earth Technology (江西稀土工程技术研究院)

Table 4–5: Leading REE research institutions in China.

4.6. Civil Society and Media

Societal actors do play a very limited role in Chinese politics. The Chinese leadership suspects social actors and bottom-up initiatives of posing a potential threat to political stability and the predominance of the Communist Party. The Chinese state strictly regulates the space for action available to society and the media. However, within these constraints, elements of a civil society have emerged. Non-governmental organizations have burgeoned since the late 1980s and 1990s, especially in areas less sensitive to political legitimacy, such as environmental protection (Ho 2002; Stalley and Yang DN 2006). China now has a large landscape of several thousand environmental NGOs. At the same time, the basic conditions for the registration, funding and operation of NGOs, as well as public censorship and repression, make NGO work difficult and risky for the people involved (Yang GB 2005; Teets 2013, 2014; Hildebrandt 2013).

Although NGOs are still marginal in the political system, they have developed various means of exerting political influence. Some NGOs such as Friends of Nature are occasionally involved in lawmaking initiatives. For instance, the participation of social actors significantly enhanced the revised Environmental Protection Law that went into effect in 2015 (Wübbeke 2014a).

Although there are some NGOs also dealing with the environmental impacts of the resource industries, such as Greenpeace, Greenovation and Da'erwen, there are few NGOs focussing mainly on the local impacts of the mining and refining of minerals. One of the exceptions is Tongcaohua in Daye, Hubei, which deals with the environmental situation around iron and copper mines (Wübbeke 2014b). However, people often voice their concerns through protest, which erupts in an unorganized way without any formal organizational structures, especially in rural China (Deng YH and Yang GB 2013; Tilt 2010). Environmental pollution is among the most important causes of people protesting. The exact number of "unexpected mass incidents"[59] is not available since the Ministry for Public Security has stopped publishing the number. But incidents have been increasing: there are estimates of 180,000 incidents in 2010 (Shi-Kupfer and Heilmann 2016).

One example of mining-related protest is the rioting of ethnic Mongolians against coal mining in Inner Mongolia 2011, which were suddenly triggered after a coal transporter intentionally killed a Mongolian herder (Baranovitch 2016). There are many other mining-related protests in remote villages. A rather new form of protest is large urban demonstrations against mineral processing facilities and other projects such as waste incineration (Lang and Xu Y 2013). Although some of these local protests can be successful in delaying or even stopping a project, the emerging civil society has been unable to effect a general improvement in environmental management (Wübbeke 2014b, 2015b).

The media does play a role in Chinese politics as well. The state keeps a tight control over news through its state media and censorship and propaganda apparatus. The state agency Xinhua and the Party paper People's Daily represent the voice of the country's leadership. The leadership might use these media to exert pressure on uncooperative local governments. For example, state media regularly uncover and report on misconduct among local cadres with regard to environmental protection. Those state media reports can have significant influence on local administrations and can cause them to change their policy. At the same time, the media landscape is increasingly commercialized. Many private news organizations have emerged. News sources such as Caixin and Caijing are private-run and are increasingly engaged in investigative research, in particular on economic issues (Zhu Y 2016).

The increasing importance of the internet has opened up new spaces for social discussion. In online portals and chats, even national policy can be critically debated to a certain degree, as long as the Party is not attacked directly (King et al. 2013). However, there is very limited criticism from the traditional media and social media concerning the legitimacy of the Party (Lorentzen 2014). Under Xi Jinping, censorship of the media, especially social media, has been tightened again. A telling example is that of a former CCTV journalist who made a documentary about the impact of smog on human health in 2015 and uploaded it to social media. The government was initially supportive of the project and the Ministry of Environmental Protection even made official reference to the documentary. However, as the documentary attracted millions of viewers online, censors feared negative repercussions on system stability and finally blocked it (Hatton 2015).

[59] 群体性突发事件

4.7. Conclusion

There are many actors involved in the REE industry: the central government, consisting of the State Council and its ministries; the provinces; the sub-provincial governments; state-owned enterprises; TVEs; private enterprises; scientific institutions; and civil society organisations and the media. This chapter has not attributed any inherent interests to these actors as their interests emerge within the process of policymaking and implementation and are therefore part of the empirical analysis. As the subsequent analysis will show, different actors are of differing importance during the problematization, strategy formulation and translation of policy.

PART II

5. History of REE in China (until 1996)

5.1. Introduction

This chapter describes the history of the Chinese REE industry from 1927 to 1996. The overview examines China's path to becoming the world's largest REE producer and the rather weak role of the central government in managing the REE industry in the 1980s and early 1990s. The central government's position and strategy at this time was to boost production and exports and keep REE prices down. Little attention was paid to environmental matters.

The chapter analyses three phases of industry development up to 1996 (see table 5-1). During the first phase, 1927 to 1956, geologists discovered and explored the REE deposit at Bayan Obo (5.2). During the second phase from 1957 to 1974, the state laid the basis for China's REE industry. The third phase began in 1975 with political institution building and groundbreaking chemical innovations. Production and export rose swiftly with the promotion of private and township and village enterprises in the 1980s and 1990s. The year 1996 was a turning point because the central government began to question the development of the REE industry and its previous strategy.

	1927-1956	1957-1974	1975-1996
Phase	Geological exploration	State-led build-up of small industry	Private-led growth of industry and weak regulation
National Strategy	Promotion of research on REE and a small industry	Political institutions built; promotion of production and exports	Weak regulation; political institutions built; strong promotion of production and exports
Industry Organization	State-owned enterprises	State-owned enterprises	Few state-owned enterprises and strong growth of TVE and private enterprises
Production	Discovery and exploration of Bayan Obo	Start of REE mining and separation and discovery of deposits in Sichuan and Jiangxi; production of REE grows slightly	Development of deposits in Sichuan and Jiangxi; production of REE grows significantly and China becomes world's largest REE producer
Environment	Not an issue	Not an issue	Not an issue; at local levels some assessment of environmental impacts
Export	No export	Limited exports to Japan and others	Increasing exports to Japan and others; overseas customers are the biggest

Table 5–1: History of the Chinese REE industry in four phases from 1927 to 1996.

5.2. Discovery of Rare Earth in China (1927-1956)

5.2.1. The Discovery of Bayan Obo in 1927

The first REE applications emerged in Europe in the late 18th and early 19th centuries. China was totally absent from this development. Norway and Sweden in particular, but later Brazil and British India supplied REE (Szabadváry 1988). China was in practice a resource-scarce country because no systematic geological exploration of existing resources had been conducted (Zhu X 2006).

This changed in the 1920s. In 1927, a young geologist, Ding Daoheng (丁道衡), discovered the rich iron ore deposits at Bayan Obo 150 kilometers north of Baotou, the capital of the Autonomous Region of Inner Mongolia. The iron needed for steel-making attracted

Ding's attention. He envisioned that Bayan Obo would "become an important treasury for China" because of its iron deposits (Ding 1933).[60]

He had no idea that Bayan Obo was also rich in REE. At this time, neither scientific circles nor state agencies showed any interest in the discoveries of the young geologist (Xiao Ya 2011; Xiao S 2011). In 1933, He Zuolin (何作霖) of the Chinese Academy of Sciences discovered a tiny amount of REE in mineral samples taken from Bayan Obo (Liu JS 2012).[61] After that the exploration of Bayan Obo stagnated due to the Japanese occupation, although the Japanese carried out some geological work and discovered the west and east ore bodies of Bayan Obo (Li YY 1959).

5.2.2. Exploration of Bayan Obo after 1949

After the foundation of the People's Republic of China in 1949, the communist leadership devoted more attention to Bayan Obo and REE. From 1949 to 1978 the state was the only driving force behind the REE industry's development. In the beginning, the development of the Bayan Obo mine was related to its rich iron resources. The central government selected Bayan Obo as the northern "steel center." The development of Bayan Obo was one of the 91 projects jointly pursued with the Soviet Union as part of its support to the Chinese economy. The exploration and development of iron resources became closely interwoven with the build-up of a prosperous communist economy (Xu GX 1995; Wu J 2012; Zhou FF 2009; Liu JS 2012).

With the support of Soviet Union scientists, early geological surveys made resource assessments of the iron deposits, which exceeded Ding's original estimates by far. Additionally, a first assessment indicated REE reserves of 980,000t at a grade of 4.39 percent. Later work estimated the reserves at 2.2 Mt at a grade of 1.6 percent. The size of this deposit surpassed any known deposit of REE. China the REE-rich nation was born. Bayan Obo became known as a "mineral storehouse" and the "wealth of China's REE" (Yan 1954; Zhou FF 2009; Liu JS 2012; Bureau of Mines 1978, p. 253; REI 1985, p. 1).

[60]此地将成为中国一个很大的福源.

[61] Under the microscope, He identified a very tiny amount of fluorite. From the fluorite powder, he isolated 0.01 mg of a yellow substance. After further research of spectral analysis at the Division of Physics, the substance turned out to contain two REE.

5.3. The Early REE Industry 1957-1974

5.3.1. The Creation of a REE Industry in 1957

Based on the findings of the geological explorations, the central government began the construction of the open-pit mine at Bayan Obo in 1957. It subsequently founded the Baotou Steel Group subordinate to the former Ministry of Metallurgy (Song LG and Liu HM 2012).[62] After Baogong's first blast furnace began to smelt iron, the People's Daily celebrated the development: "Baogang for the nation, the nation for Baogang" (People's Daily 1959).[63]

As a consequence of the iron production, Baogang also began to make use of the REE resources. Based on the Bayan Obo ores, several REE separation and reduction plants opened from 1959 to 1966 throughout China (Shanghai Yuelong 2014; Guangdong Zhujiang 2014).[64] These plants formed the backbone of the rising REE industry. Compared to the mines in Brazil and India and the separation operations in France and the US, however, the Chinese industry was small at that time (Li SF 2011a).

5.3.2. Government Strategy and Chemical Innovations

During the development of Bayan Obo's REE resources, the central government focused greater attention on these metals. The National Twelve Year Science and Technology Development Plan of 1958 included REE. Vice Prime Minister Nie Rongzhen, responsible for science and technology, called China a "rare earth power"[65] and emphasized the necessity of building up research on REE. To this end the government founded the Baotou Rare Earth Research Institute[66] (Zhang HJ 2003).

This research led to progress in the extraction and separation of REE in the 1950s. Researchers at the Chinese Academy of Sciences and research institutes from the Ministry of Metallurgy succeeded in developing the methods of ion exchange and organic liquid-liquid extraction for REE separation. They also developed ways to produce REE metals through fused-

[62] Baogang was first named "May 4th Steel Enterprise" (五四钢铁公司).

[63] 全国为包钢，包钢为全国

[64] The Changsha Factory 602 started in 1959. In 1961, Baogang constructed the 8861 test factory, the Shanghai Yuelong Chemical Plant went into operation in 1964, and the Guangdong Zhujiang REE Factory followed in 1966.

[65] 稀土大国

[66] BRIRE, 包头稀土研究所

salt electrolysis and metallo-thermic reduction. These research results enabled the emerging REE industry to carry out the separation and reduction of REE (Xu 1995; Liu YJ and Yan SH 2009).

5.3.3. Discoveries in Southern China

Exploration teams discovered ion-adsorption REEs in the southern province of Jiangxi in the 1970s. Chemists had great difficulty identifying this atypical REE using traditional means and had to develop a new method entirely. Further geological teams discovered LREE reserves in Sichuan. The newly discovered REE deposits in the south helped secure China's status as a leading REE nation (Rao ZH and Feng SJ 2007a).

5.4. Rise of the Chinese REE Industry 1975-1996

5.4.1. Foreign Innovation and Difficulties Faced by the Chinese REE Industry

Through these discoveries, the country came to have the richest REE resources in the world. Yet the technology to separate and purify REE was still quite backward. Since the 1960s, China has produced small amounts of REE, but its products were of low quality, mostly REE-iron-silicon alloys used for metallurgy or mischmetal for flint stones (Xu 1995). After relations with the Soviet Union deteriorated, cooperation between Chinese and Soviet scientists ended. In the US, research improved the ionic-exchange separation method so that it became possible to produce 99.99 percent pure REE metals. But as there was a technology boycott against China, China's REE production technology remained weak (Li SF 2011a). China sat on a treasury of resources but was unable to use it. China's ability to become a REE producer hinged on its ability to decode the riddle of REE chemistry. Whereas China produced only low-end REE products, research in Western countries swiftly increased the number of high-technology applications for REE from the 1960s onward.[67]

[67] REE became an important industrial material due to foreign research at the end of the Second World War. In 1962, the petroleum cracking processes began using REE as a catalyst. Color TVs demanded yttrium and europium

5.4.2. Government Strategy

The relevance of REE to high technology did not immediately lead to growth in the Chinese REE industry. Due to the growing industrial applications for REE, however, the state leadership did start to pay increasing attention to the industry. In the 1960s, Vice Prime Minister Nie Rongzhen organized several conferences on the use and application of REE in Baotou. In 1962, Nie urged in a document on "Material Matters for New Defense Technology" that research on REE in the steel industry be intensified. Nie saw "Baotou's REE as a very precious resource." (Nie RZ 1962).[68] For the first time REE were tied explicitly to national affairs and military defense.

The State Council set up a REE Leading Group[69] in 1975, which remained ineffective until the end of the Cultural Revolution. When the reform and opening period began to take shape in 1978, the central government revived the Group and reorganized it as the REE Office[70] within the former Ministry of Metallurgy (Shuai 2011). The development of the northern and southern REE resources entered the 5th and 6th National Key Science and Technology Plans. The institutional articulation of REE in the state bureaucracy reflected the leadership's interest in forming research and industry around the REE reserves in Bayan Obo.

The process of bringing an end to Chinese backwardness in the REE industry was connected to efforts to strengthen China's economy. The August 1975 "National Conference for the Promotion of REE Use"[71] noted that China's REE industry was backward and even had "to import [a very basic component made with REE such as] flints" for firelighters, a statement that put the technology gap in a nutshell even if it somewhat exaggerated the situation regarding flints (Cui and Liang 1975). This conference, which led to the creation of the REE Leading Group, marked a new level in the state's willingness to build up a strong and competitive Chinese REE industry (Li DY 1998, p.3).

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to produce the red color on the screen. Yttrium-based (YCO_5) and samarium-based ($SmCO_5$) permanent magnets started using REE in the late 1960s. As REEs can store hydrogen their use was extended to nickel batteries, heat pumps, and refrigeration in the 1970s. REE-steel alloys began to be used in airplanes and military applications as well as in steel making as REEs can remove oxygen and sulfur in the production process. In 1971, a new terbium-based magnetostriction technology, named "Terfenol" entered the market. In the early 1980s neodymium magnets (NdFeB), to date the most powerful permanent magnets, were commercialized (Xu 1995).

[68]包头的稀土是一个很宝贵的资源.

[69] 稀土领导小组

[70] 稀土办公室

[71] 全国稀土推广应用会议

5.4.3. Chemical Innovations

Chinese chemists tried to improve REE chemistry and applications in various state and university laboratories. In 1962, the Hunan Non-Ferrous Metals Research Institute developed the first Chinese flintstone, more than half a century after European entrepreneurs had invented it. China ended its import dependence on pocket lighters, but its REE production remained backward (Tungsten Association News 2010).

This began to change with several chemical inventions in the 1970s. Xu Guangxuan, a well-known chemistry professor at Peking University, made a path-breaking discovery that would end China's backward position in REE production and herald the staggering growth of the REE industry. In 1972, he accepted the task set for him by the government to develop a new method[72] of separating praseodymium and neodymium metals. The aim was to replace the existing separation methods, which were expensive and could produce only low-purity metals.[73] Although chemists had successfully used this new method for other metals, it was hard to apply it to REE. Due to previous research, Xu already had some experience with the new method.[74] However, Xu refined the method and finally was able to separate REE at a much higher efficiency than any other known method (Xu GX 1995).[75]

This development changed the Chinese REE industry. It broke the technological advantage of the US, Japan and other nations and laid the foundation for China as the world's largest REE producer. The new method allowed cheaper, purer and greater production of REE. Xu presented the results at the "National Conference for the Promotion of REE Use" in 1975. The Shanghai Yuelong factory applied the method in 1976. In the following years, Xu gave several national seminars for factory engineers to further diffuse the method (Xu GX 1995, Zhang XS and Hu J 2010). Additional important chemical advancements in the 1960s and 1970s

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[72] This is the counter-current extraction. It basically separates substances by their different solubility in solutions into different liquids.

[73] These are the ion-exchange method and the fractal crystallization method.

[74] Xu had applied it successfully to the separation and purification of nuclear fuels. In the early 1960s he developed a comprehensive theoretical framework for solvent extraction.

[75] In the past, the solvent extraction of REE could only achieve low separation factors for neodymium and praseodymium, meaning that they have not been separated in a satisfactory manner. He developed a new method using pentetic acid or diethylenetriaminepentaacetic acid (DTPA). He not only succeeded in separating neodymium and praseodymium, but he did break the international separation factor record. Preliminary tests at Baotou in 1974 were not successful, but after some time they did succeed. This was the first time DTPA counter-current extraction was used for REE on an industrial scale (Xu GX 1995).

improved the beneficiation and separation of REE.[76] New methods of tank leaching and in-situ leaching allowed the mining of HREE deposits in the southern provinces (Hzabg XW et al. 2011; Ding JY 2012).[77]

The Chinese innovations topped international technologies. Chemists at the Beijing Nonferrous Metals Institute could produce 16 REE metals at a purity between 99.999 percent and 99.9999 percent in the mid-1990s (Huang XW 2009). In a 1988 publication by the US REE Information Center, one of the leading American REE chemists, Karl Gschneider, said that

> Based on research results presented in several papers the Chinese appear to be as advanced or ahead of the Western countries and Japan in some areas…If the Chinese scientists and engineers would publish more in English in major peer review journals, we would see a more rapid expansion of REE applications and a growth in the industry (both Chinese and non-Chinese) as a result (Gschneider 1988).

5.4.4. Decentralization and Privatization

The newly introduced chemical methods, the increasing attention from the government, and the growing demand from new technologies enabled fast growth in the REE industry in China. In the 1970s production increased very quickly. Jiangxi province produced it first kilograms of REE in 1980 and several tons one year later. The liberalization and decentralization paradigms of the opening and reform period gave further impetus to an enormous surge in the 1980s and 1990s (Su WQ 2009; Naughton 2007, pp.85-97).

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[76] Researchers from the Beijing Nonferrous Metals Research Institute (北京有色金属研究总院) developed carbonic acid baking in rotary kilns (回转窑焙烧) to produce low-grade REE chlorides (20-30 percent REO). Later improvements of the method achieved purity grades of the concentrate between 40 and 70 percent (Huang XW et al. 2011). The Canton Non-Ferrous Research Institute (广东有色金属研究院) resolved the difficulties that had hampered the processing of Bastnäsite and Monazite minerals from Bayan Obo. The new method allowed the production of REE oxide concentrates with a higher purity of about 60 percent. The Chinese Academy of Sciences proposed sulfating for baking of REE and developed a sodium hydroxide separation method which was then used with great benefit in processing at Bayan Obo. Using these methods, China could produce REE products of 99.999 percent purity (Xu GX 1995).

[77] In the early 1970s, Chinese chemists successfully tested "tank leaching" (池浸) using ammonium sulfate ((NH4)2SO4) to extract the southern ion-adsorption REE from the soil. A second generation method was developed in 1985; it allowed in-situ leaching without scrapping the top of the hill and had a higher efficiency (Ding JY 2012; Huang XW 2009).

The economic policy of the central government aimed at maximizing the output of raw materials and commodities through strengthening the private sector and attracting foreign investment. The aim was to deliver sufficient raw materials for the growing economy. China's economy was "growing out of the plan" (Naughton 1995). As in other mining industries, the government supported the entrance of collectively and private-owned township and village enterprises (TVE). This strategy, which was introduced in 1983, is also known as "speeding up resource flows"[78] (Rui HC 2005, pp. 54-58; Fu 2004, p. 232).

This strategy implied that the central government de facto gave up its control over the REE industry. As the role of state-owned enterprises was receding and the regulatory framework was weak, the central government's policies did not play a role at this time (Lang YH and Rong DH 1992). Central state-owned enterprises were marginal to REE mining, processing and separation. The reforms of the state-owned sector in the late 1990s (Qian YY 1996) did not have much impact on the REE industry (Su WQ 2009; Xu GX 1995).

The economic decentralization of political power from the central government to local authorities allowed provincial and local governments considerable discretion in pursuing their own economic agendas. Responsibility for managing the local REE industry de facto fell to the local governments. They promoted growth paired with a laissez-faire policy. This policy facilitated the entry of TVEs and private enterprises into the mining business through lax supervision and light tax. City governments actively promoted the diffusion of REE mining technologies.[79] The TVEs were very important for developing the small-scale deposits in the southern provinces. This led to a very fragmented REE industry in the south (Su WQ 2009; Xu GX 1995).

Under these conditions, production quickly outpaced plans and demand in the 1990s. The REE market was quite liberalized and there were no price controls. While this policy supplied high volumes of resources to the hungry economy, the central government lost control of those resources. In later years, the central government made it clear that it found this development problematic (Li PL 1984; Lang YH and Rong DH 1992). Due to the new role of private enterprises, the mode of resource management changed from control over state enterprises to regulation of private enterprises through laws and standards (Wu WS 2011, p. 88). But regulation was too weak to have an influence on the industry and the cancellation of the REE Leading Group in 1994 weakened macro-control even further (Qi F 2010).

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[78] 有水快流

[79] The municipal government of Ganzhou city (Jiangxi) offered several training classes for leaching procedures to TVEs (Ding 2012).

5.4.5. A Global Leader in REE Production and Export

The largest share of REE extraction was from Bayan Obo and processing from Baotou.[80] The state-owned enterprise Baogang produced 25,000t of REE concentrate in 1987. From 1987 to 1988, China's REE mining increased by 70 percent. Due to this high growth rate, China replaced the United States as the world's largest REE supplier (USGS 1988). Production increased even more quickly in the 1990s, particularly due to the massive increase in production at Bayan Obo. The production level at Bayan Obo rose to nearly 40,000t in the mid-1990s and above 60,000t in 2007. Provinces in the south increased production from about 2900t in 1990 to 45,000t in 2007 (Su 2009, p. 122).

China also became a major exporter of REE. China now produced much more than it needed: in 1988, production was 18,000t in excess of domestic demand (REI 1989). In 1978, China began exporting REE, in particular to Japan.[81] In order to promote exports, the government introduced a tax rebate on exported REE in 1985 (Li SF 2011a). China was Japan's most important REE supplier in the mid-1980s. In 1986, about 40 percent of Japanese imports originated in China, with roughly 30 percent originating in the US (REI 1988a). China closely cooperated with Japan and other countries.[82] Foreigners were important customers for the Chinese REE industry in the 1990s: export accounted for roughly 37 percent of REE concentrate production in 1990. At the end of the decade, China was already exporting 70 percent of domestic REE production. Due to its ability to deliver REE at low prices, China crowded competing REE producers out of the global market. This new competitiveness compared to other countries made the Chinese very proud. The chemist Xu Guangxian stated in 1995:

> Later China's REE products quickly moved towards high purity and high-value products and actively participated in international competition. This promoted the third global

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[80] The Gansu REE Factory, which originally started production of REE in 1975, became a second major processing center for northern REE.

[81] At the time, export was still quite regulated. Only the China National Non-ferrous Metals Import and Export Corporation, the China National Metals and Minerals Import and Export Corporation, and the China Metallurgical Import and Export Corporation were allowed to export REE (REI 1987).

[82] In 1987 the State Planning Commission and the Japanese Ministry of International Trade and Industry achieved an agreement to intensify REE extraction, refining, and trade (REI 1988b). This cooperation included close interaction between Chinese and Japanese experts (REI 1988c). China also had close contact with other international REE producers such as the former Rhône-Poulenc (REI 1989).

> decline of REE prices and the development of REE applications at a greater scale. The 'golden age' of rare earths became more resplendent (Xu 1995, p. 8).[83]

China became de facto the only large producer of REE. At the turn of the century, the former largest REE producer, the United States, decreased its production and eventually stopped it altogether. In the late 1990s, Mountain Pass sales declined significantly due to Chinese competition and environmental problems.[84] In the 2000s, China achieved a near-monopoly over production (Su WQ 2009).

Due to economic growth, the domestic consumption of REE grew as well. The growing steel and chemical industries demanded more and more REE. The distribution of color TVs in Chinese households in the 1990s incited an increase in the production of REE-based polishing powder, which is used for the glass envelopes of cathode ray tubes, and of phosphors for the colors of TVs (Dou N 2011a, 2011b). In the late 1990s, China became the largest direct consumer of REE as it developed its downstream industry. The increasing demand of domestic consumption contributed to a new problematization of the development of the REE industry by the central government and its ambition to take a greater role in the management of the REE industry in 1996.

REE became a truly "Chinese" element. Endowed with a huge geological richness and dominance on world markets, China exported REE applications around the world. Deng Xiaoping described this new view of REE as a Chinese resource:

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[83]随后中国稀土产品迅速向高纯，高附加值方向转化，积极参与国际竞争，促使世界范围内稀土产品的第三次大降价（第一次降价是由于离子交换技术的工业使用；第二次降价是由于液—液萃取技术的工业应用和稀土用于彩电荧光粉，用作炼油裂化催化剂市场的开发），有可能促成世界范围内更大规模开展稀土的应用开发，稀土的黄金时代因此更加灿烂. The first price decrease was due to the commercialization of the ion-exchange technology; the second price decrease was due to the commercialization of liquid-liquid extraction and the application to color television fluorescent powder and its development as catalyst in petroleum cracking (Xu GX 1995).

[84] A 14-mile underground wastewater pipeline at Mountain Pass transported the wastes including radioactive material and heavy metals to an evaporation pond. The operating company had told the regulators that the pipeline would carry only highly salted waters. The pipeline spilled nearly 70 times between 1984 and 1998. After a major spill occurred in 1996, the company was obligated to clean up the pollution and to pay fines. In response to a lawsuit introduced by local officials, the company halted production in the mine in 1998 and closed the mine in 2002. The company was unable to implement the new environmental measures (Nystrom 2003; Castor 2008).

> The Middle East has its oil, China has its rare earths. China owns about eighty percent of known world reserves, its position is comparable with the Middle East's oil. This is of tremendous strategic importance (quoted in Zhang XS 2010).[85]

REE were not only an important economic commodity but were also linked to the interests of the Chinese nation. The vice chairman of the Standing Committee of the People's Congress of the Autonomous Region of Inner Mongolia, also a representative of the National People's Congress, reiterated this claim in 2011: "The REE are a strategic resource important for the nation. The whole world puts attention on this thing. In the past it was called 'vitamin of the industry'. Now this is no longer precise. It is the vitamin of high-technology in general" (REI 2011a).[86]

5.5. Conclusion

This chapter clarified two aspects of China's REE industry: first, the rise of China as the world's largest producer of REE was due to the government's support for the build-up of the REE industry. Intensive geological exploration, innovations in the chemical industry and the creation of Baogang were milestones that signaled an end to China's backward technological position and the launch of the REE industry.

Second, economic liberalization and decentralization led to the central role of private enterprises and TVEs in the extraction and processing of REE. Local governments practiced weak supervision of the industry in order to increase production and promote local economic growth.

As a result of these two factors, China was able to outgun all other REE producers and achieve a near monopoly in global REE production.

While the central government had had firm control of the REE industry until 1978 – which was then very small– it totally lost control during the 1980s and 1990s and local governments practiced lax regulation. A very weak regulatory regime emerged. To be sure, this was to a large degree a desired effect as the central government aimed to speed up resource supply. As chapter 6 will show, however, the central government started to criticize the development of the REE industry and the weak role of central control in industry management in 1996.

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[85]中东有石油，中国有稀土。中国的稀土资源占全世界已知储量的百分之八十，其地位可与中东的石油相比，具有极其重要的战略意义，一定要把稀土的事情办好.

[86]稀土是国家重要的战略资源，全球都在关注这件事，过去称之为工业的维生素，现在来看还不是很准确，是整个高科技的维生素.

6. Problematization

6.1. Introduction

This chapter provides an answer to the first part of the first research question: Why has the Chinese central government been carrying out a new strategy of strong intervention in the REE industry since 2005*?* The conceptual argument is that policies are formed through a process called problematization (Callon 1986). According to chapter 2, the theoretical assumption is that problems do not arise by themselves but depend on a practice of defining problems in discursive processes and factual changes in the material world (Yearley 1991). This chapter focuses on the central government's problematization since 1996.

The findings indicate that the central government identified the REE industry as a strategic industry on the grounds of national identity and economic importance. However, in the central government's view, the REE industry failed to fulfill its role as a strategic industry due to six problems: 1. depletion of REE resources; 2. environmental degradation associated with REE mining; 3. the low prices of REE products; 4. industry fragmentation; 5. the outflow of resources abroad; and 6. technologically backward downstream sectors. There do not appear to be geopolitical motives that can be attributed to the Chinese problematization, although as a result of the dispute with Western consumer states in 2010, a linkage between REE and nationalism emerged in society. These six problems can be subsumed into two major categories: economic interests and environmental concerns.

This chapter consists of two parts. Section 6.2 presents the historical genesis of the problematization from 1996 to 2005 and the emergence of elements of a strategy. Section 6.3 then juxtaposes the identified problems as isolated story lines.

6.2. The Unfolding Problematization

6.2.1. REE as National and Economic Elements

Chapter 5 showed that the Chinese state has perceived REE as important resources since the 1960s and has strongly promoted their development from this time onward. Throughout this process, the identity of the Chinese nation has been closely connected with REE resources. China's abundant REE have been integrated into China's national identity: Deng Xiaoping's comparison of China's REE with the Middle East's oil testifies to the particular "Chineseness" of this resource, a resource that stands for China and a China that stands for REE (Zhang XS

2010). The sheer abundance of the resource is presented as a source of national power through which China can become a resource-wealthy economic power similar to the oil-rich Middle East. REE are not only important in economic terms, but as a power source that puts China at an advantage compared to other countries. It is a national resource (Wang JZ 2011).

The central government perceives this unique position of REE as a particular opportunity for economic development. The government generally regards mineral resources as a means to develop the national economy. A 2003 White Paper stated the need to “increase the ability of the mineral resources to guarantee the building of a well-off society in an all-round way” (State Council 2003; see also MLR 2008). Due to their relevance in high technologies, REE have become a significant element in efforts to transform China from mass production manufacturing towards a knowledge-based economy that centers on creating cutting-edge innovations and selling high technology products. If China exports more finished products using REE, such as wind turbines, electric vehicles and LEDs, instead of exporting REE as raw materials, China will significantly move up the value-added chain (Wübbeke 2015a; Altenburg et al. 2008).

REE have become a “strategic” resource with huge relevance to the entire economy.[87] The State Council (2012; see also MIIT 2012a) noted: “Rare earths are an important, non-renewable natural resource with increasingly wider applications in economic and social development.” Overall, the definition of REE as a strategic industry is based on its relation to national identity, its role in the transformation towards an innovation economy and a source of economic profit.

6.2.2. Problematization and Emerging Elements of a Strategy since 1996

The 1990s were a decade of new challenges to economic reform. The runaway inflation and the overheating economy produced new problems. The Asian Financial Crisis showed that the Chinese economy could be vulnerable to the impacts of declining demand (Naughton 2007). The central government, concerned about its loosening grip as a result of decentralization, came to the conclusion in 1993 that a degree of recentralization would be necessary. It carried out a redistribution of tax income from the local to the national level (Wang S 1997; Saich 2011, pp. 284-285).

[87] Whereas in the United States the term “strategic” refers to security aspects, the Chinese usage points solely to the economic dimension.

The government's perception of the REE industry changed against this backdrop in the mid-1990s. The problematization occurred within the leading government organizations, although enterprises and later scientists and media also had considerable influence. Before the mid-1990s, the government sought to promote the production and export of REE through privatization and loose local regulations. During the first half of the 1990s, the industry realized big profits due to rising demand for REE. The policymakers agreed with the industry that production should grow rapidly (Bai J 1995, p. 3). The Ninth Five-Year Plan (1995-2000) aimed to significantly increase extraction by 10 percent annually to 70,000t and the export of REE to above 25,000t in 2000 (SPC 1995, 1996a, 1996b, Hong F 1995).

Yet in the second half of 1996, REE supply clearly outpaced demand, exports stagnated as a result of the looming Asian crisis, and profits tumbled (Wen KY 1998, p. 6; Shuai B 2012, p. 18). The largest mining enterprises of the REE industry raised concerns about running losses and the economic difficulties of the entire Chinese REE industry. This led to changing sentiments in relation to the development of the REE industry on the part of the central government (SPC 1996a, 1996b, SDPC 1998, 1999). Unlike marginal earlier attention paid to resource protection and export prices, the central government expressed its concerns much more vigorously from 1996 onward (REI 1998; CREE 1988; SPC Rare Earth Office 1993, p. 1).

Hong Feng, director of the State Planning Commission (SPC) REE Office mentioned in 1997 that the biggest challenges for the development of the industry would not come from foreign competition but from overcapacities within China (Hong F 1997). Experts associated with the State Development Planning Commission (SDPC)[88] mentioned the following problems:

> Currently, the capacity of rare earth refineries for treating concentrates is already at 100,000t REO per year. This does not only exceed the targets of the Ninth Five Year Plan but outpaces global demand by far. Hence, the challenges for China's rare earth industry do not come from abroad but from the industry itself (SDPC Rare Earth Expert Group (Industry Group) 1998, p. 3).[89]

The experts further spoke about the challenges of a fragmented industry, relatively low revenues and poor product quality (SDPC Rare Earth Expert Group (Industry Group) 1998). The problematization, which emerged in the industry and the ministerial administration, began to embrace the state leadership in 1998. Visits by Premier Zhu Rongji and President Jiang

[88] After the government reorganization in 1998, the State Planning Commission became the State Development Planning Commission. Both are predecessors of the National Development and Reform Commission (NDRC).

[89] 目前我国稀土冶炼厂精矿处理能力已超过10 万吨/ 年R E O不仅超过了国家“ 九五”稀土发展计划的目标, 而且大大超过了当前全世界稀上的需求量, 所以对我国稀土产业的挑战不是来自国外, 而是来自我国稀土产业内部。

Zemin to Baotou in 1998 and 1999 were essential to elevate the development of the REE industry on the government agenda. President Jiang raised concerns that China had not yet been able to make use of its natural abundance to promote general economic development: "we have to successfully develop and use rare earths, and turn our resource advantage into economic advantage."[90] Jiang and Zhu provided important comments (*pishi*)[91] to a classified report which criticized that the "fierce competition [of a fragmented industry] caused the rare earth price to decline by half"[92] (SDPC 1999, p. 2, 2001, p. 2).

Concerned about overcapacities and low prices, the state leadership commissioned the SDPC in 1998 to formulate a national strategy for an intervention in the REE industry. The SDPC convened a National Conference, which discussed the possibility of slightly decreasing REE smelting production, improving resource protection, promoting mergers and acquisitions, and transfering mining rights licensing back from the local to the central level (Wen KY 1998, p. 6-8). The Ministry of Land Resources temporarily halted the issuance of new REE mining licenses (SDPC Rare Earth Office 2000, p. 2; MLR 1999, 2000). Moreover, Sichuan and Jiangxi province restructured their provincial REE industries. The Politburo authorized the creation of the Inner Mongolia Rare Earth Group, which was supposed to unify all northern REE enterprises under the leadership of Baogang. However, only a few of these measures were actually put into practice (Zhou GH 2004, p. 24; Sichuan People's Government Office 1997; Jiangxi Rare Earth Office 1998; SPC Rare Earth Office 2001, p. 3; SDPC Rare Earth Office 2000, p. 2; Li SF 2011b).

Under the emerging problematization, the central government also began to see the activities of foreign enterprises in the REE industry as a growing concern. From the Chinese view, REE were something that belonged to the Chinese and therefore also should be extracted and used by the Chinese. Huge investments by the French Rhodia company,[93] a large manufacturer of REE downstream products, in Sichuan's REE upstream industry spurred governmental concerns that Chinese REE could be dominated by foreigners. Interventions by Politburo member Wu Bangguo in 2002 and 2003 led to an order prohibiting not only Rhodia's mining activities but REE mining by any foreign enterprise (SDPC Rare Earth Office 2002, 2003, p. 3).

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[90] 搞好稀土开发应用，把资源优势转化为经济优势

[91] A *pishi* (批示) is a written comment on reports from lower levels of the government or society and implies instruction for further action. A *pishi* by the state leadership indicates that the issue has found great attention.

[92]恶性竞争导致稀土产品价格下降一半

[93] The Rhodia company emerged in 1998 from outsourcing parts of the company Rhône-Poulenc and was absorbed by the Belgian Solvay group in 2011 (Nicholson 2011).

6.2.3. Influence of Science and the Media

The problematization of the REE industry's development occurred mainly within the government in response to the concerns of enterprises. However, science and the media played a role in raising awareness of environmental degradation and resource depletion starting in 2005.

In 2005, a group of 15 researchers from the Chinese Academy of Science, China's elite scientific institution subordinate to the State Council, sent a report to Prime Minister Wen Jiabao on resource conservation and environmental pollution at China's largest REE mine, Bayan Obo (Xu GX and Shi CX 2005). Before this time, it was widely assumed that China had huge, nearly inexhaustible REE reserves. However, the scientists found that China would lose its resource richness if current extraction levels were to continue. The scientists warned that because of the low recovery efficiency of REE China would waste its abundant resources: "If extraction continues at current rates, the main and east pit [of Bayan Obo] will be exhausted in less than 35 years and China will become a small power in rare earths" (Xu GX and Shi CX 2005, p. 448). Xu Guangxian even estimated that the southern Chinese reserves could be exhausted within the following ten years (Sina.com 2010b).

The authors of the report recommended stronger intervention by the government into the industry by successively reducing production at Bayan Obo, sealing off the east pit by 2012, and producing REE only from the unused massive tailings of refineries in the Inner Mongolian city of Baotou (Xu and Shi 2005,p.450; Ma 2006; Zhao ZY 2006). Resource protection and efficiency had been concerns before this report (MLR 1999, 2000), but the scientists raised new concerns about the possibility that China would lose its status as a REE-rich country and its identity as a REE power (Xu GX and Shi CX 2005, p. 448). Especially significant was that the scientists referenced the Bayan Obo mine, which is a symbol of the strength of the Chinese REE industry and China's identity as a REE-rich country. Any depletion of the Bayan Obo reserves would have devastating effects.

Bayan Obo was eventually not closed down as suggested by the scientists, but the state leadership understood well the importance of the scientific advice. Premier Wen Jiabao and Vice Premier Zeng Peiyan provided comments (*pishi*) on the report. The NDRC and the Consultative Conference investigated and reported on the situation at Bayan Obo and suggested that export taxes be raised and that other measures be taken in order to limit REE extraction (NDRC 2007, p. 4; NDRC 2008, p. 4; CNMM 2012).

Science and the media linked the REE industry to another issue: the pollution of the Yellow River, China's second largest river and an important water supply. In the 2000s, the seasonal drying up of the Yellow River became a more frequent phenomenon and pollution reached new heights (Chun and Pahl-Wostl 2012; Wu BS et al. 2004). A media investigation broadcast on the state-owned channel CCTV in April 2005 asked: "How much longer can the Yellow River survive?"[94] (Shen Z 2005). The broadcast reported on the pollution of the Yellow river in the Baotou section, especially emanating from the Sidaoshahe River, a tributary to the Yellow River in the Baotou region. Local REE enterprises are a major source of waste discharges into the Sidaoshahe. This report linked the environmental impact of the REE industry with the intense debate about pollution and water scarcity in relation to the Yellow River (Pietz and Giordano 2009; Quan XS 2005). A lot of pressure was put on the REE industry and Baotou city to eliminate the pollution flowing into the river. Due to the impact of the REE industry on the Yellow River, environmental issues became a central part of problematizing the industry's development. This gave the State Environmental Protection Agency, the predecessor of the Ministry of Environmental Protection, a growing role in the central government's policy with regard to REE (NDRC 2005a, p. 4).

6.3. Industry Problems[95]

Based on the previous historical account, this section provides an analysis of the storylines that were formed within this problematization of the REE industry's development. Although a strategy became apparent in 2005, problematization did not end there. New storylines have emerged or changed. This section will extrapolate these storylines from the White Paper On the Situation and Policies of China's Rare Earth Industry of 2012 (State Council 2012a). This document is particularly suited for analyzing the government's problematization since it provides, unlike most policy documents, an extended elaboration of the government's views on the development of REE. It is, moreover, less influenced by inner-Chinese controversies than strategy documents as it is not a legal document but a depiction without immediate policy relevance. At the same time, the document is primarily addressed at a foreign audience in order to influence the framing of China's role in the dispute with its trade partners. In this sense, the document certainly puts Chinese policy in a positive light. But as it is the goal of this section to understand the government's reasoning and not to assess the accuracy of these views, the White Paper is an adequate source. This section will also use statements by officials, expert literature and blogs regarding issues that the White Paper elaborates on less.

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[94] "黄河还能活几年"

[95] Some parts of this section align with the arguments made in Wübbeke 2013b.

6.3.1. Depletion of Resources

China sees itself as a country that is rich in many non-energetic minerals, but there are concerns over the rather poor quality of many low-grade ores such as iron and bauxite (State Council 2003; Lin et al. 2011, p. 4-7). REE are an exception as China has not only the largest reserves but also high-grade ores (USGS 2014). Yet the scientific problematization created the fear of a long-term depletion of the country's precious REE reserves. The White Paper shares the warnings of the aforementioned CAS report about an impending depletion:

> After more than 50 years of excessive mining, China's rare earth reserves have kept declining and the years of guaranteed rare earth supply have been reducing. The decline of rare earth resources in major mining areas is accelerating, as most of the original resources are depleted. In Baotou, only one-third of the original volume of rare earth resources is available in the main mining areas, and the reserve-extraction ratio of ion-adsorption rare earth mines [i.e. HREE mines] in China's southern provinces has declined from 50 [years] two decades ago to the present 15 [years] (State Council 2012a).

China's foreign trade partners contested this fear of a coming depletion of domestic REE reserves. The contention revolved in particular around the geological reserve data and the actual size of Chinese reserves. Contrary to US Geological Survey (USGS) data, which estimated Chinese reserves at 50 percent (2013) and 36 percent (2010) of global reserves, the Chinese Ministry of Land Resources (MLR) said the reserves account only for 23 percent (State Council 2012a; USGS 2010, 2013; REI 2012a, p. 2). A New York Times article suggested that the Chinese reserve data ignores new discoveries (Bradsher 2012a). It is beyond the scope of this study to assess which data is correct. More interesting are the political implications of these opposing positions: whereas the Chinese sources make the reduction of extraction a more pressing issue and demonstrate China's limited capability to provide the global economy with REE, the USGS data indicates that Chinese REE resources are still abundant and are sufficient to supply global demand.

6.3.2. Environmental Pollution

The problematization of environmental pollution in the REE industry is part of a larger discourse over the country's environmental situation. Although the government began paying attention to environmental issues in the 1970s and China was the first country to formulate a national Agenda 21 strategy in 1992, the actual actions against environmental pollution have been weak. Since the turn of the century, greater attention has been paid to environmental issues. Local cadre evaluation now includes environmental factors and China has become more attentive towards climate change, water and air pollution. There is also a drive towards greater energy efficiency. Significantly, the environmental regulatory framework has been improved and environmental impact assessments have become obligatory. Although many problems remain unsolved, there is a trend towards a greening economy (Cann et al. 2005; Heggelund et al. 2010; Zhang ZX 2011; Economy 2010).

In addition to the general environmental regulatory framework, mining-specific environmental regulations emerged around 2005 and environmental pollution became an important topic in the REE industry (Yin GX 2010, p. 413). Official documents refer to environmental pollution as an important motive for strong intervention in the REE industry (State Council 2012a). Of primary concern is the radioactive waste that is associated with REE mining and processing. The White Paper says that "great attention must be paid to its impact on people's health and the ecology when they [the light rare earth minerals and radioactive thorium] are mined, smelted and separated" (State Council 2012a). The White Paper also expresses concern about the effects of toxic gases, ammonium nitrogen, heavy metals, and landslides. An important concern is that dealing with the long-term environmental impacts requires massive financial funds, by far in excess of many local governments' fiscal capacities (State Council 2012a).

It is worth noting that the White Paper emphasizes "people's health." The "people" are not a very important actor in the state's policy. Yet in the central government's problematization of the REE industry they do play a role as the impact of REE mining and processing on people's health could lead to protests or what the government calls "mass incidents" (Economy 2010). Mining- and processing-related "mass incidents" are a common feature in Chinese politics (Wübbeke 2015b). In 2012, massive environmental protests in the Sichuan city of Shifang led to the cancellation of a planned molybdenum and copper refinery and similar incidents occurred against a petrochemical plant in Kunming (Duggan 2013; Shi JT and Wei HY 2012). These large-scale protests are only the tip of the thousands of environmental protests (Tong YQ and Lei SH 2010). Some of these protests are a potential threat to the political legitimacy and monopoly of the Party (Economy 2010).

So far, there have been no large-scale mass incidents related to REE projects, although there have been some local incidents. There were, for example, protests over the impacts of an illegal REE mine and corruption in a village in Ganzhou city in 2011 (see figure6-1). Local governments often ignore or suppress the protests. However, the central government wants to avoid a situation in which environmental protests destabilize the political order. While this often means suppressing public opinion, there is also an interest in reducing the impact of pollution on people. It can thus be argued that the government has at least a limited interest in reducing the impact of mining on people's health.

Figure 6–1: Protesting villagers and police forces in Reshui village (Xinfeng county, Ganzhou city, Jiangxi) and Xiatang village (Luhe county, Shanwei City, Guangdong). Source: Tianya Forum 2011; Luhe Hotline Forum 2011.

6.3.3. Low Prices

In 1995, China's leading REE scientist Xu Guangxuan (1995) proudly spoke of the low prices at which Chinese enterprises could deliver REE. Today, in contrast, the Chinese government and upstream enterprises are convinced that REE prices are too low (Wübbeke 2015a). REE prices are linked to a broader discussion over "pricing power" in the raw materials markets. Pricing power is about "who manages the price in a trade"[96] (Zhu JG 2012, p.3). This definition implicitly assumes that it is not supply-demand equilibria but power relations among trade partners that determine the price. The central government is convinced that China lacks international pricing power as both buyer and seller: "What China buys becomes expensive on the international market; what China sells becomes cheap on the international market" (REI 2010, p. 40). A spokesman from the Ministry of Commerce clarified that the central government shares this view: "China has nearly lost its pricing power in the international trade system" (Zhao ZW 2011).

[96] 定价权简单说就是交易中谁主导价格的问题

Regarding import commodities such as iron, oil and soy beans, the Chinese government laments the high import prices due to the power of foreign market oligopolies. For REE, the government is dissatisfied that China could not use its near-monopoly to increase export prices because of various domestic reasons (REI 2007a). This understanding ascribes to REE a high intrinsic value because they have high economic relevance. The factual price, however, is far below the perceived intrinsic value. The prices of REE have indeed been at a relatively low level up to and including 2010, whereas other resource prices increased very much during the 2000s (IMF 2013b; Lynas 2013a). While foreign governments in particular argue that these prices result from market forces, the Chinese government interprets these "low" prices as a problem. The Chinese discourse labeled these prices, which are below the intrinsic value, "pork prices" (猪肉价) or "Chinese cabbage prices" (白菜价) (Xinhua 2010a). According to the White Paper,

> the price of rare earth products has remained low and failed to reflect their value, the scarcity of the resources has not been appropriately represented, and the damage to the ecological environment has not been properly compensated for (State Council 2012a).[97]

This statement interprets the low prices as a cause of environmental pollution and depletion. As enterprises make little profit from low-value REE, they do not invest in environmental protection and over-extract resources. According to the government's view, the reasons for the low prices are the fragmented industry structure, smuggling, the lack of innovation capacity, and the immature coordination of the industry and government agencies (Qi YS and Li WX 2010).

6.3.4. Fragmented Industry Structure

There have been many small and private enterprises dealing with the mining, processing and separation of REE. The central government sees the fragmented industry structure as one of the largest problems. This is similar to a range of other mineral industries (Song LG and Liu HM 2012). Su Wenqing, former Party secretary of the Baotou National Rare Earth High Technology Industry Development Park, summarized: "the industry is large, enterprises are small and technology is poor" (Su WQ 2004a, p. 73; see also Su WQ 2004b).[98] The White Paper bemoans the fact that the industry is "relatively small in scale, features a low concentration rate

[97] 一段时期以来，稀土价格没有真实反映其价值，长期低迷，资源的稀缺性没有得到合理体现，生态环境损失没有得到合理补偿。

[98] 整体规模大，单体规模小，硬件设施不完善.

with numerous businesses, but lacks large enterprises with core competitiveness" (State Council 2012a). In addressing "core competitiveness," the White Paper makes reference to the aim of the Chinese government to build large mining enterprises that can compete with the large international mining enterprises (State Council 2012a).

The government sees the fragmented industry structure as a root cause of many other problems. It argues that the fragmented structure causes fierce competition, overcapacities, backward technological capabilities and poor product standards. As small companies lack competitiveness due to constrained funds and low investment in advanced technology, their only way of being more competitive is to focus on mass production of low-value products. While this might increase benefits in the short term, it also leads to overcapacities, pressure on prices, and depletion of resources. Low investment in efficient production and environmental treatment technology causes severe pollution (Schüler et al. 2011).

Illegal mining, processing and separation operations are a particularly difficult challenge. Similar to small operators, the White Paper sees illegal miners as a cause of the depletion of resources: "illegal mining has severely depleted local resources, and mines rich in reserves and easy to exploit are are [sic] favored over the others, resulting in a low recovery rate of the rare earth resources" (State Council 2012a). Jia Yinsong, head of the Ministry of Industry and Information Technology (MIIT) Rare Earth Office said that "because illegal mining remains active after repeated prohibition and chaotic processing and separation expand, unbearable impacts are imposed on the local environment"[99] (China Daily 2011).

6.3.5. Climbing the Value-Added Ladder

Concerns over a technology gap to cutting-edge international technology have haunted the Chinese REE industry from its birth. The industry has successfully caught up in some areas. With regard to processing/separation technology, China is at the most advanced technological level (Liu GH 2007; Gschneider 1988). However, the central government has raised concerns that China still lags behind the international level with regard to many downstream products. China is already the largest producer of REE-based permanent magnets, phosphors, polishing powder, catalysts, and other immediate applications. But China's products are of lower quality and value so that it even has to import some advanced REE products from Japan (Feng RH et al. 2012; Zeng SB 2003; Wu H 2008; Yan HZ 2012, Xie LY 2010).

It is the aim of the Chinese government to increase the value of exported REE upstream products leaving China and to channel FDI into the high-tech end of downstream REE industry and manufacturing. China aims to climb the REE production chain. MIIT Vice Minister Su Bo

[99] "由于非法开采屡禁不止，冶炼分离无序扩张，给当地生态环境造成了不可承受之重。"

stated that "in the next steps, we encourage foreign investment in areas such as environmental management, the recycling and reuse of rare earths as well as high-end applications and the manufacture of rare earth production equipment" (People's Daily 2012a). But Chinese ambitions go even further, extending to end-use industries further downstream such as the construction of generators, wind turbines and electric vehicles (State Council 2011).

Chen Yanhai, head of the MIIT Raw Materials Department, opined that China's research on REE materials is insufficient (Gao 2011). There is dissatisfaction that Japan and the US control core patents for downstream products. Su Wenqing (2009) reported that between 1998 and 2002 most Chinese patents were of low quality. The Japanese Neomax company, a subsidiary of Hitachi, owns the patents for advanced neodymium magnets (NdFeB).[100] Chinese enterprises complain that they are excluded from high quality production and have to pay high royalty fees to license patents (Wübbeke 2015a).

6.3.6. Foreign Demand

The Chinese government is annoyed that large volumes of Chinese REE are sold abroad. This concern is not officially formulated in the White Paper, however various statements by government officials indicate the government's dissatisfaction (Qi F 2010). China argues that REE deposits are distributed globally, but China is supplying cheap REE to the entire globe. According to this view, other nations make use of this situation, depleting China's resources while preserving their own reserves and making a fortune with the finished products (Qi F 2010). There is, moreover, the widespread allegation in Chinese discussions that Japan and other nations buy much of the low-price REE to build up stockpiles (Zhang DH 2010).[101]

MIIT minister Miao Wei clarified that the Chinese government is no longer willing to satisfy the world's REE demand alone:

> With the economic development of China and each country in the world, the demand for rare earths is continuously rising. This successively increases the pressure on

[100] One patent expired in 2012 and another one on the basic structure of NdFeB is to expire in July 2014. There are some more important patents that will expire between 2017 and 2025 (Magnequench 2010).

[101] It is not clear exactly to which kind of reserve this statement is pointing and what the source of information is. REE have not been included in the official Japanese strategic reserves. REE have, however, been considered recently among the strategic reserves in Japan (Maeda 2010). The Chinese sources are possibly referring to enterprise reserves, but there is no specific information about that.

Chinese rare earth resources so that they are on the verge of depletion”[102] (Chen YM and Liu JH 2011a).

The government is particularly dissatisfied with the fact that China has to pay a high environmental price for extracting REE. While other nations have closed their own mines and processing facilities due to environmental reasons (Nystrom 2003; Castor 2008; USEPA 2012), the Chinese government does not want to shoulder the environmental burden alone. Su Bo, MIIT vice minister, said at the press conference for the release of the White Paper: “They [the foreigners] closed all mines that had caused environmental pollution. By contrast, China has supplied 90 percent of global demand at the expense of severe pollution to our environment” (REI 2012a, p. 4). Given that Chinese and global REE consumption are increasing, China wants to supply domestic rather than foreign markets.

6.3.7. Geopolitics

Geopolitics is related to the relative power position of a country in the international system. According to geopolitics, countries strengthen their national capabilities compared to other countries in order to reduce insecurity. Among many other factors, natural resources influence power relations in the international system. Countries use their control over natural resources to gain advantages vis-à-vis their competitors (Wübbeke 2012b).

This analysis finds that geopolitics was not an important motive for the Chinese government to restrict exports and carry out other measures in the REE industry. Between 1996 and 2009 – the most critical stage of problematization of the REE industry that led to the formulation of a formal strategy in 2009 – there were neither official statements nor public discourse that would indicate geopolitical motives on the part of the Chinese government (Wübbeke 2013a).

It is true that REE have a high value for Chinese national identity and are relevant to defense technology. It is moreover true that the Chinese government is suspicious of foreign demand. However, these actions came out of a consideration of economic reasons and economic power. The export restrictions cannot be equated to a trade embargo, which aims to weaken the power position and defense industries of other countries. There is simple evidence: if China had wanted to engage in geopolitics with REE, it would have not only restricted exports of REE raw materials and metals but also those of critical components such as magnets and phosphors. However, it did not do so (Gholz 2014).

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[102] “随着中国和世界各国经济发展对稀土需求的持续增加，中国稀土资源压力正逐渐加大，一些资源濒临枯竭。”

In 2010, REE became politicized due to a trade dispute between China and its trade partners over Chinese export restrictions (Morrison 2012). The Chinese government appeared surprised that its own policy had caused security concerns in other countries. The leaders were hasty to allay foreign concerns and alleviate any politicization of the dispute (Gillispie and Pfeiffer 2012). In a statement former Chinese Premier Wen Jiabao said:

> the management and control of rare earths is necessary, but there will be no export ban. China will not use the rare earths as an instrument for bargaining. The sustainable development of the world is our goal (Sina.com 2010b; Ling C 2010).

The Chinese foreign ministry mentioned in response to the WTO consultations that it does not actually want a monopoly position in REE supply, but instead encourages other countries to contribute more to global production (Xinhua 2012a).

However, while the *general strategy* was not rooted in geopolitics, there are indications that China might have used control over REE supply as a bargaining tool at some point in time in relation to single security issues. During the height of the OECD countries' trade protests, Japanese industry representatives reported a two-month ban on REE exports to Japan. There might also have been a delay of deliveries to the EU and the US from September 23 to November 19, 2010 (International Crisis Group 2013). The OECD countries interpreted the delay as a direct decision by the central government as a response to the re-emergence of Sino-Japanese struggles over the Diaoyu/Senkaku islands after a Chinese fishing vessel rammed a Japanese coast patrol boat and the Chinese captain was detained by Japanese authorities. Exports to Japan resumed, slowly, only after the Captain was released (Morrison and Tang 2012).

It remains unclear whether the unofficial delay reflected a consensual government decision and whether it was actually a ban. Some observers suggested that the customs agents might have acted on their own without the authorization of the Ministry of Commerce (MOC). The State Council, MOC and the China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters denied any such action (Bradsher 2010). While the interpretation of a ban was popular in Western discourses, there were also Western opinions that contested this interpretation (Hatch 2010; King and Armstrong 2013; Gholz 2014). It might have been that Japanese industry misinterpreted the dramatic reduction of exports as a form of sanction. However, the reduction might also have been a result of the decreasing export quota in mid-2010, which implied a particularly strong decline for all countries and had no geopolitical motives, but was due to Chinese dissatisfaction with the extensive exportation of REE in general (Zhang DH 2010).

Moreover, import data from relevant Japanese ports suggests that different ports were affected differently. There was no unitary sanction policy enacted by the Chinese government.

Some ports even experienced increases in some shipments in November 2010. The import data itself does not provide sufficient evidence that there were sanctions (Johnston 2013, pp. 24-25). There is, in other words, no evidence of aggressive Chinese behavior (Hagström 2012). It remains unclear whether China really imposed a ban or whether Western media and industry executives merely interpreted the general reduction of REE exports as a ban.

If one assumes that the government actually did order a ban, it might have acted contrary to its words: it might in fact have used REE as a bargaining tool. During the dispute of 2010 the problematization of the REE industry's practices by the central government may have changed so that REE were increasingly seen from a more geopolitical angle and so that the government was more willing to use this resource for foreign policy aims. However, this framing by the Chinese government became apparent only *after* 2010. That is to say, geopolitical motives did not play a role in the Chinese state's development of its general strategy of strong intervention into the REE industry. Rather, the Diaoyu/Senkaku case demonstrates that REE can be punctually drawn into crisis situations, but geopolitics does not affect the overall trade and policy of REE.

There are, moreover, indications that the 2010 incident around the Diaoyu/Senkaku islands issue was rather a singular event in which REE became entangled in a geopolitical dispute. Despite similar tensions around the Diaoyu/Senkaku islands in 2012 and media claims that a similar ban on REE exports could have been imposed on Japan, the Chinese government refrained from doing so. One reason might be that China did not want to damage its good trade relations with Japan as this could hurt the Chinese economy badly. During the steep decline in exports to Japan in 2010, there were reports that Chinese exporters were hit hard by the ban and that wider implications for the economy seemed possible. Moreover, more REE deposits are being developed abroad and Japan is diversifying its imports and finding strategies that render it less vulnerable to supply disruptions. This suggests that REE might not serve as a good geopolitical tool after all (Seaman 2012; Els 2012; Gholz 2014).

6.3.8. Nationalism and Resources

The politicization of REE in 2010 also led to the stronger integration of REE and nationalism. Although there were linkages between China's national identity and REE before 2010, this framing was limited to elite circles and more linked to economic strength than political power. With the clash of 2010, however, REE suddenly emerged in public nationalist discourses. The attacks by OECD countries against the Chinese export restrictions led to enormous emotional reactions in Chinese society. The concept of a “rare earth defense war”[103] was very popular (Wang JZ 2011). According to this view, China had to defend its REE resources against foreigners. The Chinese leadership did not use this term but it must have been officially endorsed as the state news agency Xinhua deployed it in its articles: “China declares ‘Rare Earth Defense War’” and “Will it be easy for China to win the ‘rare earth defense war’?” (Xinhua 2012b; Xinhua 2010a).

The internet blogosphere, which gives a good account of societal opinions, showed that emotional nationalism had spread. For example, one blogger said that “it is totally incomprehensible that some [Chinese] leaders say, faced with the unjustified claims and the predacious logic [of the OECD countries], that they would not take recourse to an export ban and not use rare earths as a bargaining tool” (Hou and Wübbeke 2010).[104] This nationalism is partly sponsored by the government through official propaganda instruments. At the same time, it has its own dynamics that emerge when China’s sovereign control over land and resources is contested. One such example is the Diaoyu/Senkaku issue that spurred waves of nationalism (Downs and Saunders 1998). In 2010 REE also became a subject that could ignite nationalist storms. However, this societal nationalism has not greatly influenced Chinese policy beyond the already existing linkage between national identity and resources, since there was no significant change in policy after 2010. Yet it plays an important role in legitimizing and supporting Chinese policy domestically.

[103] 稀土保卫战

[104] 但是，令人不解的是，一些官员面对日本人的无理要求和强盗逻辑却一再表态中方不会将稀土的出口作为封锁手段

6.3.9. Findings

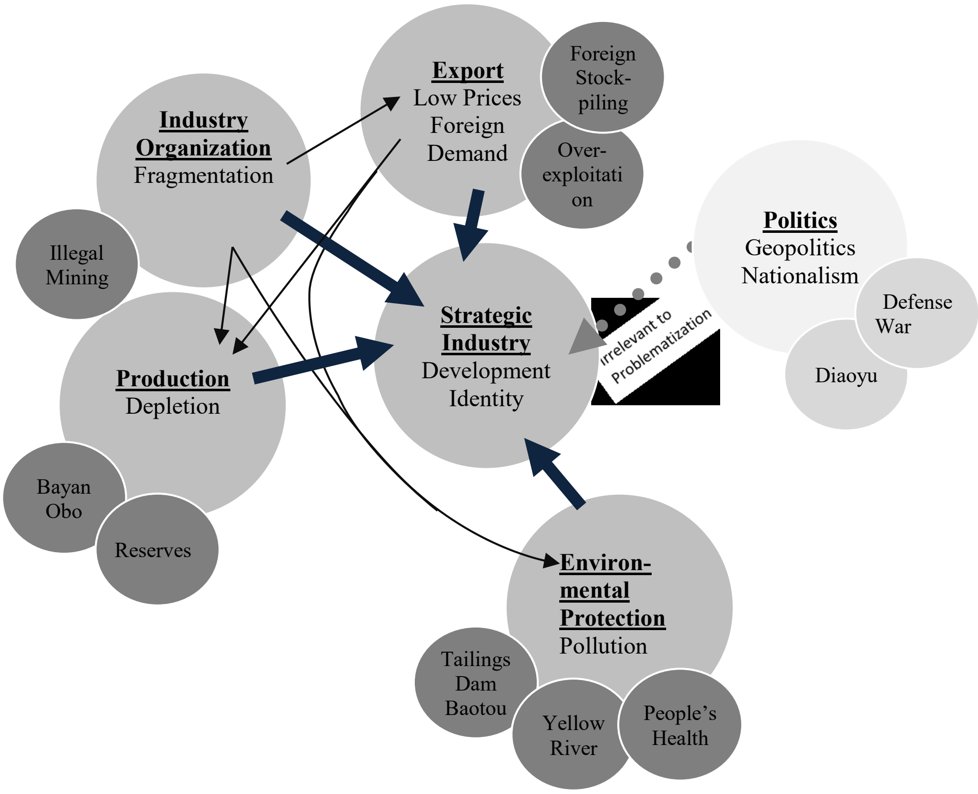

Figure 6–2: The central government's problematization of the practices of the REE industry and the interrelation of single problems (author's illustration).

This overview of the storylines shows that the government sees the problems of the REE industry mainly at the domestic level and much less at the international level. At the centre is the understanding of REE as a strategic industry based on the "Chineseness" of REE and its relevance to economic development (see Figure 6–2). The government raises a number of problems that hinder the REE industry from making an important contribution to climbing the value-added chain. With regard to REE mining, the government indentifies depletion of resources as a serious problem. The practice of industry organization is problematized due to the predominance of many small enterprises and illegal mining. The industry's fragmentation is identified as a root cause of a number of further problems, including resource depletion, pollution and low prices. Within the practice of export, the low prices as well as the outflow of REE to foreign customers are criticized, in particular with regard to foreign stockpiling of REE. Environmental pollution is also seen as a problem, with particular attention paid to the environmental risks of the Baotou refineries and tailings dam, the pollution of the Yellow river and environmental protests. Finally, after 2010 geopolitical and nationalist storylines emerged. However, they have not affected the government's problematization of the REE industry's development in general, even though in certain situations, such as the Diaoyu/Senkaku conflict, REE may have appeared in relation to national defense issues.

Among the political elite and experts, this problematization of the REE industry is rather commonsense. But there are some voices from within this circle that criticize the government's portrayal of the industry's development. For example, Hong Feng, former director of the SPC/SDPC Rare Earth Office in the 1990s, said that it was rational in the early times of the opening and reform period to export REE at low prices as China needed foreign currency. Even today, prices should not be too high, he suggested: "Too low or too high prices are both harmful to REE industrial policy…The result of increasing prices by coercion is that for making a million more profit the entire value-added chain is ruined"[105] (Cui H 2011). Zhou Chengxiong, vice director of the Chinese Academy of Social Science Advice and Research Centre for Strategic Issues similarly stated:

> To set the price of commodities by administrative measures will destroy the market's level playing field. A unitary price can help China to make short-term benefits, but these administrative monopoly measures will harm the interests of foreign enterprises, violate international market rules and damage China's international image (Zhou CX 2010).[106]

While Zhou also opines that prices were too low, he does not agree that higher prices should be achieved at the cost of other goals, affecting relations with other countries.

6.4. Conclusion

This analysis shows that the central government has problematized the REE industry since 1996. Against the backdrop of the strategic relevance of the REE industry to China's national identity and economic development, a number of problems were identified: Concerns about resource depletion and wastage strengthened the government's view that resource protection is necessary. Environmental protection increasingly attracted the attention of the leadership. Low prices for REE products in the aftermath of the Asian Financial crisis and in the following years were an important driving force for the Chinese government to discuss the

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[105] 太低或者太高的价格都对稀土的政策产业不利... 强行拉抬价格的结果是，为了赚 100 万把整个产业链都坑死。

[106]通过行政手段规定竞争性产品的价格，会破坏市场公平。统一定价短期内可以让中国企业获得更多的利润，但也是在通过行政垄断手段损害国外企业利益，违反了国际通行的市场规则，必然影响中国的国际形象

formulation of a new national REE strategy. The industry structure, with many small and illegal miners and processing operators, was identified by the government as a root cause of many other problems. There has also been dissatisfaction that foreigners are able to capitalize on this situation and that REE flow abroad in large quantities. The low quality of downstream products is a further problem related to economic development. These identified problems can be subsumed into two basic motivations for the initiation of a strategy of strong intervention into the industry: economic interests and environmental concerns.

This chapter has answered the first part of the first research question: Why has the Chinese central government been carrying out a new strategy of strong intervention in the REE industry since 2005? The chapter showed that China wants to a) decelerate the depletion of REE to ensure sufficient supply for its own industry and future use; b) minimize environmental pollution in local communities; c) increase REE prices to raise revenues; d) consolidate the industry to build national champions and strengthen control; e) limit the export of REE to foreign customers; and f) strengthen the role of Chinese enterprises in high-quality downstream products vis-à-vis other countries.

7. General Strategy

7.1. Introduction

This chapter deals with the second part of the first research question: How has the Chinese central government carried out its strategy of strong intervention in the REE industry since it began in 2005?

The analysis of the central government's strategy shows that there was a strategic shift in the REE industry beginning in 2005. However, a formal and integrated strategy was not created until 2009, when the MIIT promulgated a first plan for industry management. In 2011, the State Council released a second document for a coordinated strategy.

The two documents of 2009 and 2011 clarify the principles, positions and targets of the strategy. In essence, the strategy plans a centralization of the management of the REE industry by the government. Its targets are to: a) increase industry concentration; b) conserve REE resources; c) protect the environment; d) increase prices; e) upgrade the industry; and f) decrease exports.

This strategy is relevant with regard to four industry practices: industry organization, production, environmental pollution and export. The central government has formulated various regulatory instruments to ensure the proper implementation of its targets. Figure 7-1 gives an overview of the targets and regulatory instruments for changing the four industry practices.

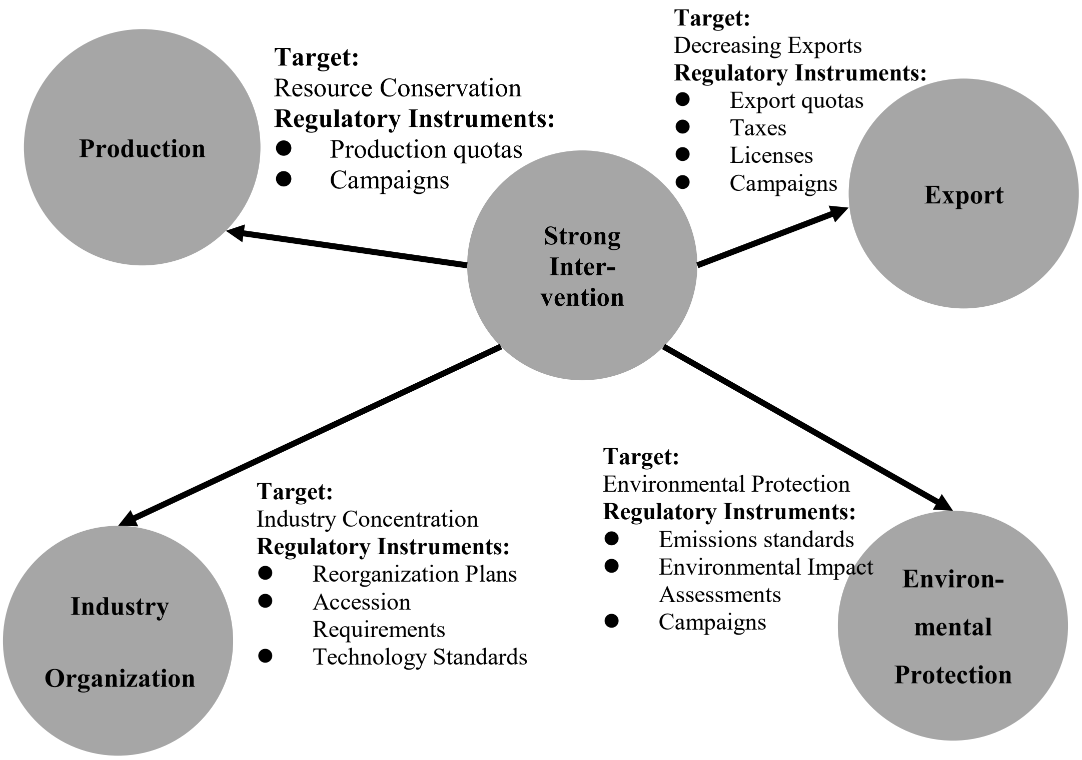

Figure 7–1: Targets and regulatory instruments used by the government to intervene in various REE industry practices.

This chapter sets out with an analysis of the informal and formal stages of the new strategy since 2005 (7.2.) and then continues by detailing the principles and targets of the strategy (7.3). However, the chapter does not examine the design and actual performance of the specific instruments of strategy. This will be the task of part III.

7.2. Development of a New Strategy

7.2.1. Strategic Shift

Since the 1950s, the central government has always had some form of strategy for the REE industry. The government defined targets and regulatory instruments to guide the development of the industry. As was detailed in chapter 5, the central government strategy in the 1980s and 1990s was to promote the growth of production and export and keep prices down. This meant in effect that industry management was delegated to local governments and enterprises.

However, the problematization of the REE industry since 1996 called this old strategy into question. Shortly after the beginning of this problematization a new strategy emerged. There are essentially two phases of the new emerging strategy: an informal stage from 2005 to 2009 of rather uncoordinated ministry-level policies without any guiding strategic document and a formal stage which began in 2009 on the basis of the two strategic documents issued by the MIIT and the State Council. The shift to the new informal strategy after 2005 marked the return of the central government to the management of the REE industry. As the central government had de facto only very limited influence on the REE industry during the 1980s and 1990s, a central feature of the new strategy was a re-centralization of competences, with a strong top-down decision-making process.

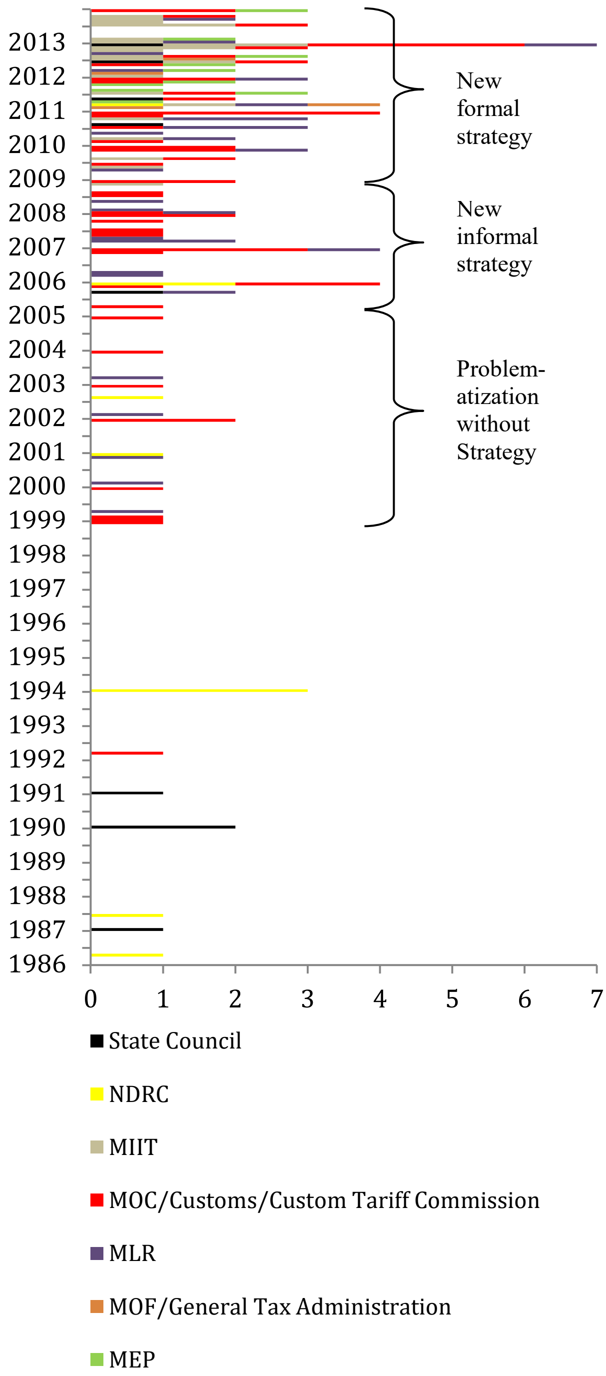

Figure 7–2: Number of REE-related laws and regulations on a monthly basis by ministry from 1986 to 2013.

This attempt at re-centralization is reflected in the significant increase in decision-making activities within the central government. Figure 7–2 shows the quantity of REE-related regulations from 1986 to 2013 on a monthly basis.

From 1986 to 2005 there was only sporadic regulation, although there was a slight increase in the number of regulations issued between 1999 and 2005. These regulations dealt with industry management, trade and foreign investment, and resource protection. The "Methods of Rare Earth Export Management" of 1992, which constrained export rights to a few companies, was later discarded (MOFTEC 1992). The 1991 "Notification on Listing Tungsten, Tin, Antimony, and Ionic REE as Special Resources for Protected Extraction" stipulated that southern REE required special resource management, which in principle gave preference to central government control over local policies (State Council 1991). However, the notification lacked much practical relevance as local governments retained their control over mining rights. In 1999, the Ministry of Foreign Trade and Economic Cooperation (MOFTEC), the predecessor of the Ministry of Commerce (MOC), established the export quota for REE and the newly established MLR took measures to temporarily halt the issuance of new REE mining licenses (MOFTEC 1999; MLR 1999). There was, however, no integrated industry strategy since regulations were published very sporadically and not in a coordinated manner as part of a larger strategic framework with overall principles and targets. The policies were hardly more than paperwork with little noticeable impact.

Beginning in 2005, the number of regulations increased significantly. After 2011, the pace at which new regulations were released accelerated again (see table 7-1). What is also visible from Figure 7–2 is that the number of ministries releasing relevant regulations increased from 2005 and even more so from 2009. Besides the quantitative changes, there have also been qualitative changes in the strategy. This will be discussed in the subsequent overview of the two stages of the new strategy.

General Strategy ● "Several Opinions on Promoting the Sustainable Development of the Rare Earth Industry," State Council, 2011 ● "Special Development Plan for the Rare Earth Industry (2009-2015)," MIIT, not officially adopted
Industry Reorganization ● "Opinion on Promoting the Mergers and Acquisitions of Enterprises," State Council, 2010 ● **Accession**: "Accession Requirements for the Rare Earth Industry," MIIT, 2012 ● "Leading Opinion on accelerating and promoting mergers and acquisitions of enterprises in key industries," MIIT, 2013 ● "Notice on Developing Special Restoration Activities for the Order of Chinese Rare Earths and other Mineral Extraction," MLR, 2010 ● "Notice on Developing Special Restoration Activities for the Order of Chinese Rare Earth Production," MIIT, 2011 ● "Managing Measure on the Special Fund for Upgrading the Rare Earth Industry," MIIT/MOF, 2012
Production ● "Notice on Listing Tungsten, Tin, Antimony, and Ionic REE as Special Resources for Protected Extraction," State Council, 1991 ● "Notice on the All-Round Consolidation and Standardization of the Mineral Resources Development Order," State Council, 2005 ● "Notice on the Quota for Controlling the Total Amount of Tungsten and Rare Earth Extraction," MLR, annually ● "Mandatory Production Plan for Rare Metals Minerals and Refining and Separation Products," MIIT, annually ● "Temporary Managing Measure on Mandatory Production Plan for Rare Earths," MIIT, 2012
Environmental Protection ● "Emissions Standards for Pollutants of the Rare Earth Industry," MEP, 2011 ● "Opinion on Strengthening the Protection, Control, and Restoration of the Ecology of Rare Earth Mines," MEP, 2011
Export ● "Catalogue of Goods Subject to Export Licensing," MOC and Customs, annually ● "Notice on the Export Quota for Normal Rare Earth Trade," MOC, biannually

Table 7–1: Selected regulations by the central government ministries.

7.2.2. Informal Strategy (2005-2009)

The formulation of a new integrated strategy for the REE industry had been discussed since 2003, but did not take official form until 2009 (Su 2009: p. 285). In 2003, the National Development and Reform Commission (NDRC) began to draft a development plan for the REE industry. In December 2003 it held a symposium with provincial REE offices and REE enterprises on “Management Provisions for the Rare Earth Industry”[107] and “Management Provisions for the Export of Rare Earth Products”[108] (CRE 2003). Later, the drafts were discussed under different titles, but the ministry did not continue the drafting work.[109]

In 2007, the NDRC came close to releasing a new industry plan but the drafting work did not come to an end as the responsibility for the REE industry was transferred to the Ministry of Industry and Information Technology (MIIT) (Wen LW 2008; Jiang D 2011). The draft of the “Mid- and Long-Term Development Plan for the Rare Earth Industry (2006-2020) (Draft),”[110] which revolved around strengthening resource conservation, environmental protection, cleaner production, technological innovation, and the industry’s structure through to 2020, was discussed at a workshop with experts in January 2007 (NRDC 2007).[111] The main difficulties in formulating an explicit new strategy were the resistance of some provinces and the institutional reform of ministries in 2008 (Finance World 2010).

Despite the difficulty in drafting an official industry strategy, the central government had already realized an informal new strategy for the REE industry in 2005. There were several indications of a strategic shift. First and foremost, in 2005 the State Council endorsed the “Notice on the All-Round Consolidation and Standardization of the Mineral Resources Development Order” (State Council 2005a). The notice sought to reorganize the mining industry, including the REE industry, and to strengthen the control over REE production. Although there was no REE-specific strategy, the REE industry strategy changed due to a general strategic shift in the mining industry. Second, as a consequence of this notice, the Ministry of Land Resources (MLR) began to define production controls for REE in 2006 and carry out campaigns against illegal mining (MLR 2006). Third, in 2005 the Ministry of

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[107] 稀土行业管理规定

[108] 稀土产品出口管理规定

[109] 稀土工业产业发展政策 and 稀土工业中产期发展规划

[110] 稀土工业中长期发展规划(2006-2020 年)(草案)

[111] Among the participating experts was Xu Guangxian, who previously spoke proudly of the low REE prices and later drew more attention to resource and environmental protection (see chapters 5 and 6).

Commerce (MOC) began to successively lower the quota for the export of REE (MOC 2007; Su WQ 2009).

7.2.3. Formulation of a New Strategy in 2009

Another change occurred in the government's strategy in 2009. The government regulations increased again in quantitative number and more ministries began to participate in regulatory work through ministry-level regulations. The shift from an informal to a more formal strategy occurred due to the draft of the MIIT for a new REE industry development plan. In 2008 the MIIT began drafting its own plan for the REE industry. The draft of the "Special Plan for the Development of the Rare Earth Industry (2009-2015)"[112] (hereafter "the Plan") was very similar to the previous drafts by the NDRC, but it refered to a shorter time period (MIIT 2009a; China Mining Rights 2011).

Although the Plan has never been officially released, many of its details were leaked to the public. The draft Plan was commonly perceived as the guiding strategic document for the Chinese REE industry. Contrary to the previous attempts by the NDRC to formulate a strategy, this plan had a much greater influence on the REE industry, even though it was not adopted (China Mining Rights 2011). In sum, it can be regarded as the first step towards a formal strategy.

The Plan was never officially promulgated for two reasons: First, within the central government there were jurisdictional struggles between the MIIT's Raw Materials Department (原材料四) and the NDRC's Industry Department (产业司). Because the Plan was originally drafted by the NDRC but later worked on by MIIT, only a few changes were made. As the whole Raw Materials office of the NDRC was moved to the MIIT, the same people that had previously worked for the NRDC now worked for the MIIT. It was not clear who was responsible for drafting and implementing the plan, since during the drafting process the draft was sometimes sent to the NDRC and sometimes to the MIIT (Finance World 2010).

Second, beyond the central government ministries, related provinces were involved in the consulting process for the Plan. In particular, officials from Jiangxi raised several objections to the draft of the Plan in 2010. Ling Ping, an involved official from the Enterprise-Coordination Section of the Economic and Commercial Committee of Ganzhou city,[113] explained his position

[112] 稀土工业发展专项规划(2009-2015)

[113] 赣州经贸委企业协调科

against the Plan: "the government policy does not fit the rare earth industry development of the southern ionic rare earths"[114] (Finance World 2010).

As the MIIT draft plan was only a ministry-level document, the State Council intervened in an effort to overcome these difficulties. In 2010, the State Council appeared to be preparing a formal integrated strategy document. In the first half of 2010, Wen Jiabao made 13 comments (*pishi*) on REE policy, a very high number (People's Daily 2011b) and thus the State Council created its own strategic document. In its 144th session in February 2011, the State Council discussed the REE issue and promulgated the "Several Opinions on Promoting the Sustainable Development of the Rare Earth Industry"[115] (hereafter the Opinions). The session basically confirmed and formalized the government's perception and strategy, which came as no surprise. The most important effect of this session was that the policies of various ministries now had support from the top leadership. The Opinions promulgated by the State Council in 2011 are to date the only high-level document giving the government strategy a formal character and functioning as an authoritative point of reference and instruction for the state in carrying out the strategy. The previous draft Plan of the MIIT lacked the power to give the policy efforts a basis from which to effectively implement the strategy as the Opinions did. After the release of the Opinions, a member of the Chinese Rare Earth Society said that this document would facilitate further regulation by ministries: "Actually, drafting for these documents is already finished, they only need to be approved by the ministries. In the time coming, all these documents will one after the other be published"[116] (Zhu YC 2011).

7.3. Principles and Targets

7.3.1. Principles and Positioning

The principles and targets of the central government strategy can be derived from the State Council's Opinions, because they are formulated most explicitly there. The overall principle of the strategy is to achieve the "sustainable and healthy development"[117] of the REE

[114]国家政策制定不太适合南方离子型稀土（产业发展）。He expresses discontent about the minimal size of rare earth smelting and separation operations, which are proposed to be at 3,000t REO. However, he considers this number too large as they normally are only at 1,000 to 2,000t REO. Thu, it would be more appropriate to consider the value of output for setting minimal size of enterprises

[115] 国务院关于促进稀土行业持续健康发展的若干意见

[116] 事实上，这些文件都已经起草完成，就等有关部门批复。接下来，这些配套文件都会陆续发布。

[117]持续健康发展

industry. This is a very general phrase that is also used in the context of reforming other industries. The term clarifies that the central government intends to substantially change the practices of the industry according to its principles and goals. This is in line with the more general change in the management of the Chinese mining industry. The State Council's "Notice on the All-Rround Consolidation and Standardization of the Mineral Resources Development Order"[118] of 2005 heralded the beginning of the informal strategy, which aims to:

> promote the entrance of China's mining industry into a new path of high technology, economic profit, high resource efficiency, low environmental pollution, high safety, and proper use of the advantages of human resources.[119]

The principles and targets of the Opinions point in the same direction. The realization of these targets relies on a fundamental principle of the strategy: the central government is the primary actor managing the REE industry. The call for "a unified, standardized, and highly efficient rare earth industry management system" (State Council 2011)[120] essentially means that the management of the industry should be unified under the leadership of the central government. The central government seeks to put itself in a key position that is indispensable to achieving "sustainable and healthy development." Given the weak role of the central government in the industry's history, this is an important change in strategy.

7.3.2. Targets

The Opinions formulated a set of targets to solve these issues between 2012 and 2015. Specifically, the Opinions sought to:

> accelerate the transformation of the development model, promote the industry's structural adjustment, strictly control extraction, refining, and separation capacities, fully develop the rare earth-based advanced materials and application industries, further consolidate and bring into play the important role of the rare earth's industry as a strategic base, and maintain the sustainable and healthy development of the rare earth industry.[121] (State Council 2011).

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[118] 关于全面整顿和规范矿产资源开发秩序的通知

[119]推动我国矿业走出一条科技含量高、经济效益好、资源利用率高、环境污染少、安全有保障、人力资源优势得到充分发挥的新路子。

[120]统一、规范、高效的稀土行业管理体系

[121]加快转变稀土行业发展方式，促进稀土产业结构调整，严格控制开采和冶炼分离能力，大力发展稀土新材料及应用产业，进一步巩固和发挥稀土战略性基础产业的重要作用，确保稀土行业持续健康发展。

This represented a bundle of unspecific targets, but these were specified more concretely in several implementing documents (State Council 2011).

First, to cope with the problem of resource depletion, the central government sought to conserve REE resources. The MIIT draft plan stipulated that extraction up to 2015 should be limited to between 130,000 and 150,000t and separation between 120,000 and 150,000t (China Mining 2009). The National Mineral Resources Plan of the MLR sought to limit REE production to 140,000t in 2015 (MLR 2008). This target is approximately equal to the production level of 2010.

Second, the strategy set the target of improving the environmental protection of REE operations. Unlike for resource conservation, the government did not specify an aggregated target for the entire industry but only enterprise-specific emissions standards (MEP 2009, 2011a).

Third, the strategy sought to regain pricing power over REE in order to be able to significantly increase their price. The government did not, however, define a specific price to be achieved (State Council 2011).

Fourth, the strategy aimed to fundamentally reorganize the industry through reducing fragmentation and building a highly concentrated industry structure. The Opinions planned to have two to three big state-owned enterprises that would control the REE industry and account for 80 percent of REE production in southern China by 2015 (State Council 2011). MIIT Vice Minister Su Bo said that "if we want to solve the industry's current problems of fragmentation and chaos, we first have to increase the level of concentration of rare earth enterprises"[122] (Xinhua 2012c).

Fifth, climbing the value added-ladder is a central aim for the REE industry and REE applications. The aim is to export fewer low-value REE products and more high-value end products. Foreign manufacturers are to be attracted to invest in REE high-value production in China. The aim is in particular related to various downstream industries such as LEDs, electric generators and electric vehicles, electronics and other industries. All of these have been selected as strategic industries to be promoted by the central government (State Council 2012c; Wübbeke 2015a).

Sixth, the strategy sought to reduce the export of REE and to increase the export of semi-finished and finished products. The MIIT draft Plan sought to control exports at about 35,000t annually until 2015. The original plan to ban the exports of dysprosium, terbium, thulium, lutetium and yttrium was dropped (China Mining Rights 2011; Tse 2011; State Council 2011).

[122] "要治理目前行业的散和乱问题，首先是要提高稀土行业集中度。"

7.4. Conclusion

This chapter presented an answer to the second part of the first research question: How has the Chinese central government been carrying out a new strategy of strong intervention in the REE industry since 2005?

The new strategy became apparent in 2003. Only since 2005, however, has the new strategy taken an informal shape through various regulatory measures such as industry reorganization, production quotas and a decrease of export quotas. The year 2009 marked the beginning of the formal stage of the strategy as the MIIT's Draft Plan and the State Council's Opinions were promulgated in 2009 and 2011.

The principles of the strategy are clear: industry management is to be centralized in the hands of the government, with a decision structure arranged in a top-down fashion. The central government's view is that the development of the REE industry can only be achieved under the auspices of the central government itself.

The targets with regard to the four practices of industry organization, production, environmental pollution and export are to increase industry concentration, conserve REE resources, reduce pollution from production activities and limit exports of REE as raw materials. The central government defined a whole list of regulatory instruments that are expected to translate this policy into practice.

To be sure, this strategy takes account only of the central government's own perceptions and plans. To what degree these principles, targets, positioning and regulatory instruments work out in practice is part of the analysis in the subsequent five chapters of part III. These will deal with the translation of the strategy to local practices.

PART III

8. Industry Reorganization

8.1. Introduction

This chapter analyzes the government's strategy to reorganize the REE industry and its implementation. Industry reorganization is an ongoing and common practice of the REE industry: enterprises enter and exit the market, acquire and merge with other enterprises, and purchase and sell mining rights. In a state-led economy like China's, government participation in industry organization is normal. Since 2005 and more intensively since 2009, the central government has been promoting a fundamental reorganization of the industry that goes far beyond what one would expect if the industry were left alone. The target of the substantial reorganization is to build an industry controlled by a few big state-owned enterprises (SOE), in particular central government-owned enterprises (COE). Subsequently, the analysis will differentiate between central government-owned enterprises (COE) and province-owned enterprises (POE). State-owned enterprises (SOE) include COEs and POEs.

The chapter finds that provincial governments and state-owned enterprises are the most important mediators for carrying out mergers and acquisitions (M&A) (see Figure 8–1). The provinces, however, used their role as mediators and their control over mining rights to pursue their own interests. While they agreed with the national strategy to reorganize the industry, they tried to reduce the involvement of central government-owned enterprises (COE) in their provincial REE industries. Instead, they promoted their province-owned enterprises (POE). They have been successful in changing the national policy in this direction. Being aware that the provincial strategy is partly consistent, but partly inconsistent with the national strategy, the central government adopted a strategic flexibility that left the specification of the concrete activities of the reorganization to the major mediators. The central government deliberately allowed a factual change of policy by the mediators.

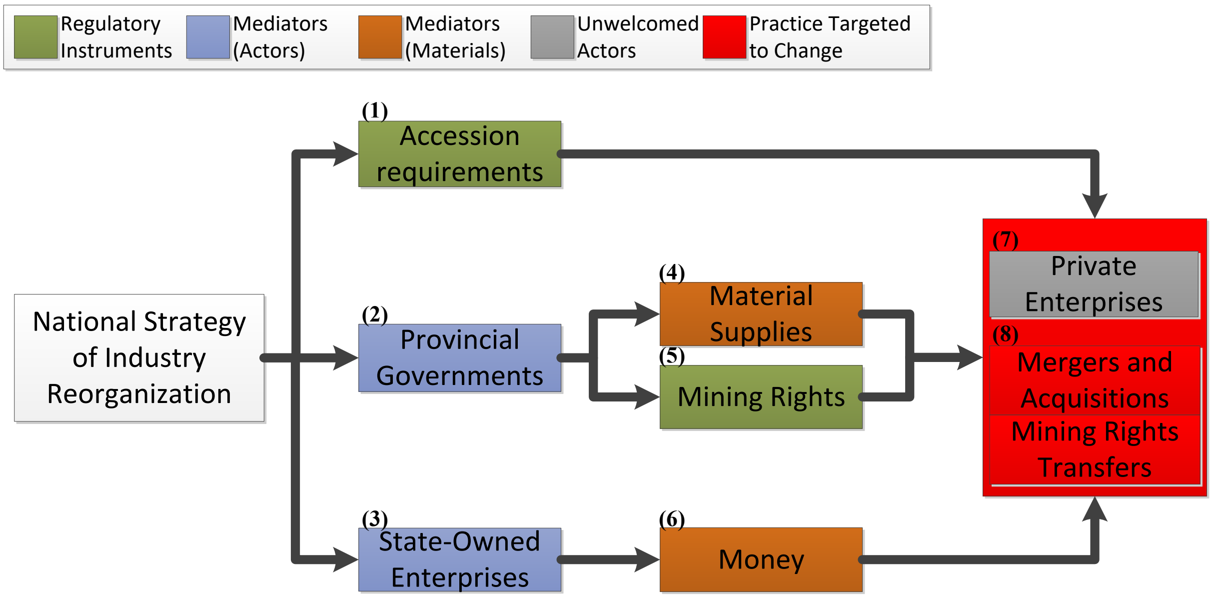

Figure 8–1: Translation of the central government's strategy to consolidate the industry and build big mining enterprises.

The national strategy aims to realize industry reorganization at the expense of private enterprises. Attempts by these targeted actors to reject the M&As failed. Provinces and city governments as well as some state-owned enterprises (SOE) used their control over REE supply to restrict private separation businesses.

This chapter starts by delineating the central government's strategy and its strategic flexibility to include the positions of other actors (8.2). It then presents the interests of provincial governments and state-owned enterprises in comparison to the national strategy (8.3). The central part of the chapter revolves around how the provinces have changed national policy (8.4).

8.2. Strategy of Reorganization

8.2.1. National Plans

The central government's efforts to reorganize the REE industry originated in 2005.[123] The central government decided at this time to fundamentally change the structure of the mining

[123] National plans to restructure the REE industry are not new. There have been four attempts by various levels of government since the 1970s. The last efforts to divide the Chinese REE industry between a "northern" and "southern" REE enterprise were proposed in the early 2000s. In October 2002, the preparation group for the "China

industry (State Counil 2005, 2006). The reorganization accelerated with the formal strategy to reform the REE industry in 2009.[124] The Ministry of Industry and Information Technology (MIIT) is responsible for formulating and carrying out the industry reorganization strategy.[125] In 2011 the State Council defined a target of building two or three big enterprises that were to control the REE industry by 2015; these were expected to account for 80 percent of extraction in southern China (State Council 2011). These two goals provided a general indicator against which to evaluate the success of policy. This was a tremendous task, as the Chinese REE industry was previously very fragmented with many small enterprises.

Beyond these targets, the official documents remained fairly general about the implementation of the reorganization for a long time. The government did not indicate which two to three enterprises should control the industry. Attempts to define a list[126] of prevailing enterprises did not come to an end and the central government remained ambivalent about who the winners of the reorganization would be. The government adopted a strategically flexible position on this question, allowing the mediating actors – the provinces and big enterprises – plenty of discretion to reorganize the industry according to their own strategic interests and to change the actual policy outcome. The indecisiveness of the central government is related to the fact that it does not see itself as an implementer of the M&As and mining rights transfers. The central government only coordinates reorganization.

Only in 2014 did the MIIT finally determine a list of six enterprises to dominate the REE industry (Liu ZA 2014). As is obvious, the central government did not reach its goal of building

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Northern Rare Earth Group" (中国北方稀土（集团）股份有限公司) was convened (CRE 2002). Four months later, the central government set up the preparation group for the "China Southern Rare Earth Group" (CRE 2003). However, these plans ran out of steam in 2005 due to uncertainties over mining rights and export licenses for the two planned enterprises, which resulted in participating enterprises withdrawing their support (Dai ZX 2005).

[124] Two documents laid out the aim to reorganize the industry: the MIIT's "Special Plan for the Development of the Rare Earth Industry (2009-2015)" and the State Council's "Several Opinions on Promoting the Sustainable Development of the Rare Earth Industry." Two further documents clarified the aim to conduct reorganization across industries: the "Opinions on the Promotion of the Mergers and Reorganization of Enterprises" of the State Council (2010) and the "Leading Opinion on Accelerating and Pushing the Mergers and Reorganization of Enterprises in Key Sectors" by the MIIT (2013a).

[125] The reorganization focuses on the upstream sector, but not the downstream sector.

[126] In 2010, the MIIT and the National Development and Reform Commission (NDRC) sent a list of enterprises that should lead the reorganization to the State Council for approval. However, the list was not published and no information was leaked about its specific content. In May 2012, the MIIT began drafting a specific reorganization plan, but the plan has never been publicly released (Yang Y 2012).

two to three strong enterprises by end of 2015. Instead, it accepted that a larger number of enterprises would prevail. The final list generally did included two COEs, as favored by the central government, but also four POEs, to the satisfaction of provincial governments. The outcome was the result of the flexibility of the central government and the influence of other actors, in particular the provinces.

8.2.2. The Winners of Industry Reorganization

Before the central government defined the six primary enterprises for the industry, the chances of the candidate enterprises surviving reorganization varied. First, the government had favored state-owned enterprises (SOEs). Second, among the SOEs it had preferred mainly central-owned enterprises (COEs). If the reorganization had happened solely according to the desire of the central government, it would have mostly been COEs that would have finally prevailed (Zhou Y and Ding QC 2010; Chen YP 2013; Yan K 2013; Meng SS 2013).

The candidates for dominant positions in the industry included COEs and POEs. In essence there were five COEs[127] engaged in the REE industry in 2013: Chinalco, Minmetals, China Nonferrous Metals Mining Group (CNMM), China Iron and Steel Research Institute Group (CISRI),[128] and the General Research Institute for Non-Ferrous Metals.[129] Of these, only the first three made large, cross-provincial investments in the REE industry. Only Chinalco and Minmetals were eventually selected by the central government to stay in the industry (Liu ZA 2014).

The POEs involved were Baogang, the Guangdong Rare Earth Group,[130] Jiangxi Copper[131] and the Fujian Rare Earth Group. The Ganzhou Rare Earth Group (GZRE) is the only important city-level enterprise. Table 8-1 shows the "winners" of the reorganization.

Enterprise	Previous Enterprises	Location of Mining	Location of Separation
Central-Owned			

[127] The central government is involved in some other marginal ways. The Ministry of Finance, for example, participates through its ownership of Taiyuan Science and Engineering Tiancheng Technology (太原天成科技股份有限公司) in the Sichuan REE industry (Gao Y 2013).

[128]中国钢研科技集团有限公司

[129] 北京有色金属研究总院

[130] 广东稀土集团. The Group is based on Guangsheng Non-Ferrous Metals (广晟有色).

[131] 江西铜业公司

Chinalco	Chinalco	Guangxi, Shandong	Jiangsu, Jiangxi, Guangxi, Sichuan
Minmetals	Minmetals	Hunan, Yunnan, Guangdong, Fujian	Jiangxi, Guangdong
Province-Owned			
Northern Rare Earth	Baogang	Inner Mongolia	Inner Mongolia, Gansu
Guangdong Rare Earth	Guangdong Rare Earth	Guangdong	Guangdong
Fujian Rare Earth Group	Fujian Rare Earth Group	Fujian	Fujian
Southern Rare Earth	Jiangxi Copper and GZRE	Jiangxi, Sichuan	Jiangxi, Sichuan

Table 8–1: The most dominant enterprises selected by the central government to survive industry reorganization.

The two enterprises with the brightest prospects throughout the reorganization were the POE Baogang and the COE Chinalco. As Baogang controls China's largest REE deposit at Bayan Obo, the government could hardly ignore its importance. An unknown person involved in the drafting group to the MIIT's M&A strategy said during the early stages of the reorganization that "now, only for the northern rare earth deposits is the situation relatively clear. Baogang is dominant and has a place in the national rare earth strategy"[132] (Chen YP 2013).

The MIIT also demonstrated a close relationstip with the COE Chinalco. In contrast to the other COEs, Chinalco received very explicit support. MIIT Vice Minister Su Bo visited the Chinalco headquarters emphasizing the need for industry reorganization. The head of the MIIT REE office paid visits to Chinalco affiliates after its REE acquisitions in Jiangsu (Xinhua 2012d; Zhu YK and Pu ZC 2011).

8.2.3. Accession Requirements Supporting Reorganization

The central government stepped back from engagement in concrete M&A, but it set a regulatory framework aimed at creating an environment conducive to crowding small enterprises out of the market and forcing them into the arms of big enterprises. Among these

[132]现在只有北方稀土格局比较明朗，包钢稀土一家独大，在国家的大稀土战略中占有一席之地。

measures are accession requirements, tax rebates, subsidies, land policy, and information and risk assessment services (State Council 2010; Yang Y 2012).[133]

The most relevant regulatory instruments are detailed in the "Accession Requirements for the Rare Earth Industry" published by the MIIT in July 2012 (MIIT 2012b; Xiao M 2010).[134] The requirements encompass rules for minimum production capacities for mining, separation, metals refining and other rules (for details see table 8.2). The aim is to promote large operations and eliminate small ones.

	LREE			**HREE**
Type of Mineral	Mixed Type	Bastnäsite	Monazite	Ionic
Extraction in t REO/yr	≥ 20,000	≥ 5000	not allowed	≥ 500
Processing and Separation in t REO/yr	≥ 8,000	≥ 5000	not allowed	≥ 2000
Metal Production**	>=2000			
Equity Ratio for Fixed-Asset Investment	≥ 20 percent of total investment			

Table 8–2: Selected minimum accession requirements for the REE industry (MIIT 2012b). *t REO/yr. **t metal/yr.

With regard to existing REE projects that do not reach the minimum thresholds, the requirements state that these should either upgrade their technology or face being absorbed by larger enterprises. These provisions put existential pressure on small REE miners, separators, and metal producers (MIIT 2012b).[135]

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[133] Many of these measures do not conform to an understanding of "market" as understood in a pure market economy.

[134] In addition to the accession requirements, there are a variety of other rules which put pressure in particular on small enterprises. Among these are the new environmental emissions standards and the raised resource taxes. The new emissions standards of 2011 function as a gatekeeping mechanism against new market participants, which is in line with the government's strategy for industry concentration and, in terms of existing enterprises, market domination. New enterprises have to comply with even stricter emissions standards. The maximum concentration for ammonia in waste water is set at 15 mg/L. This raises the threshold for market entrance. According to Wang Guozhen (王国珍), former vice president of the China Enfi Engineering cooperation, a REE-related research institute: "With the "Accession Rules" and the "Emission Standards" above 60 percent of enterprises face elimination" (一个《稀土行业准入条件》，一个《稀土工业污染排放标准》，两者淘汰的企业数量就在 60 percent 以上) (Yang Y 2011, p. 49).

[135] Jia Yinsong, director of the MIIT REE office said that "about one-third of extractive enterprises and nearly one -half of processing and separation enterprises do not meets these requirements" ("采矿这一块接近 1/3 达不到这样的标准要求，冶炼分离这一块接近一半的企业达不到(标准要求)") (People's Daily 2012a). The final

However, the requirements remained weak in practice as many actors opposed them. Small private enterprises, as well as provinces and big enterprises, saw the requirements as a threat. The provinces feared that rigid requirements could affect the development of provincial REE industries.[136] The practical weakness of the industry accession requirements can be seen in the fact that neither Baogang nor GRZE fulfilled the environmental elements of the requirements in 2012. However, neither of the two had to stop production (MIIT 2012b).[137] As the requirements had no legal basis and were only a ministry-level rule, it has been difficult to enforce them in practice (Xinhua 2012h).[138]

8.3. Mediating Actor's Strategies

8.3.1. Provincial Strategies

The central government defined the provinces as important mediators of the national reorganization strategy. The tasks for the provinces were to eliminate barriers to M&A, to gain

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version of the requirements even dropped the originally planned a transition period of two years for existing enterprises to comply with the requirements (MIIT 2010b, MIIT 2012b). Only a few private and collectively owned enterprises in Ganzhou (Jiangxi) have a processing and separation capacity of 2,000 t/yr. The requirement of 8,000 t/yr for processing and separation of the mixed type REE of Inner Mongolia is also very demanding. Currently, only about a dozen companies can meet the minimum capacity of 2,000 t/yr for metals production.

[136] During the formulation of the standards, provinces and enterprises successfully watered down some of the provisions. In the 2010 draft of the accession requirements, the capacity for ionic REE mines was set at 3,000 t/yr. The southern provinces had an interest in lowering this threshold because many ionic REE deposits are scattered and comparatively small. The final requirements set the minimum extraction volume at 500 t/yr. Other influences from enterprise interests are visible in the determination of the minimum equity ratio for fixed-asset investments. The drafts originally planned an equity ratio of 40 percent for new projects, whereas the final requirements set the threshold at 20 percent (MIIT 2010b; MIIT 2012b).

[137] The MIIT has published lists of 35 enterprises fulfilling the requirements (MIIT 2012c, 2012d, 2012e). However, in practice the requirements and the lists of enterprises fulfilling the requirements have only very limited influence. Due to environmental concerns, the list does not include the active mining operations of Baogang – the largest producer in the north – and Ganzhou Rare Earth – the largest producer in the south (MIIT 2012b).

[138] The 2010 draft gave the government the right to cut energy supplies to non-compliant enterprises. But as the requirements were only set by ministerial rules, they would have been hard to defend if targeted enterprises were to make administrative complaints. Thus, the current requirements do not include such a cut-off right (Xinhua 2012h).

the support of sub-provincial governments through fiscal discounts and credit subsidies, to encourage commercial banks to provide loans to M&A activities, and to set up M&A funds (State Council 2010). The provinces were generally enthusiastic about this strategy of industry reorganization (REI 2011b, p. 21).[139]

However, the provinces had their own ideas about translating the reorganization into practice. Using their roles as mediators and based on the strategic flexibility of the central government that left the outcomes of the reorganization open for a long time, the provinces formulated their own strategies.[140] Most provinces' strategies deviated from the national strategy in important aspects: the provinces tried to support their own provincial mining enterprises (POEs) instead of the COEs.

In promoting their own POEs, these provinces significantly changed the central government's original strategy of prioritizing the involvement COEs. In particular, four provinces built up their own POEs or other local enterprises to control the local REE industry: Inner Mongolia, Jiangxi, Guangdong and Fujian (Guangdong Province 2012; Fujian Province 2012).[141] With each province pursuing its own interests, it became impossible for the central

[139] Yang Ruiping, vice director of the Inner Mongolia Economy and Information Technology Commission (IMEITC) said that: "The reorganization and elimination work of the rare earth upstream enterprises is totally in line with the national orders and claims" (自治区开展稀土上游企业整合淘汰工作，与国家的部署和要求完全一致) (IMEITC 2012a).

[140] The government of Inner Mongolia adopted the "Reorganization and Elimination Plan for Rare Earth Upstream Enterprises" (稀土上游企业整合淘汰工作方案) in 2011. The plan included a list of 35 separation and metal production companies, which accounted for about half of the REE enterprises in Inner Mongolia. The provincial government had identified these as lagging behind with regard to environmental protection, resource efficiency, and production technology (IMEITC 2012a). They should either be closed down or integrated into the POE Baogang (Gao Y 2013). Guangdong province formulated the "Opinions on the Promotion of the Reorganization of the Rare Earth Industry" (关于推进我省稀土行业整合的意见) and Fujian the "Action Plan for Strengthening Resource Protection (2012 to 2015)" (福建省加强稀土资源保护科学开发稀土资源行动方案) (Guangdong 2012; Fujian 2012).

[141] The change of the policy through the provinces is visible in the strategy of Guangdong province: "a provincial rare earth group is basically responsible for managing the concentration of rare earth resources and it will be a huge group under the national key developments" (省稀土产业集团基本实现对稀土资源的集中经营管理，并成为国家重点发展的大型稀土企业集团) (Guangdong Province 2012). Similarly, the Fujian government states that "at the end of 2012, the creation of the Fujian Rare Earth Group…should be completed, in order to form a big enterprise leading the development of the rare earth industry" (一下 2012 年底前完…福建稀有稀土集团公司的

government to concentrate the national REE industry across provinces in the hands of two to three enterprises. The central government had to give up its target to establish only two to three big enterprises due to the influence of the provinces (Zhu YC 2013).

Jiangxi province most vocally raised its concerns over the national strategy to involve COEs in local REE industries. A Jiangxi government official said: "What should Jiangxi province do about this huge policy? It has to go its own path. This is a way that suits the position of its own industry. Although this is quite difficult, we have to go down this way" (Xu D 2011, p. 33). Meanwhile, the Inner Mongolian government was less concerned about competition from COEs as the central government had already confirmed its support for the provincial champion Baogang (Chen YP 2013).

The provincial governments promoted POEs instead of COEs for several reasons: First, the REE upstream industry is an important source of revenue and tax income for some sub-provincial entities such as Ganzhou, Heyuan (Guangzhou), Mianning and others. If the COEs controlled the REE mines, the tax revenues would be transferred to the central government instead of the local governments (Wu YD and Liao LF 2012, p. 68). [142] Second, the provinces have learned that the REE industry will be even more important in the future. As it is included among the "emerging strategic industries" promoted by the central government, the provinces see it as a possible future key pillar for local development (State Council 2012c).

8.3.2. SOE Strategies

The central government identified the SOEs as mediators for carrying out M&A. The big enterprises are very much interested in extending their business. The vice director of Baogang Xing Bin said "A strict reorganization must be carried out…we can bring the resources back to order only in this way…"[143] (REI 2011b, p. 20). Baogang's CEO Zhang Zhong stated that "With so many contradictory interests in the REE industry, the situation will get worse if we

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组建，形成大企业应另稀土产业发展格局) (Fujian Province 2012). The Jiangxi government speaks of "creating a leading Jiangxi rare earth enterprise" (组建江西稀土行业龙头企业) (Jiangxi Province 2012a).

[142] Because COEs direct their capital flows through their headquarters, they pay most of their taxes to the central government. Even if parts of the taxes were to be transferred back, the local governments would still forgo a large tax income.

[143]严格整合势在必行…只有这样才能对稀土资源进行强有力的整治

totally rely on the market mechanism. The leaders of the reorganization should have the overall situation in mind" (Gao Y 2013).[144]

Under the reorganization efforts, Minmetals intended to turn its subsidiary Minmetals Rare Earth (Ganzhou) into the world's largest REE enterprise (Yang Y 2011, p. 49). In his function as a member of the Consultative Conference, Minmetals CEO Zhou Zhongqu petitioned the National People's Congress and the Consultative conference to accelerate the industry's reorganization (Chen YM and Liu JH 2011b). For Chinalco, the engagement in the REE industry had a similar relevance; the company aimed to become the "world's longest-lasting top mining enterprise"[145] (Chinalco 2011).

There are indications that the ambitions of the SOEs sometimes went beyond those of the central government's plans. Baogang, for example, saw a chance under the reorganization strategy to build a nationwide monopoly in both northern and southern China. Although the central government sought to forge big enterprises, it was aware of the possible detrimental effects of creating a monopoly (Gao Y 2013). MIIT Vice Minister Su Bo said that China should "take care to avoid the emergence of resource monopolies"[146] (Su B 2013). Consequently, the MIIT suggested that Baogang revise its plans.[147]

144在利益相关方势力交错的稀土产业，如果全部交由市场机制调节，只会越来越糟糕。整合的主要引导者应当胸怀大格局，打破地区、企业、行业等这种条块的利益划分。There are more examples of such statements, such as when the director of the Bayan Obo mine said: "Rare earths are a strategic resource and China's treasury. We are responsible for protecting them." ("稀土是战略资源，是国家的宝藏，我们有责任把资源保护好。") (Ren HB and Zhang YL 2011).

145 最具成长性的世界一流矿业公司

146 也注意防止形成资源垄断

147 Together with the province of Inner Mongolia, Baogang lobbied the central government to plan a "Northern Rare Earth group" under Baogang's leadership. Inner Mongolia and Baogang picked up this old idea again in order to put themselves in a dominant position (Yang Z 2012). Baogang planned a three-step strategy: first, integrating the entire REE industry in Inner Mongolia; second, taking over the industries in Gansu, Sichuan, and Shandong, and finally participating in the reorganization of southern Chinese deposits (Xu D 2011; Cai YJ 2011). The MIIT showed its interest in the plan and its willingness to establish Baogang as the Northern China Rare Earth Group. However, it also stated that it would not accept Baogang controlling the entire Chinese REE industry (in northern China and particularly in southern China). It called for a revision of the plan and its submission to the State Council (IMEITC 2012b).

8.4. The Dynamics of Reorganization

8.4.1. Control over Mining Rights

The success of the industry reorganization critically depended on the transfer of mining rights. Authorization by the state is required for all transfers.[148] The legal regulations are contradictory about who within the state is responsible for authorization. The regulations stipulate that the central government has exclusive control over mining rights for important minerals and "special resources for protected extraction," including REE. At the same time, provinces are responsible for mining rights for small and mid-sized mines (State Council 1998).

The regulations are irrelevant in practice. Since the 1990s, central government agencies have had only a limited capacity to deal with the scattered and numerous REE deposits. The provincial governments have de facto controlled the mining rights for most minerals and REE.[149] Their de facto control over mining rights provides provincial governments with the ability to significantly change the policy of reorganization according to their own interests (Lin et al. 2011, p. 77).

In addition to the provinces, city- and county-level governments can also be important actors in decisions about mining rights.[150] In the 1990s, many counties controlled the

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[148] Mining rights can either be transferred directly from one enterprise to another or they can be transferred as part of an acquisition or joint venture. In both ways, authorization by the state is necessary.

[149] Hong Feng, former director of the Rare Earth Office of the State Development Planning Commission, said that "According to the 'Mineral Resources Law' minerals belong to the state, but these are only words, resources factually belong to the local governments" (按照《矿产资源法》矿产归国家所有，但这只是一句很好听的话，资源实际上是归属地所有) (Cui H 2011).

[150] Whereas the contrasting strategies between COEs and the provinces are most obvious, there are at times also conflicting strategies between provinces and sub-provincial authorities. Despite the dominance of POEs, the city-owned GZRE dominates REE extraction in Ganzhou. The provincial government sought to bring the mining rights of Ganzhou under the control of its provincial mining enterprises (The most relevant POE in this regard is Jiangxi Tungsten (江钨集团)), but these enterprises have only one mining right in Jiangxi, outside of the Ganzhou city area. The reason for the dominance of GZRE is the particular dispersion of resources in Ganzhou over many counties. In order to get the mining rights in these areas, agreements over the lending of land have to be achieved with all concerned counties. However, the city government of Ganzhou closely coordinates with its inferior county governments, which makes it difficult for the POE to enter REE mining in the city. This is one of the few cases

management of REE mines. Currently, however, the provincial governments allocate nearly all mining rights for REE. Besides mining rights, the city- and county-level governments make decisions on the lending of land, awarding business licenses, and many other formal licenses. The balance of influence between provincial and sub-provincial governments varies between provinces. In most cases, the provincial governments are generally more important with regard to industry reorganization and the transfer of mining rights (Lin et al. 2011, p. 77).

8.4.2. COEs' Failure to Enter REE Mining

The reorganization of REE mining focuses mostly on southern China. The REE reserves in northern China are concentrated in one place and are already controlled by a single company, Baogang. REE deposits in southern China, in contrast, are more scattered. There are 57 mining rights in southern China compared to 10 in northern China. As many different provinces and enterprises control these mining rights in southern China, it is very difficult for the central government to reorganize the industry in these areas according to its own strategy. The vast extension of the REE deposits constitutes a material barrier to translating the national strategy into practice as it increases monitoring, implementation and enforcement costs (Wübbeke 2013).

The central government sought to involve COEs in the REE industry, in particular Minmetals, Chinalco and CNMC. As mediators of the national strategy holding interests similar to the central government, the COEs tried to obtain mining rights in the provinces. Before the central government started its most recent reorganization efforts in 2009, none of the COEs had possessed any REE mining rights. Chinalco and CNMC also had no experience in the REE business (Liu Y 2010).[151]

The provinces used their control over mining rights to keep these COEs out of their provincial REE mining industries. Their resistance was effective: the COEs could acquire only a few licenses and only for small mines. The COEs accounted for a share of only three percent of the national quotas for REE extraction in 2013. POEs, in contrast, dominated REE mining. They controlled 73 percent of the national extraction quotas in 2013, while city-owned, county-owned and private enterprises accounted for 14 percent. There are, however, differences among provinces (see figure 8-2).

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where city and county governments could get their own strategies into the national reorganization policy (Securities Times 2013).

[151] Minmetals once owned mining rights in Jiangxi.

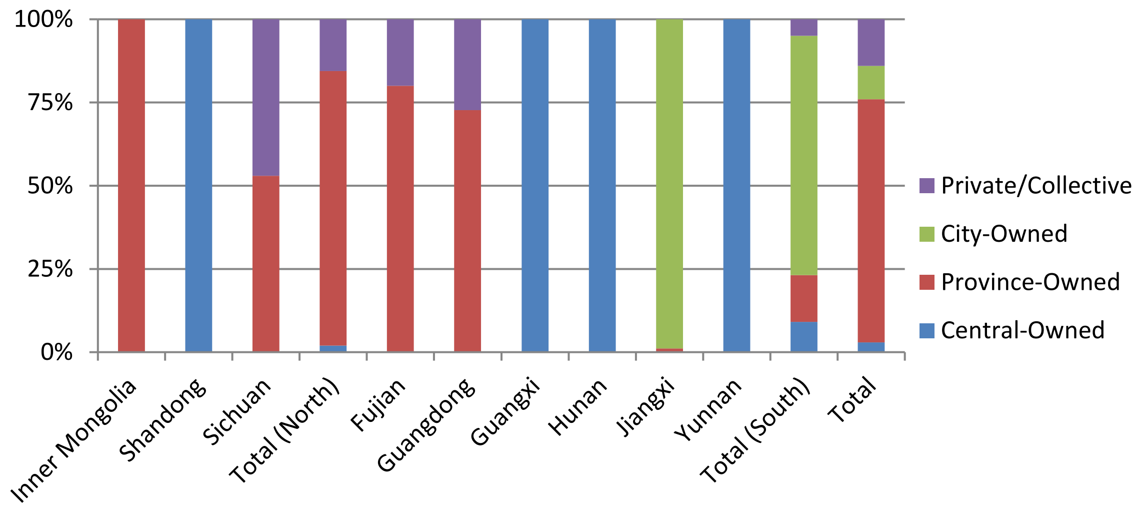

Figure 8-2: The provincial and national REE mining industry structure as of 2013: types of enterprise and their share in the provincial extraction quota for REE. The values for Inner Mongolia, Jiangxi and Guangdong were estimated by the author. Quotas for recycling from tailings and other wastes are not included. Calculations were made by the author on the basis of Sichuan Province 2013; Fujian Province 2013; Guangdong Province 2013; Guangxi Province 2013b, 2013c; Hunan Province 2013; Yunan Province 2012.

The difficult situation for COEs is especially evident in Minmetals' attempts to enter mining in the REE-rich provinces Jiangxi, Fujian, Guangdong, and Sichuan. Jiangxi province and Ganzhou city reorganized their local REE industries in 2004. The city-owned Ganzhou Rare Earth (GZRE) took over most of the local mining rights. Minmetals thus already faced a very strong local competitor when it tried to enter the market in 2010 (Liu Y and Zhang YL 2010). Moreover, Minmetals had a bad relationship with Jiangxi province due to its failure to cooperate with the provincial government in the past (Xu D 2011). Minmetals once owned REE mining rights in Jiangxi, but because the Jiangxi government accused Minmetals of not producing and investing enough in the mine, it transferred the mining license back to its provincial enterprises (Xu D 2011, p. 33). Furthermore, there were frictions over Minmetals' purchase of the Jiangxi Tungsten Group, a former provincial mining group. The provincial government accused Minmetals of merely extracting tungsten without doing much to develop the local economy (Liu Y and Zhang YL 2010).

Minmetals' efforts to enter Fujian and Guangdong were similarly unsuccessful until recently. As a defense against Minmetals, Fujian integrated provincial mining and separation capacities into the POE Fujian Rare Earth Group (Xinhua 2012e; Shen J 2013; Ju YT 2012).[152] Guangdong province established the Guangdong Rare Earth Group, which controlled nearly three-fourths of the province's extraction quota in 2013 (China Metals Online 2013).

Minmetals also failed to acquire mining rights in Sichuan province. This case demonstrates that the COEs did not always fail on grounds of provincial resistance, but also because of their lack of commitment to industrial reorganization prior to 2009. Already in 2006 the province had succeeded in effecting major industrial reorganization through a bidding process for the mining rights at Maoniuping, one of China's largest REE deposits. This gave the COEs the chance to acquire mining rights. However, this was at a time when the central government's policy for industry reorganization was not yet as strong as it would become after 2009. Many interested enterprises participated only half-heartedly in purchasing REE mining rights. In the end, Jiangxi Copper, which is Jiangxi's strongest provincial mining enterprise but is not involved in Jiangxi's REE industry, won the bidding (Cai ZY 2012).[153]

Due to the resistance of these provinces, Minmetals changed its strategy. It tried to enlist other actors to help it achieve its aims: it signed cooperation agreements with several city and county governments in the mining areas.[154] These lower levels of government can be important in decisions over mining rights and other licenses. However, Minmetals proved unable to obtain mining rights through this strategic readjustment in Guangdong and Fujian. The government of Sanming city, one of Fujian's REE-rich areas, ended its agreement with Minmetals due to

[152] The Fujian Rare Earth Group owns three of Fujian's five mining rights and has a 70 percent share in a fourth through the subsidiary Xiamen Tungsten. Although Minmetals has shares in Xiamen Tungsten, these are not enough to control these mining rights (Fujian Province 2013).

[153] Only Jiangxi Copper and Minmetals were willing to pay the deposit of 30 million RMB as a condition to participate in the bidding. Other companies including Baogang, Chinalco and GZRE refused to pay the deposit despite their interest. Minmetals tried to improve its chances in the bidding process by previously acquiring some of the small enterprises that possessed some of the relevant mining rights. Among these enterprises was Fangzheng Rare Earth, a subsidiary of a Beijing university-owned enterprise. In the end, however, Jiangxi Copper was willing to pay 430 Million RMB, more than Minmetals. The starting price had been 180 Million RMB. After Jiangxi Copper achieved further agreements with the Sichuan government and Liangshan city, Minmetals had to transfer its previously acquired mining rights to Jiangxi Copper. Subsequently, Jiangxi Copper founded, together with Sichan Mining Investment (四川矿业投资公司), the joint venture Sichuan Jiangxi Copper Rare Earth (四川江铜稀土有限责任公司) in order to develop the deposit at Maoniuping (Cai ZY 2012).

[154] Minmetals signed cooperation agreements for example with Heyuan city (河源) in Guangdong, Sanming city (三明) and Changting county (长汀) in Fujian, Yongzhou city in Hunan, and Dehong city in Yunnan. These agreements include a facilitation of handling formalities and modalities related to the transfer of mining rights.

pressure from the Fujian provincial government. An official from the Sanming city Economy and Trade Comission said that "we act according to the will of the provincial government"[155] (Fu M 2011; Ju YT 2012). Other COEs have also been unsuccessful in the REE-rich southern provinces.

The COEs could obtain sizeable mining rights in only four provinces with small REE deposits and production: Guangxi, Hunan, Shandong and Yunnan.[156] Chinalco acquired Guangxi's only mining rights[157] Minmetals got the mining rights in Hunan and Yunnan, and the China Iron and Steel Research Institute Group, a REE application producer, obtained the mining rights in Shandong. CNMM did not secure any mining rights, but building on its overseas experiences, it has explored REE deposits in Myanmar. The COEs' successes in these provinces were possible because the provinces' REE mining was less developed and therefore they welcomed the COEs' activities to support the establishment of competitive local REE industries (Fu M 2011; Ju YT 2012; Xinhua 2013f; Gu X 2012; Cao KH 2011; Xiao Yi 2011; Hunan Morning 2012; Securities Times 2012).

8.4.3. COEs' Entry into REE Separation

The resistance of the provincial governments to the involvement of COEs in their local REE industries and the transformation of the central government's policy to better fit provincial needs led to a further strategic readjustment by the central government and the COEs: the COEs focused on entering the separation industry instead of mining operations in the REE-rich provinces.[158] The COEs see entry into REE separation as a first step which could later increase their chances of entering the mining business in these provinces.[159] This engagement in

[155] 我们按照省的意思。

[156] These four provinces accounted for only 6.6 percent of the national extraction quota of 2013.

[157] Chinalco formed a joint venture with the Guangxi Non-Ferrous Metals Group (广西有色金属集团有限公司) and the COE Grirem Advanced Materials (有研稀土新材料股份有限公司). The joint venture's subsidiary, Chongzuo Rare Earth Development (崇左稀土开发有限公司), owns the mining right in Guangxi.

[158] A representative of Minmetals said that "To get REE resources and build a complete REE chain has always been our goal of entering Jiangxi. But because we are hindered by local interests, we have no choice but to settle in refining further downstream" ("获取稀土资源、打造完整的稀土产业链，一直是我们进军江西的目标，但碍于地方利益，我们只能蜗居下游加工环节。") (Zhou HB 2010).

[159] Minmetals Director General Zhou Zhongqu said: "Because of the fragmentation of domestic rare earths, only local governments can carry out reorganization in the first step. Minmetal's plan is to step in later through

separation activities is possible because, unlike mining rights, the provinces have no exclusive authority over approval for REE separation projects. This weakens the capability of the provinces to resist the central government's strategy and change policy (Zhou HB 2010; Cao KH 2009).

As a result, the COEs built up dominance in REE separation in southern China, although many private, township and village enterprises are still present in this sector. After acquiring several large private enterprises, Minmetals is now the largest separator in Ganzhou (Zhou Z 2013a). Chinalco has come to control half of Jiangsu province's REE separation capacity through acquisitions and has invested in REE separation in Guangxi (Zhu YK 2011; Chinalco 2013; Wang L 2010; Xu D 2011, p. 33).[160] CNMM has become the dominant separator in Guangdong province (Xu D 2011, p. 33).

The provinces also tried to extend the separation capacities of their POEs, but were less successful in achieving dominance than in mining. The city-owned GZRE sought to control 80 percent of mining and separation in Ganzhou, but faced competition from the COE Minmetals (Ruan XQ 2013).[161] Separation in Inner Mongolia is, due to the support of the central government, dominated by Baogang. Baogang pursued an intensive campaign to acquire all separators in Inner Mongolia and Gansu (Peng F 2013).[162]

8.4.4. Failed Resistance from Private Enterprises

The central government's strategy sought to crowd private enterprises out of the REE industry as they characterized what was viewed as a "fragmented" and "chaotic" mining

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acquisitions. This way we can avoid a lot of trouble" ("五矿在稀土行业的整合思路是, 由于国内稀土过于分散, 只能先由地方政府进行整合,然后五矿再去收购,这样可以避免很多麻烦。") (Cao KH 2009).

[160] Chinalco integrated five separators in Jiangsu province into the newly founded Chinalco Rare Earth (Jiangsu) (中铝稀土（江苏）有限公司) in 2011. Although there is no REE mining in Jiangsu, the province hosts a large REE separation industry. The takeover gives Chinalco control over a separation capacity of nearly 30,000t/yr.

[161] Since 2012, it started buying private separation enterprises in Longnan and Xunwu county (Ganzhou SASAC 2013; Jiangxi Industry and Information Technology Commission 2012a).

[162] The provincial plan of Inner Mongolia for reorganizing the REE industry planned closing down 22 companies (with or without compensation) and merging 13 into Baogang. Baogang entered into a framework agreement with 12 of the 13 enterprises at the end of 2012. According to this agreement, the related enterprises should be integrated into Baogang (with a 51 percent share) (Peng F 2013). In 2011, Baogang acquired majority shares in China's largest REE carbonate producer Baotou Huamei (包头华美稀土高科技有限公司) (Yang Y 2011, p. 48). Baogang entered Jiangxi's REE industry through cooperation with three small private enterprises (REI 2011b, p. 20).

industry. Despite disagreements on the role of COEs, the provincial governments agreed with the central government on the benefits of eliminating most private enterprises from the REE business. The M&A activities of the large SOEs intensely targeted private enterprises. In mining, only a few private enterprises remain; more have survived in REE separation. To be sure, some private enterprises voluntarily accepted M&As. The money paid for a joint venture can be an important source of income. One private enterprise even indicated its interest in joining with the COE Minmetals as a way of upgrading its cleaner production equipment (CAO KH 2010).

Many private enterprises wanted to remain independent. Yu Jianhua, director of the Inner Mongolian private enterprise Baotou Huacheng Rare Earth,[163] said in response to provincial government plans to integrate his enterprise into Baogang: "I have put all my life into this, how can they just close it down?"[164] (Li Y and Li CL 2011). The private enterprises emphasized the market mechanisms to resist the M&As. They referred to the governments' commitment that the reorganization should be carried out in a market-conforming manner.[165]

Several private enterprises in Jiangxi rejected M&A offers by the COE Minmetals. One of the enterprise directors said that "We now have a market mechanism. If the central government-owned enterprises want to acquire private enterprises, whether we agree depends on the price"[166] (Cai ZY 2011). Similarly, many private enterprises deemed the money Baogang offered for acquisitions too low (Yuan J 2012; Cai ZY 2011).[167]

Due to the resistance of private enterprises, some provincial reorganization plans failed to meet their targets in time. For instance, the Inner Mongolian government originally planned to complete its reorganization within 50 days in 2011. However, Baogang entered its first agreements with the related private enterprises only at the end of 2012 and some private enterprises are still unwilling to agree to M&A (Gao Y 2012).

Some provincial and city governments readjusted their strategies to cope with resistance from private enterprises. They pushed back the influence of the market and money. For

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[163]包头市华诚稀土有限公司

[164]一辈子的心血都投入在这里，怎么能说关就关了！

[165] The government insists that the reorganization should conform with market rules: "the principles of the market economy must be respected… 'interventionism' must be avoided" (遵循市场经济规则…防止"拉郎配) (State Council 2010).

[166] "现在是市场机制，如果国企想要来收购民营企业，也要看价钱是不是谈得拢。"

[167] For example, Baotou Xinyuan Rare Earth High-Technology Materials (包头新源稀土高新材料有限公司) received only 4.5 million RMB compensation, but according to the enterprise itself, its fixed assets were worth 50 million RMB, similar to the case of Baotou Damao Rare Earth (包头市达茂稀土有限公司). None of the related enterprises were satisfied with the compensations proposed (Gao Y 2013).

instance, the Inner Mongolian government required all REE operations to renew their approvals. Despite meeting the legal requirements, many private enterprises did not pass the approval process. This pushed many private enterprises into illegal operations.[168]

It is not easy to revoke the business licenses of private enterprises.[169] Despite temporary closures of their facilities, some of the targeted private enterprises continued to operate. A CEO of an enterprise in Ganzhou said: "We will use any method possible to hinder [the reorganization]. They have policy, we have anti-policy"[170] (Xu D 2011, p. 33; see also Xiao Y et al. 2010).

The local governments and SOEs turned to another strategic readjustment to achieve their aims: they used their control over material flows to force private enterprises into bankruptcy. The Inner Mongolian REE industry plan includes the possibility of cutting off the electricity supply to recalcitrant enterprises (Gao Y 2013).[171] The large enterprises Baogang in Inner Mongolia and GRZE in Jiangxi used their control over REE mines, stopping the supply of REE to the private separation industry (Cai ZY 2011). The provincial government of Jiangxi also denied or limited separation quotas for some private enterprises.[172]

8.5. Conclusion

This chapter dealt with the strategies that have been pursued by the central government to reorganize the REE industry since 2005 and in particular after 2009. The central government aimed to put control of extraction and separation into the hands of a few leading enterprises, in particular COEs. Although the reorganization of the industry has led to a concentration of production, the chapter found that the provinces managed to fundamentally change the policy according to their interests. The reorganization has without doubt been more successful than

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[168] For example the Association of China Rare Earth Industry (ACREI) publicly listed Baotou Huacheng Rare Earth as an illegal enterprise (ACREI 2013). The enterprise has been an outspoken critic of the reorganization policy. The reason officially given was that Baotou Huacheng Rare Earth had increased its separation capacity from 3,000 t/yr to 8,000 t/yr without official permission. However, 3,000 t/yr is not enough to meet the MIIT's industry accession requirements, but the enterprise did not get official approval for increasing the separation capacity (MIIT 2012b). Under this condition, the enterprise was illegal either way.

[169] These licenses are often given by other cities besides Baotou as many separating enterprises are also located in Huhehaote and Bayan Nao'er city. These cities also have to agree to closing these enterprises down.

[170] "他们有政策，我们有对策" (Xu D 2011, p. 33).

[171] According to the provincial government, this method was not used.

[172] For example, two private enterprises which had quotas of 120t and 80t in 2012 were not given any in the first half of 2013 (Jiangxi Industry and Information Technology Commission 2012b, 2013)

any previous attempt. Several large enterprises now dominate mining and separation. According to MIIT Vice Minister Su Bo, the ten largest enterprises already controlled 99 percent of REE reserves and 61.5 percent of separation capacity in 2013 (Su B 2013).

There have been two conflicts in implementation: the most relevant conflict involved the central government and COEs on the one hand and provinces on the other hand. These conflicts took place within a rather cooperative relationship because the central government and provinces shared the overall strategic goal of reorganizing the industry. The provinces were the main mediators in this reorganization for the central government because they control the issuance and transfer of mining rights. Many provinces used this important position to change the central governments' policy. The provinces have promoted reorganization, but they have put mining under the control of POEs instead of COEs.

In this way, the provinces have forced a strategic readjustment on the part of the central government. The central government has chosen a strategy of flexibility that has left the mediators space to change the policy's thrust. The COEs have entered instead into REE separation, where they faced less resistance from the provinces. The result has been a REE industry split between mining dominated by many POEs and separation dominated by some COEs (YU YF 2010).

The second conflict was between the local governments and private enterprises. Private enterprises have been the main losers in the reorganization, as they have been crowded out of the industry, despite their attempts at resistance. Few could stay within the industry with only low capacities in separation.

9. Resource Conservation and Illegal Mining

9.1. Introduction

This chapter looks at the political measures introduced in China against illegal mining in order to conserve resources.[173] The central government seeks to lower the volume of REE extraction in order to reduce the loss of REE resources. Illegal mining is a widespread practice that undermines the national strategy of resource conservation. There are many legal enterprises which exceed their obligatory extraction targets as well as thousands of mines operating without any mining license. The focus here in particular is on the latter.

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[173] The analysis focuses on illegal mining because it is at the core of the national resource conservation strategy. However, the fight against illegal mining is not the only strategy for resource conservation. Resource efficiency through improvement of production technology, the increase of production costs and REE prices through raising resource taxes, the build-up of strategic stockpiles, price management and trade centers (Meng SS 2012) are other relevant measures. Mining enterprises have to pay resource taxes and mineral compensation fees. Until 2011, the government levied a tax of 0.4 RMB for HREE minerals and 3 RMB for LREE minerals. The Ministry of Finance raised the tax in 2011 to 30 RMB for HREE and 60 RMB for LREE (MOF and General Tax Administration 2011). The resource taxes are generally too low to limit extraction (Lin et al. 2011, p. 102), but the increased REE resource tax is quite high. There are some problems with the resource tax: First, depending on the richness of the raw ore, the actual tax burden can vary markedly among regions (China.com 2013a). Second, while the tax encourages efficiency in the extraction of REE, it leads to mining only rich ores and neglecting poor ones (Lin et al. 2011, p. 102). Third, whereas the taxes reach legal enterprises, illegal miners can evade these taxes, and are thus able to provide REE at low prices. This puts legal enterprises at a disadvantage.
As a further measure, the central government created a strategic stockpile system for REE. In 2007, the State Administration for Material Reserves below the NDRC (国家物资储备局) proposed in a report to create strategic reserves for REE. Baogang already started in 2008 to stockpile REE at the enterprise level (Chen YP 2012a). The State Council set up a public-private stockpile (State Council 2011). The aims are to provide enough REE for future uses if deposits are exhausted and to influence prices through buying REE for the stockpile at times of low prices. Moreover, this is a measure against the outflow of REE from China through export (Chen YP 2012a; Risks and Policy Analysts 2012).

Extraction and separation targets are the central government's primary regulatory instruments to prescribe the specific levels of extraction and separation (see Figure 9–1). Sub-provincial governments are responsible for monitoring and enforcing resource conservation according to these targets. However, some local governments support illegal mining or lack monitoring and enforcement capacities. These local governments and illegal miners essentially pursue a policy of non-conservation. In these areas, targets do not lead to a conservation of resources in practice.

Strategically responding to the problem of non-conservation, the central government initiated several campaigns against illegal mining in 2010. The campaigns intensified on-site investigations and put pressure on local government officials. Yet despite some temporary and local effects, the campaigns could not contain illegal mining. The central government and some local governments reacted to these weak resource conservation efforts with a number of new mediators at the local level with the aim of strengthening monitoring in the long term. However, many problems remain with their introduction.

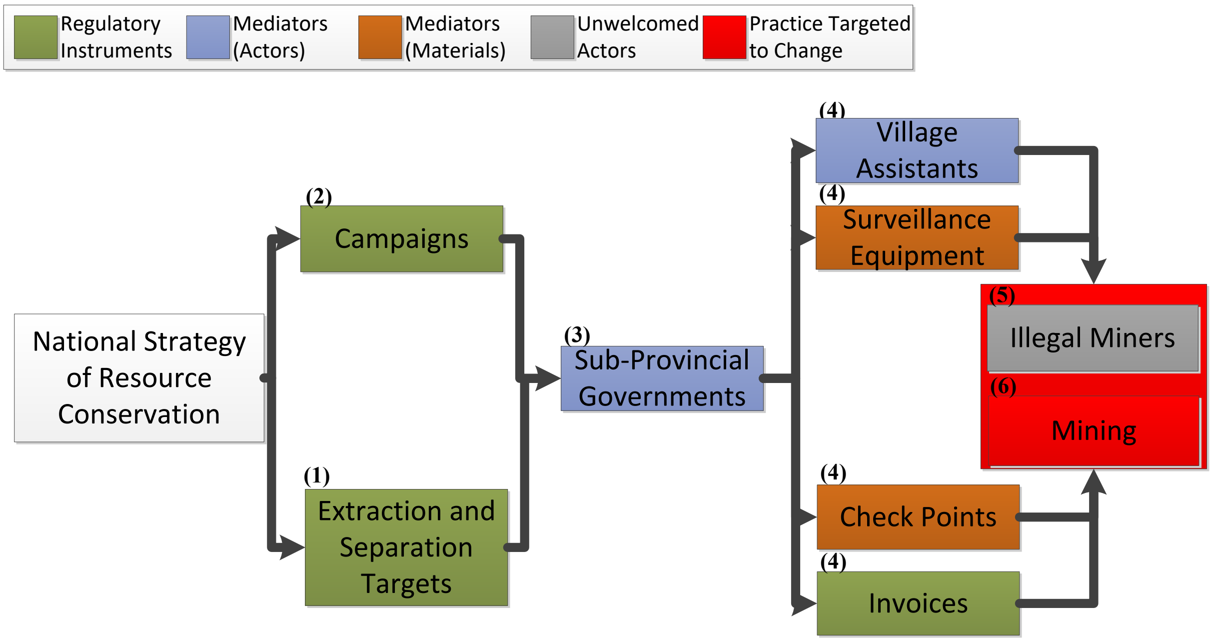

Figure 9–1: Translation process of the central government's strategy to conserve REE resources and purge illegal mining.

The chapter finds that despite massive actions against illegal mining, resource conservation efforts remain weak and the central government has been unable to eliminate illegal mining.

The chapter sets out by outlining the national resource conservation strategy and the national extraction and separation targets established in 2006. It shows that these are ineffective in practice (9.1). The following section then explains the failure of resource conservation until

2010. The main barriers are the resistance and limited capacities of sub-provincial governments and specific material characteristics of the REE deposits (9.2). After this, the chapter turns to the strategic adjustment of the central government through campaigns against illegal mining after 2010 (9.3). As the campaigns could not eliminate illegal mining in the long run, the final section presents attempts to establish new mechanisms for improving monitoring (9.4).

9.2. Strategy for Resource Conservation

9.2.1. Plans for Protected Extraction

The central government fears that China's REE resources could be depleted in the near future and it has therefore attempted to reduce the level of REE extraction. Central government ministries detailed this strategy in 2008 and 2009: the Ministry of Land Resources (MLR) and the Ministry of Industry and Information Technology (MIIT) respectively decided not to exceed an anuual REE extraction of 130,000t to 150,000t up to 2015 (China Mining 2009; MLR 2008a). The annual extraction was about 129,000t in 2009. However, the two ministries set much lower extraction targets than their maximum limit: between 80,000 and 110,000t (see below).

9.2.2. Extraction and Separation Targets

Although the central government only began to tighten its resource conservation strategy in 2005, the State Council had already defined REE as a "special resource for protected extraction"[174] in 1991 (State Council 1991). This definition endowed the central government with exclusive control over planning and managing the extraction of REE. The central government uses annual extraction and separation targets to implement its resource conservation strategy. The Chinese mineral resource laws and regulations[175] specify two

[174] 保护性开采的特种矿种

[175] The Mineral Resources Law stipulates that: "The state carries out planned extraction for national plan mining areas, mining areas with great importance for the national economy and special resources for protected extraction. Without the approval of the related ministries in charge, no unit or individual is allowed to extract the minerals" (国家对国家规划矿区、对国民经济具有重要价值的矿区和国家规定实行保护性开采的特定矿种，实行有计划的开采；未经国务院有关主管部门批准，任何单位和个人不得开采。) (NPC 1996). In addition, a 2009 notification form the Ministry of Land Resources (MLR) further specifies the actions for special resources: "the

mechanisms: the extraction quantity control target and the directive plan (NPC 1996; MLR 2009a). Defining REE as "special resources for protected extraction," the government introduced these instruments for REE management in 1991. However, the government did not make use of them. Only with the beginning of the new REE policy in 2005 did the State Council instruct its ministries to make use of these instruments (State Council 2005a). While the MLR sets the extraction quantity control targets, the MIIT is responsible for the directive plans.

The MLR has defined the annual extraction quantity control target since 2006.[176] It sets a target for the entire country and each province (see Figure 9–*2*). In 2006, the MLR set a national target of 86,200t, increasing this slightly to 93,800t in 2011 and to 105,000t in 2014. Regarding the provincial targets, Inner Mongolia has the largest target – 59,500t in 2014 (57 percent) – while Sichuan had a target of 25,000t (24 percent) and Jiangxi 9,000t (9 percent) in the same year.[177]

exploration and extraction of resources for protected extraction should be carried out according to the principles of a unified plan, quantity controls, appropriate development, and integrated use" (保护性开采的特定矿种的勘查、开采实行统一规划、总量控制、合理开发、综合利用的原则) (MLR 2009a).

[176]开采总量控制指标.

[177] LREE account for 83.1 percent, HREE for 16.9 percent of the national extraction quantity control target.

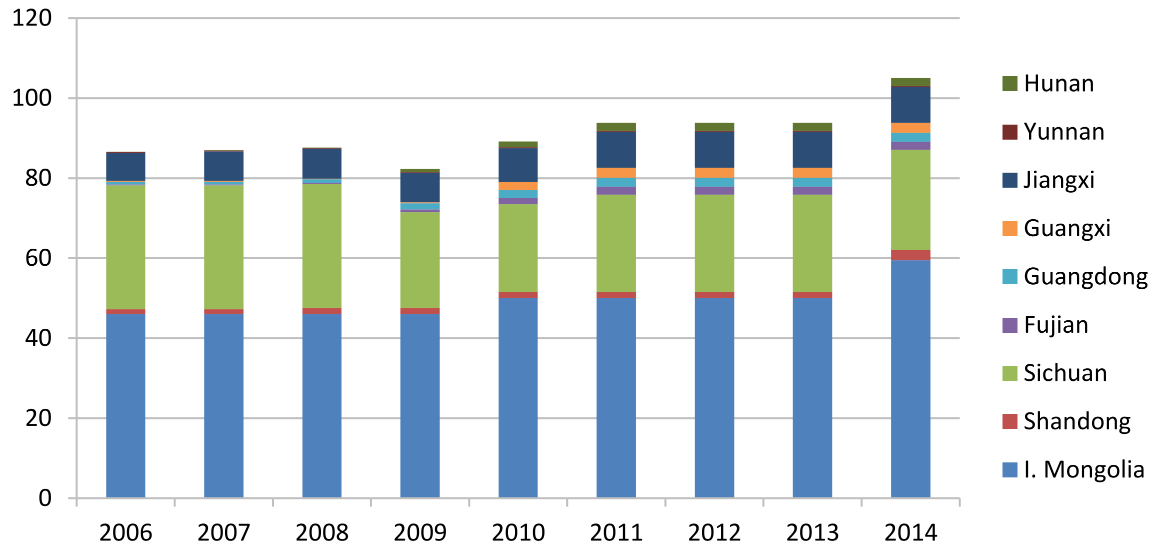

Figure 9–2: Extraction Quantity Control Target by Province from 2006 to 2013 in 1000t. Hunan had quotas for HREE from 2006 to 2008 and for LREE from 2009 to 2013. Guangxi had quotas for HREE from 2006 to 2009 and for LREE from 2010 to 2013. Source: MLR 2006, 2007, 2009b, 2010f, 2011a, 2013a, 2013b, 2014, Wang LQ 2012. The provincial shares of 2008 have been estimated by the author.

In addition to targets for extraction, the MIIT's directive plan also sets targets for separation (see Figure 9–3). The national targets are divided into provincial sub-targets (MIIT 2012f).

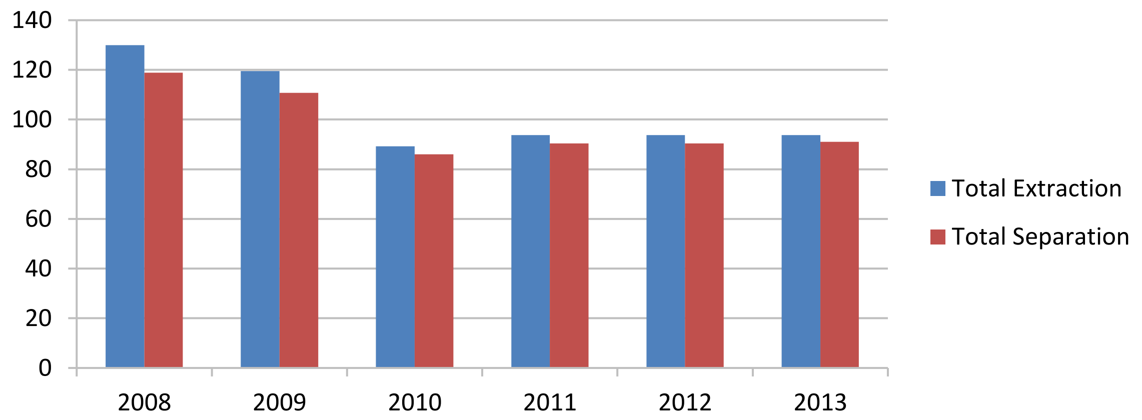

Figure 9–3: National directive plan targets for extraction and separation in thousand tons. Source: People's Daily 2009, MIIT 2009b, 2010c, 2011a, 2013b.

The implementation of the national target relies on the mediation of the provinces. Based on the provincial targets, the provinces again formulate mine- and enterprise-specific targets.[178] The provincial governments moreover sign responsibility contracts[179] with enterprises that hold them accountable for compliance with the targets (Guangxi Province 2013b).[180]

9.2.3. Ineffective Targets

The extraction quantity control target and the directive plan have been ineffective in practice. As Figure 9–4 shows, the national statistics indicate that extraction exceeded the extraction quantity control target by 40 to 60 percent between 2006 and 2009 (USGS 2007, 2008, 2009, 2010, MLR 2007, 2009b, 2010f). Whereas Chinese data suggests that since 2010 extraction levels have matched the targets, extraction is still slightly higher than the target according to US data. The enormous discrepancy between actual production and the official targets between 2006 and 2009 suggests that the targets had no effect whatsoever. Even central government-owned enterprises such as Minmetals significantly exceeded their assigned target by 3,400t in 2011, i.e. by 76 percent of the individual enterprise target (People's Daily 2013).

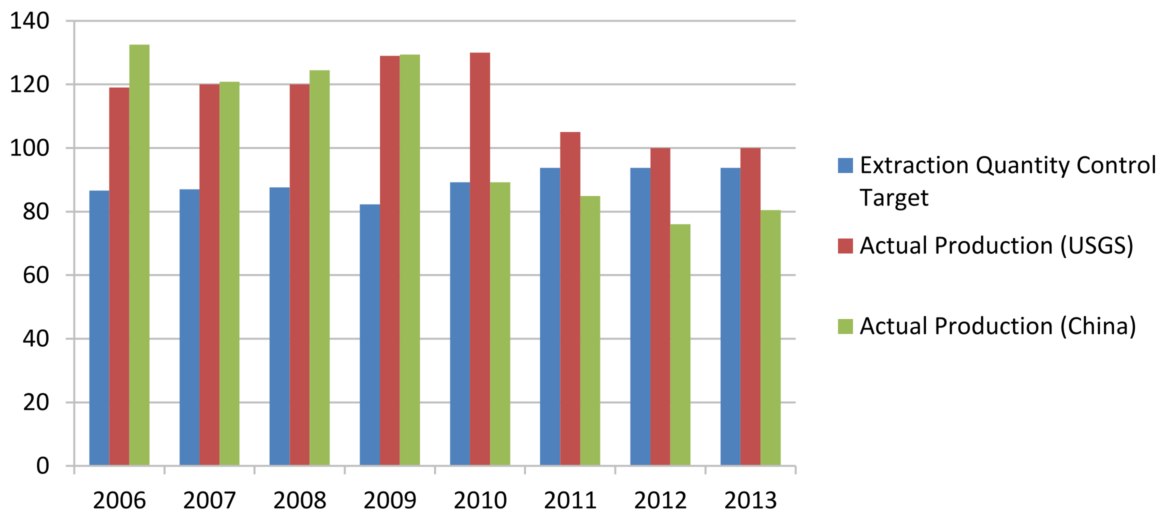

Figure 9–4: Extraction quantity control targets compared to actual extraction by USGS and

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[178] Not all provinces make full use of their targets. For example, Yunnan used 120t of 200t (Yunan Province 2012). Moreover, the targets include recycling of processing scrap. Guangxi assigned 74 percent of the provincial target to recycling enterprises (Guangxi Province 2013a).

[179] 责任状

[180] According to the contracts signed in Guangxi, non-compliance with the rules of the contract can be pursued under the Mineral Resources Law and criminal law (Guangxi Province 2013b; see also Ruidow Web 2011).

Chinese data. Source: as per figure 9-2 and USGS 2007, 2008, 2009, 2010, 2012, 2013a.

Beyond the overproduction reflected in official data (MLR 2009a, MIIT 2008), there is a lot of illegal extraction and separation which is not reflected in the statistics. This suggests that even for the years after 2010, actual extraction was much higher than the extraction quantity control targets.

One reason for the weak implementation of the extraction target was a disagreement between the MIIT and MLR over the exact target. The MIIT's directive plan set the extraction target at 130,000t for 2008, whereas the MLR set a target of 87,620t, a gap of more than 40,000t. This is a huge difference, accounting for nearly one-third of official extraction. Provinces and enterprises were unclear about which target they should use. After 2010, the two ministries settled the disagreement and set congruent targets (MLR 2010b; MIIT 2010c).

9.3. Resistance to Resource Conservation

9.3.1. Monitoring, Enforcement and Illegal Mining

The extraction and separation caps require extensive monitoring and enforcement. As REE reserves are spread all over the country, the central government is unable to carry out these activities. The regular inspection tours of the MIIT and MLR can monitor only a small share of mining. The central government thus delegates to the cities and counties the implementation of the resource conservation strategy, monitoring, and enforcement against illegal mining (MLR 2009a).[181]

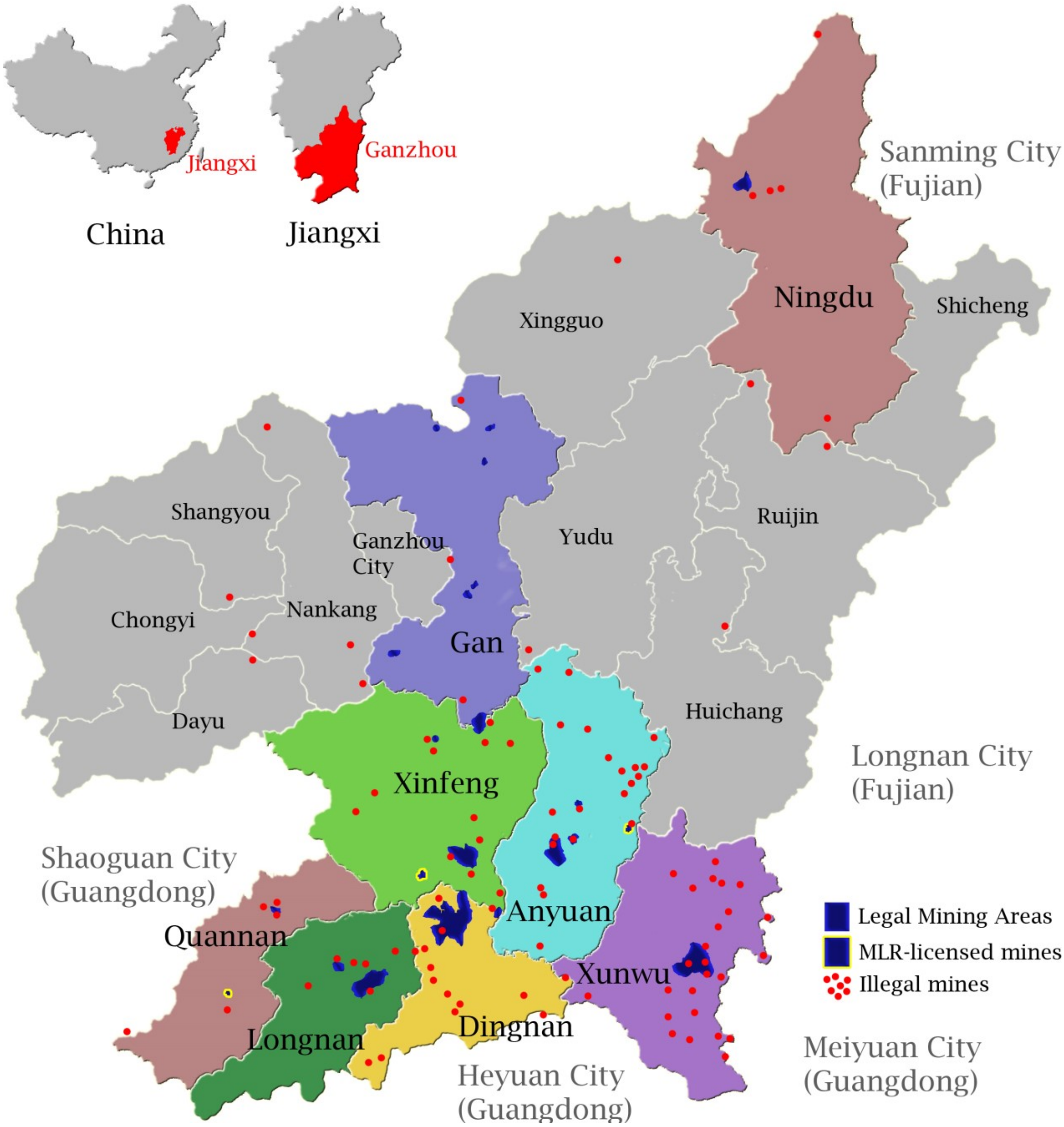
In practice, before 2010 the monitoring and enforcement system was largely ineffective. The most persistent problem for resource conservation has been widespread illegal mining.[182] Illegal mining takes place all across China's REE deposits, but it is most common in southern China. In 2012, the extent of illegal mining was estimated at 40,000t (China.com 2013b). In Jiangxi, total extraction ranged from between 30,000t and 50,000t in 2011, well above the provincial cap of 9000t (Liu FB 2011, Yang WG 2011). In some mining areas there are

[181] 执法检察队

[182] Illegal mining is mining without mining rights or beyond individual production targets. There are more aspects of illegal mining not considered here: use of outdated technology, lack of environmental and safety licenses, and illegal occupation of land (MIIT 2010c).

hundreds of small illegal mines.[183] Map 9–1 shows the extent of illegal mining in Ganzhou city (Jiangxi), one of China's largest REE mining areas. The illegal operations are spread over the entire city area, some located in and around areas with licensed mines, but more are beyond these areas. In particular the REE-rich counties in the south of Ganzhou city, namely Longnan, Dingnan, Xunwu, Quannan and Gan, experience a lot of illegal mining.

[183] A survey of Meizhou city in Guangdong revealed about 200 illegal mining operations in the city area (REI 2007b).



Map 9–1: Legal (province-licensed and MLR-licensed mines) and illegal REE extraction in Ganzhou city and its counties (author's illustration).[184]

[184] The location of illegal mining spots is approximate as only the villages where such activities have been reported in the press are indicated. Exact mining sights are not always known. There are certainly many more illegal mining activities than shown here. The data was collected by searching on www.google.com for "County/Town/Township Name" "非法稀土 村". The legal mining areas are obtained from Jiangxi 2013.

9.3.2. Material Barriers and the Resistance of Illegal Miners

Material factors play an important role in REE industry policy. They make monitoring more difficult and facilitate small-scale mining: First, the mining areas are mostly located in remote and inaccessible villages in mountainous terrain. The deposits extend over vast areas. In REE-rich regions in southern China, nearly every hill contains valuable REE. This terrain gives illegal miners the opportunity to find ideal hideouts for mining REE and the central and local governments have to make enormous efforts to trace them (Liu FB 2011).185

Second, the costs of extracting REE in southern China as well as costs of machines, pipes, chemicals and labor for mining are very low while profits are high.[186] High REE prices spurred illegal mining, especially during the period of particularly high prices in 2011 and 2012.[187] The necessary knowledge for mining the REE deposits is rather unsophisticated. This enables many people to mine REE, including nearby villagers (Li XT et al. 2010; Liu FB 2011). One local enterprise manager in Jiangxi said in 2011:

> you just load some earth on a truck, bring it to a hidden pond, use some ammonium sulphate in a liquid bath, and add some oxalic acid – that's it. Some miners

[185] Due to these material conditions, many cities which do not even have legal mining rights face huge problems with illegal REE mining, such as Yingde city (Qingyuan city) and Shanwei city in Guangdong.

[186] In Guangdong, the cost in 2010 of producing one ton of REE was 21,000 RMB; one ton could be sold for 110,000 RMB. One mining spot could earn 3 million RMB per month (Li XT et al. 2010).

[187] An enterprise manager said: "Many private [e.g. illegal] miners are driven by the rare earth price explosion of 10 times this year [2011]. You just arrange a car and you can earn some million Renminbi and you do not need to work anymore for your whole life. Even if you are caught, you could not be arrested for more than one or two years. You just gamble one time and you will have good times for the rest of your life. You have to be courageous as a private miner" (Liu FB 2011) (今年稀土产品价格成 10 倍暴涨的行情，正是大多数私采者私挖滥采的动力所在。弄一车稀土甚至能赚好几百万元，一辈子就什么都不必干了。要是搞砸了，大不了被关一两年。赌一把，就能有一辈子的好日子，私采者的胆子没法不大。) In Xinfeng county, illegal miners can earn 3000 to 4000 RMB a day when prices are high. However, when prices are low, there is less illegal mining: "if the price is too low, nobody needs to investigate. Everybody left" (Interview with Illegal Miner in Xinfeng county, 2013/8/2.).

directly leach the soil in petroleum cans in their cars, driving and producing at the same time. This "mobile factory" is even more hidden (Liu FB 2011).[188]

Third, it is enough to extract small amounts of REE to generate high revenues. It is relatively easy to smuggle these small amounts out of the mining areas without attracting the attention of the enforcement teams (Li XT et al. 2010).

9.3.3. Insufficiency of Local Governments' Human, Material and Legal Capacities

In many cases, local governments lack the human and material resources to monitor the huge and remote mining areas and enforce national strategy. The understaffed and underequipped Land Resource Bureaus (LRBs) of the local governments deal with all kind of land-related issues in addition to mining. In the county LRBs, about five to six people equipped with one to two cars are generally responsible for an average area of 2,000 km,^{2} which is often mountainous and difficult to access (Wu WS 2011, p. 186).[189]

Moreover, the LRBs have only limited competences to prosecute illegal miners. Criminal law and the Mineral Resources Law do allow the prosecution of individuals engaged in illegal mining (NPC 1997).[190] However, it is often difficult for LRBs to enforce the law, because they

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[188] 只要进山装上一车土，拉到隐蔽的池子内，用硫酸铵液体浸泡、加草酸过滤就成了。有的矿主干脆在汽车上用汽油桶装土浸取，边开边生产，成了'流动车间'，更隐蔽了。

[189] For example, the REE-rich Longnan county (Ganzhou city, Jiangxi) has an area of 1641 km^2 and Xunwu county (Ganzhou) 2311 km^2. The government of Ganzhou city employs 174 land resource law enforcers at the county level (Ganzhou 2007). This averages to about ten people per county, who deal with all kinds of illegal land activities.

[190] Article 343 of the criminal law stipulates that "Whoever, in violation of the provisions of the Mineral Resources Law, mines without a mining license, enters and mines in a mining area that is embraced in State plans or a mining area that is of great value to the national economy or another person's mining area, or mines specified minerals of which protective mining is prescribed by the State, if he refuses to stop mining after being ordered to do so, thus damaging the mineral resources, shall be sentenced to fixed-term imprisonment of not more than three years, criminal detention or public surveillance and shall also, or shall only, be fined; if severe damage is caused to mineral resources, he shall be sentenced to fixed-term imprisonment of not less than three years but not more than seven years and shall also be fined." (NPC 1997).

normally do not have the right to arrest people (Li J 2011; Xinhua 2010b).[191] If the LRBs want to prosecute illegal miners, they have to file a criminal case with the prosecution authorities, the police and the courts, and this is difficult. Witnesses often refuse to testify against the suspects due to fear of violence (Qi QS 2008; Jiang HY 2013). Moreover, the penalty for illegal mining is rather lenient, and litigation is costly and time-consuming (Saich 2011, p. 162).[192]

9.3.4. Resistance by Local Governments

While monitoring and enforcement fail due to material impediments and lack of local capacities, they also fail due to the resistance of some local governments. Local governments generally have an interest in increasing REE extraction in order to benefit local development and increase tax revenues. They are critical of the caps on extraction. In particular, the local governments and industry in Jiangxi province raised serious concerns that the national resource conservation strategy curbs the development of the local REE industry (Yang LQ and Wang KT 2012; Zhou Z 2013b; Stock City Web 2013; Zhong GD 2013a).

This is a big incentive for local governments to ignore their monitoring and enforcement responsibilities. The central government has a very limited capacity to monitor the adequate implementation of its resource conservation strategy by local governments. Although the city, county and township LRBs receive orders from the MLR, they are also responsible to and financially dependent on their local governments. Their supervision is only as strong as the local governments' commitment to fighting illegal mining (Yang LQ and Wang KT 2012).

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[191] According to a land resource enforcement official from the Mining Management Bureau of Xinfeng county, they might only be allowed to prosecute people if the occupied area is more than 10 mu. However, in many cases it is not practical to assess the size of the scene and thus they cannot arrest people (Li J 2011).

[192] The monetary penalty is rather low compared to the potential profits in the REE industry. In one case, illegal miners were punished with two to three years in prison and a monetary penalty of 100,000 RMB (Zeng Y 2013). The criminal law and interpretations of the High People's Court set a maximum penalty of three years for mining without license and destruction of resources; and up to seven years in case of severe destruction of resources (High People's Court 2003). Moreover, prosecution is costly. Due to the many small mines, the LRBs have to file numerous cases in the county courts. As the cases require expert opinions proving the illegality of the operations, these cases are quite expensive. In Fengshun county (丰顺) (Meizhou city, Guangdong), a case costs about 20,000 RMB. In 2007, there were 51 mining-related lawsuits costing about 1 million RMB in total, which is a huge sum for a poor county (REI 2007b). It is also possible for local cadres to override court decisions through the influence of the Party on the judicial system (Saich 2011, p. 162).

Some local governments are willing to attract and actively engage in illegal mining activities. A vice head of Pingyuan county (Guigang city, Guangxi) said of an illegal REE project that affected the health of the local population:

> If we do not attract enterprises we do not have tax income. We also discussed how many million RMB in tax we will get from the…rare earth project…This could of course lead to some shortcomings as we considered more the interests of enterprises when inviting new investment and did not consider the interests of people living nearby enough[193] (CCTV 2013).

These local governments operate large "protection umbrellas" (保护伞) to cover the illegal activities. The governmental-entrepreneurial networks can extend through all levels of government from village heads, to township and towns, to counties and cities.[194] Village heads are very often involved in the illegal lending of land to REE miners (Yang WG 2011).[195]

193 "地方没有企业进来，那我们这个税源就没有。我们也考虑到了…稀土的这么一个规模我们每年有几百万税的…有时候考虑问题还是有写欠缺，比如我们招商引资搞企业进来者可能单方面考虑企业利益多一些，没有考虑到旁边群众利益多一些"

194 Local cadres are often directly involved in the mining activities, through mining personally or shares in illegal mining enterprises. Investigations by the city government of Shanwei (Guangdong) and subordinate city and county disciplinary inspection organs discovered four protection umbrellas, prosecuting 23 local cadres for their participation in illegal REE mining (Hong XY 2012). The following positions have been involved in these local networks: 1. village chiefs and village cadres responsible for land and forests; 2. township officials from LRBs, environmental offices, forest and construction offices as well as township vice-heads; and, 3. officials at the county or city level. In Xinyi city (Maoming city, Guangdong) two city officials were prosecuted for involvement in illegal REE mining networks (Mao YZ and Kong B 2011). A village cadre in Meizhou city (Guangdong), who once engaged in REE mining, said that county officials are likely to be involved: "before, if one discovered and reported illegal mines to the township and county, this was without any result, because a lot of leading cadres were involved" (以前发现有人开采稀土矿，报告到镇里县里，结果都不了了之，根本原因是很多领导干部参与其中) (REI 2007b).

195 For example, Huangtang village in Beitou town, Quannan county (Ganzhou), lent 500 mu land for 450 RMB per mu for 10 years. Xingxing village lent land for 500 to 1000 RMB per mu for 5 to 10 years (Yang WG 2011) (Mu is a Chinese square measure; 1 mu = 667m^2).

9.4. Strategic Adjustment through Campaigns

9.4.1. Campaigns

Responding to weak resource conservation, the central government readjusted its strategy in 2010: it launched several campaigns against illegal REE mining (MLR 2010c; MIIT 2011b).[196] Campaigns are a common feature of Chinese politics, concentrating massive human and material resources on one particular issue within a short period of time. They are like an emergency mode of doing politics. As campaigns bring in a number of new mediators, it is riskier for local cadres and miners to engage in illegal mining.

Both the MLR and MIIT initiated campaigns. The MLR initiated a “special rectification action”[197] from June to November 2010 (MLR 2010c),[198] while the MIIT’s campaign from August to December 2011 mobilized more ministries, including the Ministry of Supervision, the Ministry of Environmental Protection, the Tax Administration, and the State Administration for Industry and Commerce (MIIT 2011b). In 2012 and 2013, the MIIT launched a second and third phase of the campaign (MIIT 2012g; 2013c).

The MIIT, the MLR and related ministries carried out their own inspection tours.[199] However, the national and provincial inspections can concentrate only on a few large cases and cover only a very limited share of the activities necessary (China.com 2012). Therefore, the implementation of the campaigns relied on the sub-provincial governments as mediators. Based on the national and provincial instructions, city governments defined a range of policies and action catalogues determining the campaign strategy and responsibilities at the county level. Whereas the city government of Ganzhou coordinated and supervised the campaigns, the

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[196] The national, provincial and city government carried out REE campaigns before 2010, for example Meizhou city did so in 2007, Ganzhou city in 2009, Sichuan in 2007, and the central government has done so since 2005, but with limited success. However, the campaign after 2010 was much more extensive (Meizhou City 2007)

[197] 专题整治行动

[198] Following the MLR’s campaign, 15 southern Chinese cities formulated a “joint action plan” to implement the campaign and improve inter-city coordination (MLR 2010d).

[199] In 2012, the MIIT inspection team investigated and closed six illegal separation factories in northern China with a capacity of 20,000t REO/yr. Central government ministries moreover supervise local governments and their efforts (China.com 2012).

counties organized and carried out the concrete actions in cooperation with officials from towns, townships, and villages (Jiangxi 2011).

9.4.2. Introduction of New Mediators

The MIIT and MLR campaigns introduced a number of new mediating actors and instruments that are not available under normal conditions of policymaking and changed existing mediators so as to enhance policy implementation. These new mediators were aimed at improving the implementation of resource conservation and reducing the ability of mediating actors to change policy.

Punishment of Officials

First, as administrative evaluation and punishment has been weak under normal conditions, the campaigns tightened control over local cadres. The central government made general propositions for new, stricter accountability for local cadres. The cities and counties implemented these propositions into accountability and evaluation systems for mining policy (MLR 2010c).

The government of Ganzhou city and county governments established accountability contracts with the town/township and village cadres. The contracts determined punishments if the cadres failed to eliminate illegal mining in their town/township or village. Ganzhou city also established a system to evaluate the success of activities against illegal mining and to punish counties with recurring incidents of illegal mining (Li XC and Lu JH 2013; Xinfeng County 2010; Ganzhou 2012a).[200]

[200] For example, the township cadres of Nanqiao town (南桥, in Xunwu county, Ganzhou city) signed a public promise that they are not involved directly or through relatives in illegal REE mining (Xunwu Online 2011a). The regulations, such as those of Ganzhou city and Dingnan county (Ganzhou), mention only the unspecific consequence that cadres will be held accountable (问责) if an illegal mine is discovered in their area for a second time (Ganzhou 2012b, Dingnan County 2012). The plans of Fengshun county (丰顺) (Meizhou city, Canton) define more specific consequences: the first time an illegal mine is discovered, disciplinary actions (处分) are taken against the township head and secretary; the second time hard disciplinary actions are taken. The third time both get fired (REI 2007b). There are more examples of measures at the county level. Longyan city (Fujian) has a more relaxed punishment level: township heads are fired only after a fifth illegal mine is discovered. If no illegal mine is discovered, a township receives a 200,000 RMB reward with a 30 percent share for the leading cadres. Diaofeng township (钓峰乡) (Ningdu city, Ganzhou city) even established a collective punishment system. Villages with several occurrences of illegal mining activities have to pay a penalty between 5,000 RMB and 10,000 RMB (Diaofeng Town 2012).

Inter-Departmental Cooperation

Second, the campaigns strengthen cooperation among ministries at the central level and between the respective departments at the local levels. This increases the efficacy of the actions against illegal mining. Jiangxi province and many sub-provincial governments established Leading Small Groups that have coordinated between the ministries (Jiangxi Province 2011; Ganzhou 2012c).[201] In the case of Gan county in Ganzhou city, the campaign involved the LBR, the bureaus of safety, environmental protection, water, forest, commerce, industry and information, local subsidiaries of the Ganzhou Rare Earth Group (GZRE), the police, and related town/township cadres (Gan County 2011). To compensate for the weak enforcement competences of the LBRs as well as the local branches of the MIIT, it was very important that the police participate in the campaign.

Investigation Visits

Third, the central feature of the campaigns has been the enormous intensification of on-site investigations which check if mining activities are legal. The counties planned and carried out investigation tours together with the town, township, and village cadres (REI 2012b). During the campaign in 2010, counties in Ganzhou carried out 754 investigations (MLR 2011b).

The investigation visits exerted physical force against illegal mines. The aim was to make it more difficult for illegal miners to resume their operations after the enforcement team had left: the enforcement teams were tasked with arresting people, destroying equipment, tearing down work sheds and destroying leaching ponds. Moreover, the teams were to cut electricity lines and water pipelines, demolish or confiscate generators, pumps, compressors and mills (Gan County 2011, Xunwu Online 2011b).[202]

Human, Material and Monetary Resources

Fourth, under normal conditions, monitoring and enforcement lack human and material resources. Campaigns concentrate massive resources in order to make intensive investigations

[201] Jiangxi province established the "Coordination Leading Group for REE and Tungsten Resources Rectification" (全省稀土钨矿资源整治协调领导小组) and Ganzhou city the "Working Leading Group for Consolidation and Standardization of Mineral Resource Development" (整顿和规范矿产资源开发秩序工作领导小组) and the "Rare Earth Mines United Enforcement Office" (市稀土矿山联合执法办公室) (Jiangxi 2011; Ganzhou 2012d). County and town/township governments created similar leading groups and coordination mechanisms (Longan County in 2011; Hushan Township in 2010; Anyuan County in 2011, and Dongshan Township in 2011).

[202] The Campaign in Maoniuping village (Mianning county, Liangshan Autonomous Prefecture, Sichuan) in 2007 confiscated weapons, munitions, knives, and grenades (Zhao L 2010).

possible. For instance, more than 3000 people participated in the campaign in Ganzhou and 1100 people in Heyuan city (Guangdong) in 2010 (MLR 2011b; Ye Q 2010).

The campaigns consume substantial financial resources. Ganzhou city commanded its counties to provide 100,000 RMB annually to each of the involved towns and townships in order to support them carrying out the inspections (Ganzhou 2012a). Some cities also provided the local enforcement teams with special cars made available for the entirety of the day to allow for fast reactions (Ruijin City 2012).

Propaganda and Public Attention

Fifth, the campaigns also released mass propaganda to make the campaigns public and to exert pressure on illegal miners. The local governments used many different ways to communicate the aims and achievements of the campaigns. In particular the publication of successful cases in the press was a popular method (MLR 2010c).[203]

The propaganda also gained the attention of local villagers. Villagers know best about the illegal mining activities in their villages, but lack ways to quickly report illegal mining to the government. Many county governments and the Association of China Rare Earth Industry (ACREI) set up 24-hour hotlines and post boxes for reporting illegal activities. Some people used the Association's reporting system, although it is unclear to what degree this helps fight illegal mining.[204] Several city and county governments also provide monetary rewards to people reporting illegal activities (Zeng Y 2013).[205]

Production Stops

Sixth, some governments also ordered production stops in all local mining areas in order to better identify illegal mining activities.[206] Ganzhou city fully halted REE production in the

[203] Xinfeng county (Ganzhou) publicized its campaign via the following media: issuing copies of the action plan in towns, townships, and villages; online publications; use of propaganda cars; permanent placards; banners; and television (Xinfeng County 2010)

[204] People used the reporting system nine times in Xinfeng county (Ganzhou) in 2010 (Xinfeng County 2010). The ACREI had received 31 calls as of mid-2012 (China.com 2011).

[205] Xunwu county (Ganzhou), for instance, grants 20 percent of the value of confiscated material and equipment or 2000 to 5000 RMB if nothing is confiscated to the whistleblower (Xunwu County 2012). This can be a very valuable reward if REE are confiscated. Longyan city (Fujian) promises rewards of 2000 RMB to 3000 RMB (Longyan City 2012).

[206] Some enterprises also announced production stops. Since 2010, Ganzhou Rare Earth Group, Baogang, Chinalco and Minmetals have announced month-long production stops. They did so when they reached their maximum extraction or separation targets and to drive up REE prices. (Yang Y and Ren HB 2011).

REE mining areas of Ningdu, Xinfeng, and Ganxian in 2011 for at least two years. During the campaign in August 2011, the Ganzhou city government shut down REE production in the entire city (Caijing 2011; Hu FJ 2013).

9.4.3. Renewed Resistance

The campaigns have been very effective in fighting illegal mining in certain areas at certain times: the Rare Earth White Paper concluded in 2012 that the LRBs investigated 600 cases of illegal exploration and mining (State Council 2012a). However, there have also been several difficulties. The long-term effect of campaigns in general is doubtful:[207] illegal mining in China was still at a very high level in 2012, estimated at about 40,000t (China.com 2013b). MIIT Vice Minister Su Bo said in May 2013: "Illegal REE mining…and black market trade and smuggling still persist"[208] (Su B 2013).

First, the massive mobilization of financial, human, and material resources during the campaigns can endure only for a short period and can concentrate only on a few areas. The campaigns take a lot of people away from other tasks, but the effect is limited.[209] A land resource official from Yingde city (Qingyuan city, Guangdong) said about the illegal mines: "They are too many. We cannot hold down this tendency of illegal mining" (Li XT et al. 2010).[210] Whereas the campaigners concentrate on one area, they neglect other areas, where illegal mining then flourishes (Li XT et al. 2010).[211]

Second, illegal miners developed renewed resistance against government control. Before the campaigns against illegal mining, it was common in Ganzhou to openly mine illegally along the major roads. Since the beginning of the recent campaigns, illegal miners have moved further

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[207] A survey among 45 mining enterprises and LRBs found that more than two-thirds see campaigns in general only as a temporary measure with limited effect, while a minority said campaigns could solve the problems (Wu WS 2011, p. 170).

[208]稀土非法开采…黑市交易、出口走私等现象还存在.

[209] In Maoniuping (Mianning, Sichuan), nearly 1400 people were required to investigate 15 places and arrest nearly 100 people (Zhao L 2010). In Heyuan city (Guangdong), 1100 people closed 12 mining places and arrested 2 people (China.com 2011).

[210] 太多了！非法盗采的势头按都按不下去.

[211] For example, the 2010 efforts in Yingde city (Qingyuan City, Guangdong) concentrated in particular on Baisha town, but less on Donghua town. A villager complaining about illegal mining in Donghua town said: "There are investigations without cease in Baisha and that is not enough, but here [in Donghua] nobody cares at all" (白沙那里是天天在整治也没整治好, 我们这里完全没人管) (Li XT et al. 2010).

into remote mountain areas. Some obtained mining licenses for minerals such as Kaolin or pretended to recycle waste materials from previous mining, but in fact extracted REE (Yang WG 2011). Investigating hidden mines in remote areas required much more extensive efforts. Moreover, even when the enforcement teams arrested people, it was difficult to catch the men pulling the strings (Xinhua Zongheng 2010; Xinhua 2010b).

Third, although inspections destroyed equipment and confiscated REE, many mines reopened after a certain time. During the campaigns, some mines pretended to be closed down but resumed production later on. One illegal miner said: "there is too much to investigate. Once they [the law enforcers] are gone, we will reopen again."[212] Law enforcement teams had to inspect some places several times before they were finally able to wipe out illegal activities.

Fourth, the accountability system to increase the cooperation of local cadres has not met the expectations of the central government. There were only a few reports about village heads being held accountable for their involvement in illegal mining. Therefore, the campaign could still to only a limited degree deal with resistance from local governments which have supported illegal mining (Li XL 2016). With President Xi Jinping's increased efforts against corrupt cadres, the new phase of the campaign in 2013 put more emphasis on punishing uncooperative local cadres (China.com 2013b).[213]

9.5. Long-Term Strategic Adjustment

As the limited long-term effect of campaigns was obvious, the central government discussed the construction of mechanisms to improve monitoring and enforcement in the long run (Chen YP 2012b). It sought to introduce new mediators that could sustain the strategic readjustment beyond the temporary campaigns. These have mostly taken the form of new mediators which have been installed at the sub-provincial level: village monitoring assistants, checkpoints, surveillance technology and special tax invoices.

[212]查不过来,他走，我们开 (Interview with illegal miner in Xinfeng county, 2013/8/2).

[213] There are signs that the campaign of 2013 held more cadres to account. For example, the disciplinary committees arrested the Party secretary of Anyuan county for involvement in illegal mining in 2013 (Sina.com 2014).

9.5.1. Village Monitoring Assistants and Mine Protection Teams

The MLR decided in 2010 to strengthen monitoring capacities at the village level, until then something of a blind spot for monitoring. According to the MLR plans, village monitoring assistants (协管员) would do everyday inspections in the mining areas, take up suggestions and concerns from villagers and regularly report to the towns/townships, which in turn would report to the county. According to the city of Ganzhou, each village with large REE deposits should have two to three assistants (Ganzhou 2012c; MLR 2010e).[214]

By 2011, the counties of Ganzhou city had employed nearly 800 assistants (Zeng Y 2013). These many new monitoring officials certainly strengthen the work of the enforcement teams, although it is premature to assess the effects of this system. There could also be problems. For instance, some counties decided that assistants should be village cadres or rangers (Xunwu County 2013). While these persons are familiar with the areas, they might also support or be involved in illegal mining.

A further trend is the construction of mountain police stations and the formation of "mine protection teams."[215] Mianning (Liangshan autonomous prefecture, Sichuan) deployed approximately one hundred soldiers in order to ensure the legality of mining operations in Maoniuping (Zhao L 2010, p. 33, Sha MX and Zhao TW 2007). A township in Fujian set up a mine protection team of 20 people (Wenheng township 2011). Ganzhou city decided that each subsidiary of the GZRE should build their own protection teams (Ganzhou 2010). However, while these teams help to eliminate illegal mining, they might not necessarily restrict their activities to protecting the resources. There are examples of private protection teams attacking villagers protesting against the impact of mining (New Ease Blog 2011; Dahe Net 2011).[216]

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[214] The villages and towns/townships propose and the county and city governments approve the assistants. The county then employs and examines the work of the assistant once a year. In order to avoid the development of too close a connection with local miners, the assistant's contract is limited to three years.

[215] 护矿队

[216] For instance, a private enterprise illegally extracting tungsten used its private mine protection team to assault and threaten local protesters, while no county, city, or province police or officials came to the help of these people (New Ease Blog 2011, Dahe Net 2011).

9.5.2. Checkpoints

Many county governments established checkpoints along the major exit roads of the mining areas in connection with other controls of material flows.[217] The checkpoints examine all incoming and outgoing transports of REE and materials such as ammonia, which are used in REE leaching. Only trucks with a transportation license for REE are allowed to pass. Transports leaving the area have to apply to the county enforcement team to do so and are escorted by police. The REE have to be transferred to a storage facility defined by the county enforcement team (Xunwu County 2013).

These checkpoints allow for better control of local resource flows. However, they also open up new opportunities for corruption among checkpoint personnel. The checkpoint system in Longnan county (Ganzhou), for example, was struck by a corruption scandal involving thirty people.[218] Another problem is that checkpoints are located on the main roads, but illegal miners can still smuggle REE out via small roads. Moreover, it is difficult for the checkpoints to control the purchase and transport of ammonium nitrate, which is necessary for REE extraction, since farmers use the substance as a fertilizer (Zou LP et al. 2008).

9.5.3. Surveillance Technology

The central and local governments also started to use surveillance technology such as cameras and satellites to improve monitoring. The MLR selected two REE-rich areas in Longnan county (Ganzhou) and Xinfeng county (Shaoguan city, Guangzhou) as pilot projects in 2012 (MLR 2011c): video cameras observe a large remote area with much less need for

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[217] An example of a complete system of monitoring and controlling resource flows is Xunwu county in Ganzhou city: Xunwu county partly delegates the task of monitoring mining to the local Xunwu Mining Company (XMC, 寻乌矿业公司), a subsidiary of the city-owned Ganzhou Rare Earth Group. The XMC should deploy an inspector at each mine to observe the situation 24 hours a day. The inspector is responsible for examining the leaching ponds and keeping account of the milled REE. The system aims to control bottlenecks of resource production and transportation. The approvals of production are translated into materially necessary actions: mine operators who produce for XMC have to apply with XMC and the county enforcement team to unlock and using mills, which are necessary for milling the REE. Thereby, illegal production becomes materially impossible and the strategy of resource conservation is translated into the unlocking of the mill. The illegal miners could still illegally operate their own mills, but these are easier to discover than illegally extracted REE (Xunwu County 2013).

[218] These took bribes for letting trucks with illegal REE freight pass. The bribes were about 1300 to 1500 RMB per truck (Zou LP et al. 2008).

human resources.[219] Despite their effectiveness in the monitored areas, these projects are very expensive (CRE 2013).[220] Due to the high up-front costs, it would be difficult to install these systems in all REE mining areas. Compared to the 100 km^2 currently covered by cameras in Longnan, the entire REE-rich area in Ganzhou is 6000 km^2. The MLR also uses high resolution satellite images to detect illegal mining activities (MLR 2010f). As the leaching activities destroy large areas of vegetation, these activities can be identified from satellite images.[221]

9.5.4. Special Tax Invoices

The State Administration of Taxation introduced special value-added tax invoices for the REE industry in 2012 (SAT 2012).[222] According to Jia Yinsong, head of the MIIT Rare Earth Office, the special invoice system should improve the supervision of the industry and make it impossible for illegal miners to trade in REE (Nezoy 2012; Zhang GD 2012).

The idea is to issue the special invoices only to those enterprises that are allowed to mine REE. The invoices are registered through special software and transmitted electronically to the local tax authorities.[223] The special invoices identify the source of REE materials. When selling their REE to the processing and separation factories, miners need to provide the special invoice to the buyer. As illegal miners cannot do so, they cannot sell their material (SAT 2012).

The local governments have been responsible for introducing the invoice system in their jurisdictions. Baotou city only started to issue special invoices in March 2013. The progress of the system's implementation varies by province and city (Hu YJ 2013). One problem that has been reported is that illegal REE miners were able to obtain special invoices because the local tax administration only checked for the enterprise's business license and not for mining rights and environmental permissions. In this way, the special invoices gave illegal enterprises a legal cloak (People's Daily 2012b).

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[219] Longnan installed 22 cameras able to observe an area of 100 km^2. The detailed cameras can film the license plates of cars and capture peoples' appearances. A remote control center observes the filmed data 24 hours a day (Xinyi LRB 2013a, 2013b).

[220] The project in Xinfeng county cost about 900,000 RMB to install six cameras in one village (CRE 2013)

[221] Guangdong province discovered more than 1000 illegal mining cases (not only REE) through satellite images in 2012 (Metalsinfo 2013).

[222] Taxes in China are paid through the use of invoices issued by the tax administrations. Until recently, REE could be traded using normal invoices just like those for any other product.

[223] They are, moreover, protected through a two-dimensional barcode and a unique password, which makes it more difficult to counterfeit the invoices (SAT 2012).

Weak cooperation between central government agencies weakened the effect of the special invoices. The tax administrations see the invoices as a tool to improve tax collection but not for resource management. One official from the Goods and Service Department of the State Administration is quoted as saying: “To contain illegal mining or the exceeding of targets is not the task of the tax departments. There needs to be an integrated approach against the exceeding of targets. We manage the REE industry only from the view of tax income.”[224] Moreover, the invoices only affect the upstream industry, focusing on trade between miners and separators. It is, however, still possible to trade illegal REE in completely illegal value chains from upstream to downstream enterprises (Zhang GD 2012).

9.6. Conclusion

Chapter 9 has analyzed the strategy to conserve REE resources through the elimination of illegal mining. The central government has pursued a strategy of resource conservation which limits the extraction of REE. The chapter finds that illegal mining was a very virulent problem before 2010. The official extraction caps could not limit the extraction and separation of REE. In recent years, the government has been able to bring actual extraction in line with the extraction targets according to official statistics. However, illegal mining remains a major problem for resource conservation. After 2010, the central government’s enforcement policy eliminated some illegal mines, but illegal mining remained a major problem (Li XL 2016).

The most important mediators of the strategy have been local governments, in particular city, county and township/town governments. The first conflict to arise was between the central government on the one hand and local governments and illegal miners on the other. Some of the sub-provincial governments rejected the national strategy and supported illegal mining to spur local economic growth. A second conflict arose between those local governments that tried to implement the national strategy adequately and illegal miners. The widespread REE deposits, which are easy to exploit in southern China, the mountainous terrain, and the limited capacities of the enforcement teams have further facilitated illegal mining and have made monitoring and enforcement more difficult. These two conflicts have rendered the national strategy ineffective at conservation.

The central government readjusted its strategy to address these two conflicts. The readjustment helped the policy achieve at least a limited degree of conservation. There are at least two main reasons for this. First, the government launched intensive campaigns against illegal mining starting in 2010. These campaigns brought in new mediators that could change

[224]限制非法开采或超量生产等，不是税务部门的职责，对付超量生产得用综合手段，我们是从税收角度对稀土进行管理。

the power balances in the conflicts. They led to better inter-departmental coordination, stricter administrative punishments, more intense investigations and public propaganda. Although the campaigns eliminated many illegal mining spots, they could not solve the problem outright. Illegal miners found new ways to resist the changes and to continue their activities, while some local governments continued to resist the national strategy.

Second, the central government introduced new mediators that could ensure resource conservation beyond the campaigns by issuing special invoices, installing surveillance technology, and establishing village monitoring assistants and mining police. It remains to be seen to what degree these strategies will improve resource conservation.

10. Environmental Protection

10.1. Introduction

This chapter deals with the government's strategy and implementation to reduce environmental pollution (see figurefigure 10-1). The Chinese strategy aims to make production less pollution-intensive. The national strategy rests in particular on two regulatory instruments: first, emissions standards limit the maximum concentration of pollutants in waste air and wastewater; second, environmental impact assessments (EIA) ensure that projects are in accordance with the environmental regulations.

Because mining causes long-term impacts, the chapter also deals with ex-post measures such as restoration and resettlements. Based on two examples in Ganzhou and Baotou, the chapter shows that it is impossible to eliminate pollution in the short term because it takes a long time to restore land destroyed by mining. Moreover, as in the case of the tailings lake in Baotou, environmental risks threaten the surrounding areas. Nevertheless, villagers have resisted the local government's attempts to resettle them.

The chapter finds that the policy of the central government improved environmental investment by the REE industry and increased the pressure on big enterprises such as Baogang, but pollution remains an intractible problem of the industry overall.

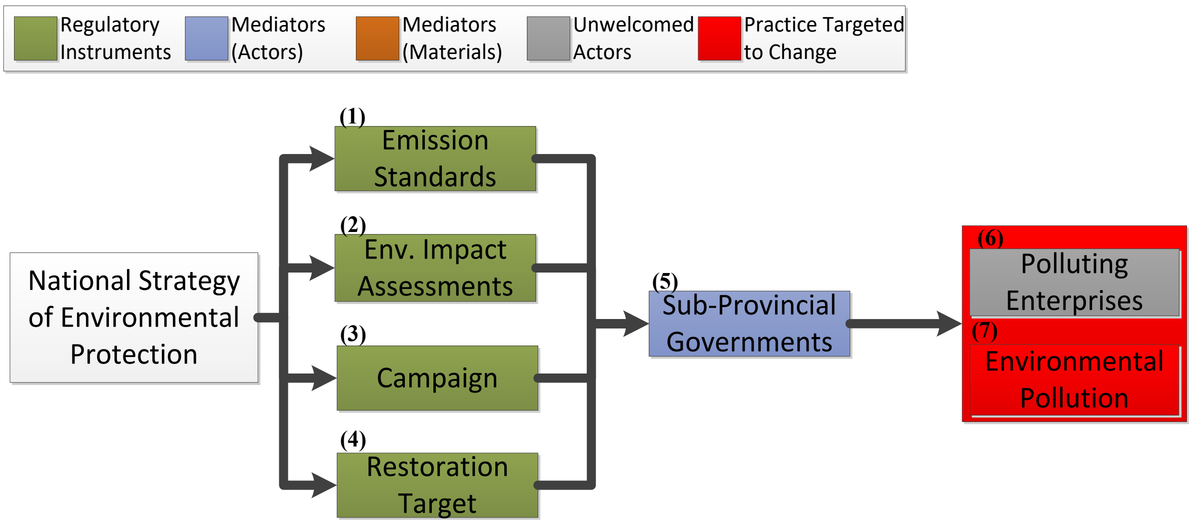

Figure 10–1: Translation of the central government's strategy to reduce environmental pollution from REE production.

The chapter starts with a descriptive overview of the pollution and environmental impacts of REE mining, processing and separation (10.2). It then continues with an analytical examination of environmental standards and environmental impact assessments as two central regulatory instruments (10.3). The following section deals with the weakness of these instruments, the resistance of enterprises and local governments to environmental protection and the strategic readjustment of the central government through an investigation campaign (10.4). Finally, two cases in Ganzhou and Baotou are presented to illustrate the role of materiality and people in ex-post measures of environmental management (10.5).

10.2. Environmental Impact of the REE Industry

This section presents the enormous impacts of the REE industry on the environment (Packey and Kingsnorth 2016). The REE industry in China, but also in other countries,[225] wreaks havoc on local ecosystems. Many of these impacts are typical of mining and metals reduction, but there are also REE-specific impacts. The REE industry affects geology, water, and air and can generate radiation (Ali 2014; Schüler et al. 2011).

10.2.1. Geological Impacts

Mines enormously affect the geological environment. They occupy land and destroy local vegetation, cause subsidence, soil erosion and landslides (Bell and Donnelly 2006, pp. 2-4). As Figure 10–*2* shows, the Bayan Obo mine covers a very large area of land that could also serve for alternative land uses such as herding (Sa Q 2012).[226] Similarly, the in-situ leaching of REE in southern China destroys large areas of vegetation (see Figure 10–3). In particular, in-situ leaching leads to mudslides (Tang XZ et al. 2000), which are a frequent phenomenon in REE mining areas and have killed several people (Ma Y et al. 2012, p. 73).[227] Other possible effects of mining include the disruption of underground water systems (Bell and Donnelly 2006).

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[225] The Mountain Pass mine in the United States closed down in the early 2000s due to environmental issues (Nystrom 2003; Castor 2008; USEPA 2012). The separation of REE in Malaysia has provoked massive public protests against the possible environmental impacts (Schmidt 2013).

[226] The main and east pit of Bayan Obo occupy an area of 4 km^2. Spoil heaps and tailings ponds extend from the west and east sides of the pits and cover an area of 13km^2. The whole mining area including the West pit covers about 60km^2 and when infrastructure and settlements are added, about 90 km^2 (Sa Q 2012).

[227] Between 2006 and 2007, 10 small- and mid-sized and two major landslides occurred in Maoniuping (Sichuan). The debris flows originated in particular from unsecured spoil heaps which are mostly located near busy transport

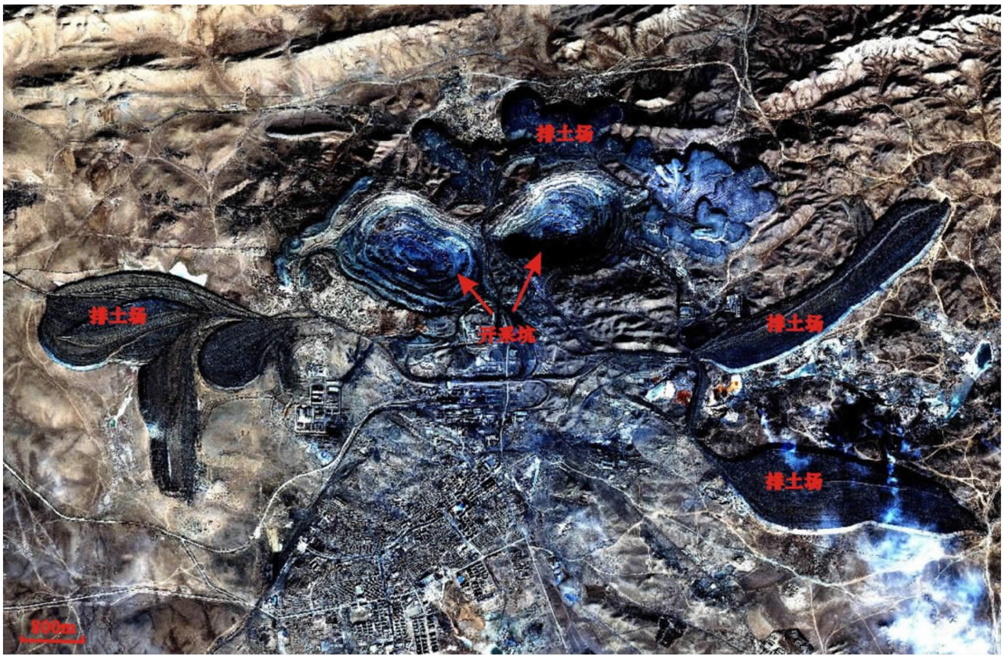

Figure 10–2: Satellite image of Bayan Obo. Source: An et al. 2011, p. 465.

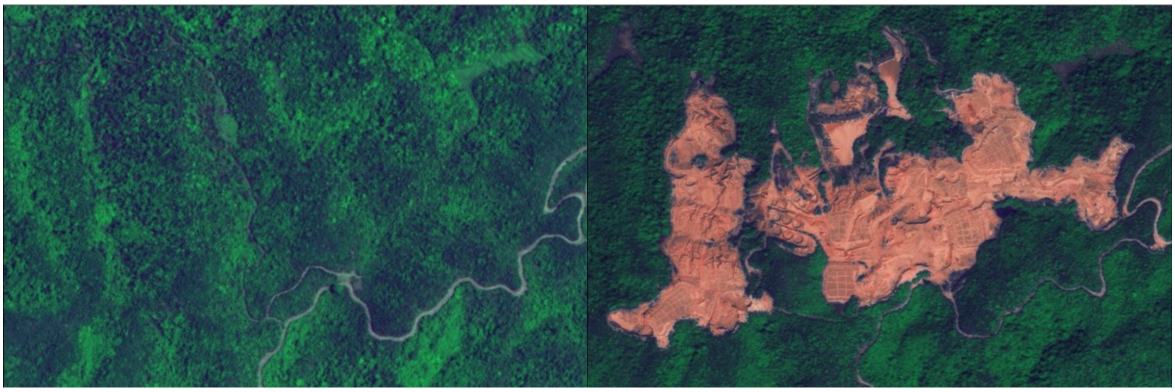

Figure 10–3: The topographical effects of mining in Xunwu county (Ganzhou). The left picture shows the area before mining (2005), the right shows it after mining (2009). Source: Guo 2012b.

10.2.2. Water Pollution

Water pollution originates mainly from the processing and separation of REE. The wastewater contains many hazardous chemicals and other pollutants. The REE industry in Baotou discharges between eight and ten million tons of wastewater per year, Sichuan roughly

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roads (Ma Y et al. 2012, p. 73). A landslide at a private REE mine in Guangxi killed nine people in 2011 and a similar event six people in Fujian in 2012 (Tang XZ et al. 2012; Jia ZJ and Wang LK 2011).

one million tons and Jiangxi approximately two million tons (Feng XJ 2011: p. 36; Wang CM et al. 2012: p. 12; Jia YZ et al. 2007).

The degree of water pollution depends on the filter technology, the processing and separation technology, and the composition of the minerals.[228] Due to the different minerals, wastewater from the Inner Mongolian REE industry contains much sulfuric acid, while wastewater in southern China contains more ammonium (Feng XJ 2011: p. 36; Wang CM et al. 2012: p. 12; Jia YZ et al. 2007).

Many REE factories fail to meet the national standards for water quality (Wang LP et al. 2004; Wang Z and Dai BC 2011; MEP 2011a). This pollution severely affects water quality in China. The REE industry in Baotou contributes to the heavy pollution of the Yellow River and its tributaries, local ground water and drinking water resources.[229] Similarly, the chemicals used in leaching pollute local water bodies in southern China (Yang QY et al. 2011; Du W 2001).

Ammonium pollution is a particular problem of the REE industry. Small amounts of ammonium is present in food and important for the human body, but large amounts of ammonia nitrate in water lead to eutrophication, harm the ecological balance of water and kill fish (Yu RJ and Z RF 2012). A large intake of ammonia nitrate can seriously damage human health.[230]

Moreover, the REE industry discharges large amounts of heavy metals. Heavy metal pollution is a common phenomenon of mining. In particular, the wastewater from leaching operations in southern China contains large amounts of lead, cadmium, copper, zinc, and

[228] Enterprises in Baotou mainly use sulfuric acid (H2SO4), hydrogen chloride (HCl), oxalic acid, and nitric acid for the acid route. They use natrium hydroxide (NaOH), natrium carbonate, ammonium hydroxide, and ammonium bicarbonate (NH4HCO3) for the alkali route. These chemical substances are also the major pollutants in wastewater (Wan LP et al. 2004: p. 60). The acidic processing is more polluting than the alkali route, but the acidic process is more popular because alkali are very expensive (Chun H and Xin H 2000).

[229] Many REE processing and separation enterprises in Baotou used to discharge large amounts of wastewater into the Sidao Sha River, which flows into the Yellow River. About 20 million tons of wastewater enter the Sidao Sha River annually. The wastewater contained 22800t sulfuric acid, 1245t fluorine, and 1267t ammonia nitrate in 2006. Smaller amounts of wastewater also enter the West River (Cai YM et al. 2006, p. 41). This has aggravated the water quality of the two rivers (Cai YM et al. 2006, p. 42): ammonium nitrate content exceeded water quality standards by 77 times and fluorine by 18 times in 2011. Moreover, wastewater trickles into groundwater. The pollution affects sections of the Yellow River from which nearby villages obtain drinking water (Gao JZ 2002; Wang Z and Dai BC 2011).

[230] Under certain conditions ammonia nitrate can damage lungs, mucous membranes and lead to irritation of the skin, eyes, and respiratory tract. Effects of long-term exposure include orthostatic hypotension, faintness, fatigue, weakness, depression, mental impairment, dizziness, shortness of breath, and cancer (Gao ZQ and Zhou QX 2011, p. 2919; Science Lab 2013).

alumina. These substances are very harmful to animal and human organisms and can accumulate along the food chain (Zhang QH et al. 2012, p. 478).

10.2.3. Air Pollution

The processing and separation of REE emits large quantities of waste gas and affects local air quality. The production of one ton of REE metals leads to emissions of 5500m^3 of waste gas (Du W 2002). The REE industry in Inner Mongolia produces more waste gas on average than other provinces.[231] The waste gases contain in particular sulfuric acid[232] as well as sulfur dioxide, fluoride, ammonium nitrate and hydrogen chloride (Feng XJ 2011: p. 76; Gao ZQ and Zhou QX 2011: p. 2919).

10.2.4. Thorium

The REE mines in Inner Mongolia and Sichuan extract REE from monazite and bastnäsite minerals. These contain concentrations of the radioactive elements thorium and uranium. Mining and processing REE from these materials generates radioactive waste. The extraction and crushing of the ores release some thorium. There are heightened levels of radioactivity at the spoil heaps of Bayan Obo (Gao ZQ and Zhou QX 2011, p. 2917). However, most thorium is released from smelting the minerals in the form of tailings (80%), dust (17%), and wastewater (0.4%). Because the thorium content in the tailings is 1.5 times higher than in the ore, radioactivity is a much larger problem at this stage of processing. As the refinery plants in China currently do not recover thorium, the environment around the processing sites suffers from heightened radioactivity levels. Especially in Baotou with its huge REE industry, the radioactivity around the refineries and the tailings dam is significantly higher than the average city level and the radioactivity of wastewater far exceeds national discharge standards .[233]

[231] In Inner Mongolia, the acid method produces about 1.5t of waste gas per ton of REO, and the alkali method 0.6 t/tREO. Processing in Sichuan generates between 0.4t to 0.8t/tREO (Feng XJ 2011).

[232] According to data from Baotou, separation enterprises emit about 100kg to 250kg sulfuric acid per ton of REO (Su WQ 2009: 187-188)

[233] Sub-section 10.5.4 details the effects on the population living around the processing sites in Baotou (USEPA 2012; Schmidt 2013).

10.3. National Strategy

10.3.1. Environmental Regulation

The Environmental Protection Law aims to reduce the environmental impacts of industrial activities. In recent years, environmental protection has become more important as the institutional position of the Ministry of Environmental Protection (MEP) has been enhanced and the environmental regulatory framework has been becoming more comprehensive (Mol & Carter 2006; Sitaraman 2007).

The 12th Five-Year Plan for Environmental Protection determined the general strategy of environmental protection up to 2015 (MEP 2011b). It planned to revise the regulatory framework, improve the system of environmental taxes, fees and services and to extend CO_2 emission trading. One part of the reform was the amendment of the Environmental Protection Law in 2014 (Wübbeke 2014a).

The MEP specified the national strategy for environmental protection in the "Opinion on Strengthening Ecological Protection and Restoration of Rare Earth Mines"[234] (MEP 2011c). This ministry-level opinion did not formulate a new strategy of environmental protection for the REE industry, but it called for compliance with existing environmental regulations, better monitoring and enforcement. The MEP has used two important regulatory instruments to implement the environmental protection strategy: emissions standards and environmental impact assessments.

10.3.2. Emissions standards

Emissions standards put a maximum limit on the concentrations of pollutants that enterprises are allowed to emit. In the past, the Chinese mining and metals processing industry was subject to general standards for emissions of pollutants. These general standards for water and air emissions were rather low and did not meet the specific characteristics of the REE industry. For instance, the general standards did not take thorium emissions into consideration (NEPA 1999a, 1999b).

In order to improve the regulation of emissions, the MEP released the "Emissions Standards for Pollutants from the Rare Earth Industry" in early 2011. Compared to the general standards of 1996, the new emissions standards were much stricter. Existing projects had to

[234] 关于加强稀土矿山生态保护与治理恢复的意见

comply with the standards by 2014 (for a comparison of the old and new standards see annex table 14-9 and table 14-10).[235] The most important novelties of the new standards were the introduction of maximum concentrations of thorium and uranium, maximum volumes of total wastewater and air emissions, and air quality standards for the area surrounding processing and separation factories (NEPA 1996a, 1996b, MEP 2011a).

10.3.3. Enterprise Resistance against Ammonia Standards

The new environmental standards for the emission of pollutants from production are an example of tightening environmental regulations. However, despite some strict new standards, there are some shortcomings. The State Environment Protection Agency (SEPA), predecessor of the MEP, began drafting the new emissions standards in 2004. SEPA's institutional power used to be weak. Only in the year after the State Council elevated it to ministry status in 2008 did the agency succeed in coming up with a first draft. The State Council's "Several Opinions on Promoting the Sustainable Development of the Rare Earth Industry" were an important trigger for issuing the emissions standards in 2011 (MEP 2009).

The leading enterprises and associations of the REE industry participated in the drafting group.[236] These were very critical of the proposed new emissions standards. Zhang Anwen, vice secretary of the Chinese Rare Earth Society, said in 2010 that the national standards "mean a life and death battle for the enterprises"[237] (Song Y 2011). After the standards were released, estimates held that about 80 percent of enterprises could not meet these standards and that production costs would increase by 70 percent (China High-Technology Enterprises 2011).

The maximum concentration for ammonium was a central issue in the formulation of the new standards. As the previous section described, ammonia is one of the major pollutants of the REE industry and national policy (State Council 2011b). The old standards set the maximum ammonia concentration in wastewater at 25 milligrams per liter (mg/L). At the beginning of the drafting of the new standards, experts proposed a new maximum value of 15 mg/L (CRE 2011a).

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[235] The emissions standards are even stricter for new projects.

[236] Among these are Baogang, the Inner Mongolia Rare Earth Industry Association, the Sichuan Rare Earth Industry Association, Jiangxi Tungsten Group and Rhodia Rare Earth Advanced Materials

[237] "对企业是生死大考"

However, the draft of 2009 then suddenly proposed a value of 50 mg/L. Finally, the emissions standards prescribed a concentration of 25 mg/L as per the old standards (MEP 2009, 2011a). In contrast to other concentration values, the new standards did not tighten the restrictions on ammonia. It is very likely that the involved enterprises weakened the maximum value during the drafting stage.

Besides the weak ammonia concentration value, the new standards have more shortcomings. Among these, the standards do not include in-situ and heap leaching of REE in southern China (Wang MR and Jia HJ 2012; Wang YG 2012).[238]

10.3.4. Environmental Impact Assessments

Environmental Impact Assessment (EIA) is another important regulatory instrument that helps to ensure compliance with environmental regulations. EIA is a compulsory ex-ante assessment during the planning stage of the potential environmental risks of a new, changed or extended project (Zhu T and Lau KC 2009).

This creates a powerful instrument because it allows environmental authorities to block projects that will pollute the environment, or to demand important changes.[239] SEPA, the predecessor of the MEP, with support from the NDRC halted many large-scale projects in 2005 and 2006 due to their failure to carry out EIAs. This period has come to be known as the "environmental storm" (Shi H and Zhang L 2006, p. 281).

[238] Another aspect is that REE themselves can have adverse impacts on the environment. Because not all REE can be recovered during extraction and separation, some enter the wastewater system. However, the standards make no provision about the maximum value of REE contained in wastewater (Wang MR and Jia HJ 2012). Moreover, REE standards concern only actual emissions; they do not guarantee the long-term quality of water. Even if the standards are followed, there is no guarantee that there will be no environmental pollution or risk to health.

[239] In contrast to EIA practices in Europe and the United States, EIA in China mainly aims to show that a project will comply with the law and standards and does not assess the impact beyond legal obligations. The EIA process is, put simply, structured in the following way: the project enterprise commissions a certified assessment agency to carry out the EIA and write up a report, which must integrate public opinion on the potentially affected local population. The EIA agency then sends the report to the environmental authorities for approval, normally city-level EPBs for small projects and provincial EPBs and the MEP for larger projects (Zhu T and Lam KC 2009).

10.4. Dynamics of Environmental Pollution

10.4.1. Resistance against Environmental Protection

The REE emissions standards are not effective in practice. The standards limit ammonia concentration in water to 25 mg/L, but actual emissions from enterprises in the Baotou area are between 300 and 5000 mg/L,[240] 12 to 300 times higher than stipulated by the standards. The maximum values for many other pollutants are exceeded as well (CRE 2011a; MEP 2009).

There are manifold reasons why the implementation of environmental protection through emissions standards has failed. First, technology lock-in is a barrier to better protection. Highly polluting production technology emitting a lot of ammonia is very common. Technology to clean ammonia from wastewater is either very energy intensive and creates other pollutants or cannot sufficiently decrease the concentration. To meet the standards, a total overhaul of production lines would be necessary in many cases (Wang MR and Jia HJ 2012, p. 101).[241]

The central government's strategy to address these technological barriers has been to prohibit polluting technologies and research alternatives. For example, the central government sought to eliminate the saponification extraction and separation method,[242] which emits large amounts of ammonia. State research enterprises invented a non-saponification and "zero-emission" production technology. New REE projects under construction are equipped with this technology (Youyan Rare Earth 2012; Hu Z 2011).

In many cases, however, the total overhaul of production lines is not practicable for enterprises. From the view of the enterprises, investment in environmental technology to manage waste emissions increases the costs of production and shrinks profits. Smaller firms especially have limited access to loans and limited funds to invest in the necessary technologies (Qi 2013, pp. 67-79).

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[240] Other data suggests that the concentration of ammonia carbonate in separation wastewater is between 4000 mg/L and 12,000 mg/L, whereas the discharge standards allow only 25 mg/L of ammonia nitrate (Wang LP et al. 2004; Wang Z and Dai BC 2011; MEP 2011a).

[241] For instance, through gas stripping and membrane treatment, the emissions can only be lowered to 50 to 70mg/L, still exceeding the standards by 25 to 50 mg/L (Wang MR and Jia HJ 2012, p. 101).

[242] 皂化萃取分离

Second, resistance from local governments hinders implementation. Although the local Environmental Protection Bureaus (EPBs) receive their orders from the MEP, their willingness to protect the environment depends on the commitment of the local government. As local governments focus very much on tax revenues and economic growth, environmental concerns are often less important. The EPBs have to cover part of their operational funding from their own revenues, which mostly come from penalty fees for exceeding standards. Collecting penalty fees has become an important business for them and as a result they have no particular interest in ensuring compliance with the standards (Carter and Mol 2007, pp. 6-9).

A recent example of local government resistance is Changting county in Longyan city in Fujian. The province-owned enterprise Xiamen Tungsten[243] owns a legal REE mine and processing facility in Changting county. The enterprise extended its factory area and occupied villagers' land in 2007. The vegetation around the factory areas and pipelines disappeared and an oily smell has emanated from local fish ponds. Despite these issues, the provincial government and the EPB of Longyan city approved the extension. The county government used violence to force some villagers to move away without compensation. The government also exerted force against villagers who decided to stay in the area.
A villager reported about an incident in May 2013:

> Changting county Vice Chairman Lan deployed several hundred people, blocking streets and electricity to our homes. In this situation, law enforcement troops beat my wife…When my daughter…went over to dispute with them, she was brought down to the ground by the police and arrested for five days. My wife is still in Changting hospital. Until now, no official has appeared to clear up these things[244] (Pan CW and Liu JC 2013).[245]

The local EPB argued that the settlements were within the environmental buffer zone of the factory. This statement ignored the fact that the people had already being using this area before the factory was ever extended (Pan CW and Liu JC 2013). In this case, the local cadres disregarded environmental impacts in order to develop the local REE industry (Fan QL and et. Al 2012).

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[243] It operates in Changting through its subsidiary Fujian Changting Jinlong REE Ltd.

[244]长汀县政府兰副县长带领几百 人，断了我家的路和电。在这个过程中，执法大队的十几人将我老婆…打伤，我女儿…过去和他们争论，被在场的公安人员按倒在地，被拘留了 5 天。 我爱人至今还在汀州医院， 至今仍没有政府人员出面处理此事。

[245] The related officials of Changting county denied this perspective of the incident.

10.4.2. Role of Environmental Impact Assessments in REE Projects

As the emissions standards have been ineffective, the question arises to what degree can EIA diminish pollution? REE projects are obligated to carry out EIAs. It is difficult to assess the extent of EIA's role in the REE industry before 2010. At least since 2011, the data on EIA suggests that all larger companies have done EIAs (for an overview of the reviewed environmental impact assessments see annex table 14-11). The MEP's new investigation campaign (see next section) has incited a more frequent use of EIA and that has led to the adoption of better environmental protection technologies among the projects.[246]

Despite the positive effects of EIAs, there are also shortcomings in implementation. As city EPBs are responsible for approving EIAs, they sometimes ignore environmental issues which could affect economic interests (see previous sub-section). A strong aspect of EIA is that it considers the opinions of the people neighboring a project. The concerns of villagers over the impact of local REE projects could help the central government to better protect the environment. However, a review of four EIAs in the REE industry found that the EIAs do not use this instrument in practice.[247]

It is problematic that the official regulations do not require that the full project documents be made available to the public. People can decide only on the basis of available information. They have only about ten days to understand the rather complex documents and give qualified feedback (Xu ZL and Su YC, p. 55). Public participation is mostly only a pro-forma measure.

The public can participate in three ways: first, people can make their suggestions in written form. However, the reviewed EIAs either did not include written suggestions or stated that none of the written suggestions raised opposition to the project.

Second, public meetings are supposed to provide information and be forums for discussing the project with the public. The public meetings, however, mainly involve local cadres and some single village "representatives."[248] Although it is quite likely that some village

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[246] At least in two cases of EIAs, the examination by EPBs and MEP included requirements for improving the environmental equipment of the project (Guangxi EPB 2013; Yangcheng News 2013).

[247] The four reviewed EIAs concern projects of the Ganzhou Rare Earth Group, two subsidiaries of the Guangdong Rare Earth Group and Minmetals (Ganzhou Rare Earth Mining 2013; Dabu Xinchengji Gongmao 2013; Pingyuan Huaqi Rare Earth Industry 2013; Minmetals 2013).

[248] These are county officials from various departments, township and village cadres, the construction company, and the EIA agency.

heads will raise concerns about a project, this is far from creating a public space that considers the opinions of the majority of the affected people.

Finally, the EIA agency in charge is expected to conduct a survey in nearby villages. It is doubtful that the surveys reflect the concerns of the villagers. In the reviewed EIA surveys, nobody opposed the projects, although a few people indicated that they were concerned about environmental impacts. The fact that survey participants have to give their name in the survey might decrease their willingness to oppose projects. In one case, four people initially opposed a project, but “basically agreed” with the project after receiving a call from the EIA agency to discuss their opposition. In at least one case, it was the project enterprise itself and not the EIA agency that conducted the survey (Ganzhou Rare Earth Mining 2013; see also Dabu Xinchengji Gongmao 2013; Pingyuan Huaqi Rare Earth Industry 2013; Minmetals 2013).

10.4.3. Strategic Readjustment through Campaigns

The MEP readjusted its strategy against the weakness of environmental protection in the REE industry. In 2011, the MEP launched a nationwide campaign to investigate the environmental performance of the entire REE industry and to collect relevant data: in the first step, the enterprises had to undertake a self-investigation and send relevant documents to the provincial EPBs. The provincial EPBs then had to examine the enterprises’ documents and carry out on-site investigations. Next, the provinces provided the MEP with a list of candidates who fulfilled the environmental regulations. The MEP had its own expert team which examined the list of candidates and made random investigations (MEP 2011d, 2011e).

The result of the investigation campaign was a public list[249] of enterprises that complied with the relevant environmental regulations (hereafter “the List”) (MEP 2011f, 2012a, 2012b). The List was a powerful sanctioning instrument through its connection with two further mechanisms: first, enterprises are, according to the export regulations of 2012, only allowed to export REE if they are on the List (MOC 2012a). Second, EPBs have been directed to approve EIAs for new projects only if the respective enterprise is on the List (MEP 2011e).

The MEP released three batches of the List with a total of 80 enterprises (MEP 2011f, 2012a, 2012b). For the first batch, the provinces proposed a total of 84 enterprises, but the MEP accepted only 15 (China Enterprise Bulletin 2011). The MEP’s inspection campaign put enormous pressure on the enterprises. This showed some results: following the inspections, the 84 enterprises that had been considered for the first batch, announced investments of 4 billion

[249] 符合环保要求的稀土企业名单

RMB in environmental protection equipment, of which they had invested half by 2012 (China Enterprise Bulletin 2011; Guo W 2012). This amounts to about 10 percent of the annual output of the industry as of 2010.

One example of an enterprise feeling extreme pressure from the MEP's campaign is Baogang. Due to its poor environmental record and violation of national emissions standards, Baogang was not successful in getting onto the List in the first two batches. When the enterprises had to hand in their documents for the first batch, Baogang attempted to resist the national investigation campaign.

Baogang did everything possible to avoid the government getting the impression that it was a big ammonia emitter. Baogang presented very well worked-out self-investigation documents, but it did not indicate clear numbers for its ammonia emissions. According to a responsible expert from the MEP "only industry insiders, who are very familiar with the situation of this factory can find the sticking points"[250] (Zhu YC 2012).

The MEP experts responded to this resistance through on-site examination of Baogang's wastewater emissions. They concluded that Baogang did not meet the requirements. As a consequence, Baogang failed to get on the List and to obtain an export quota for the first half of 2012 (Zhu YC 2012).

Only on the third attempt did Baogang get onto the list. The investigation campaign had a considerable impact on Baogang's environmental policy. In August 2012, Baogang announced that it would invest about 220 Million RMB into emissions management technology, relocate beneficiation facilities to less populated areas in Bayan Obo and construct new production lines. This represented a huge amount of money when compared to Baogang's annual net profit of 348 Million RMB (2011) (Yang M 2012a; Bai B and Dai ZL 2013). However, this amount might not be enough to solve Baogang's environmental pollution problems (China Environmental Protection 2012). It is also important to note that Baogang was able to get onto the List before it had finished installing the new environmental technology in its factories (MEP 2012a, 2012b).

Another example of the effect of the campaign concerns Dabu Xincheng Jigongmao Ltd.,[251] an affiliate of the province-owned enterprise Guangdong Rare Earth Group. The enterprise did not pass pre-examination by the provincial EPB due to its lack of environmental records. The enterprise had not conducted an EIA for its mine in Wufeng village.[252] Following its failure to pass the investigation campaign, the company started carrying out an EIA for its

[250] 只有非常熟悉该厂情况的业内人士才能发现端倪

[251] 大埔县新城基工贸有限公司

[252] 五丰

mine and invested in new technology (Dabu County 2011; Meizhou EPB 2011; Dabu Xinchengji Gongmao 2013).

Despite these examples of success, the investigation campaign did not manage to bring the entire REE industry into line with the national emissions standards. The List still includes highly polluting enterprises. The above-mentioned case of Xiamen Tungsten in Changting county, which was able to get onto the List despite the environmental impacts of its activities and conflict with the local population, demonstrates that some polluting enterprises could still operate without much interference from the state (Pan CW and Liu JC 2013). This means either that the central government was not aware of the impacts or that it ignored the company's environmental problems.

Small companies and illegal companies especially do not have the funds to comply with the environmental standards. Moreover, whereas the List indicates the state of environmental pollution at a certain point in time, there has been no campaign since 2011 that could ensure that enterprises will stay in line with the environmental regulations in the future.

10.5. Ex-Post Measures

10.5.1. Long-Term Environmental Impacts

Even if the central government managed to stop the pollution caused by the REE industry immediately, it would still have to cope with the long-term environmental impacts that result from mining, processing and separation. The environmental risks emanating from mines, tailings and chemicals do not end with the cessation of mining. Mining leaves behind destroyed land and polluted water (Bell and Donnelly 2006). The huge environmental pollution has become a massive material burden that makes implementation of the national strategy difficult. It will require decades and even longer before the land can be restored. Below, two examples that demonstrate how the state tries to cope with the challenges of restoring mining-affected areas in Ganzhou and managing the tailings dam in Baotou are presented.

10.5.2. Restoration in Ganzhou

In Ganzhou city, there are over 300 abandoned REE mines, 191 million tons of tailings and nearly 100 km^2 of eroded land. The estimated costs for restoring the destroyed land and treating the environmental hazards are more than 38 billion RMB (Zhang JG 2012, Wang KT 2012). This is a huge sum that accounted for 25 percent of the GDP of Ganzhou city and 164 percent of the fiscal revenues of the city government in 2012 (Ganzhou 2013). From 2005 to

2011, the city government spent 190 million RMB on restoration (Wang KT 2012). At this pace, it would take over 1300 years to accumulate the minimum funds necessary to restore all the land destroyed by REE mining.

However, after the central government intensified its policy demanding more environmental accountability in 2009, the provincial government of Jiangxi and the city government of Ganzhou began to pay more attention to restoration. Jiangxi province planned to restore 25 percent of the land destroyed by mining by 2015. Ganzhou city aimed at a target of 30 percent by 2015 and 40 percent by 2020 (Jiangxi Province 2012b; Ganzhou 2011). The city government of Ganzhou had allocated 2 billion RMB for restoration as of 2011 (Ganzhou 2011). Besides the city government, the central and provincial governments started restoration projects and provided restoration funds (Jiangxi 2012b; Wang KT 2012, Jiangxi Minerals Bureau 2013; Li P 2012).[253] The counties also carried out small restoration projects, but their funds have been limited (Qiu HX and Pan G 2012; China Nonferrous Metals Industry Association 2012; Anyuan LRB 2011; China Tungsten News 2013; Wang YG et al. 2012; LiP2012).[254] The total funds disbursed for the restoration efforts are not small and much higher than before 2011, but they are far from the estimated restoration costs of 38 billion RMB (Yang Y et al. 2012).

Enterprises have so far had a less prominent role in restoration. Under current laws, all enterprises are required to restore their mining areas. Jiangxi province holds the Ganzhou Rare Earth Group responsible for all its mines that are currently still in operation (Jiangxi 2011). Since 2006, the central government has required mining enterprises to pay a deposit that will be used for restoration after mining ends (MLR 2006).[255] An example of enterprise-led restoration is Jiangxi Copper's investment in the REE mining area of Maoniuping in Sichuan (Guan RR and Wangjin MD 2012). Nevertheless, this covers only a small part of the destroyed

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[253] The province selected 14 projects with a restoration area of 19.17 km^2 (about 20 percent of total destroyed land) (Jiangxi 2012b). Central government and provincial funds are available, such as the Mining Geological Environment Restoration and Refurbishing Special Fund (矿山地质环境恢复治理专项资金管理办法). Ganzhou received funds from the MLR for some projects (Wang KT 2012, Jiangxi Minerals Bureau 2013; Li P 2012).

[254] The district government of Xunwu had invested 5 million RMB between 2009 and 2011 in one area of heavy mining (at 双茶亭) to restore an area of affected mountains and eroded soil. However, to fully restore the area, 20 million RMB would have been necessary. Massive soil erosion in Xunwu amounting to about 27 km^2 of heavily eroded land has not been restored (Fu G et al. 2011).

[255] By mid-2012, mining enterprises in Jiangxi province built deposits of 1.57 billion RMB (Zhang ZY and Luo Y 2012). However, this is a small amount compared to the necessary funds for restoring land destroyed by REE mining (Xu YQ 2011; Li SH 2010; Zhu Q and Zhang XZ 2013).

land. Much of the destruction results from illegal mining activities, meaning that nobody can be held responsible for the destruction and the payment of the restoration costs.

10.5.3. The Results of Restoration

Despite the immense financial burden and the huge challenges, the restoration has achieved some results. For instance, in Jiading township (Xinfeng county), an area of 1.5 km^2 has been restored. The planted loquats produce an annual income of three million RMB (China Tungsten News 2013; Chu HL and Chen H 2012) (see Figure 10–4; for a further satellite picture of restored land see annex figure 14-1).

Figure 10–4: Results of restoration and plantation in a former mining area in Jiading township (Xinfeng county). On the left side is the restored area, while the right side has not yet been treated. Sources: Chu HL and Chen H 2012; Li GW and Liu SY 2012.

Restoration in other areas could also bring land back to a usable state for agriculture, for example for orange or eucalyptus trees (Lai YF 2012; China Nonferrous Metals Industry Association 2012). However, the soils in many former mining areas have become infertile. The transfer of new soil and enrichment with nutrients is necessary. Due to the costs and scale involved, however, this is often difficult to achieve. Only grass is planted on poor contamined soil that has not been replaced (Liu F 2013). The cultivation of plants on these soils is not always successful; restoration is a long-term process (Ganzhou 2011; Zeng M et al. 2011).

10.5.4. Environmental Risks of the Baotou Tailings Lake

The tailings lake in Baotou is a very striking second example of the environmental impact of REE processing and separation (see map 10-1). The lake is located in the Jiuquan district in the west of Baotou. The local REE factories have fed the lake with tailings for over fifty years. Since its construction in 1965, the lake has grown to a size of 10 km^2. Over the years, 160 million tons of waste and 17.5 million m^3 of wastewater have accumulated in the lake. The lake contains sulfuric acid, hydrofluoric acid, and other hazardous chemicals, 70,000 tons of thorium and 9.3 million tons of unrecovered REE. The lake is scheduled to operate until 2025. The structure is elevated 30 meters higher than the surroundings, which is why it is also called “plateau lake” (悬湖) (Xu GX and Shuai CX 2005, p. 449).

Map 10–1: The REE tailings lake in Baotou and land use (author's illustration).

The operating companies discharge a milky white, smelly liquid into the lake. The beaches of the human-made lake are black and the water has a red color. The hazardous and radioactive content of the tailings dam comes into contact with the local environment.[256] The radioactive pollution covers an area of 4.94 km^2 around the lake (Bai LN 2004).

The villagers from the surrounding Xinguang and Dalahai villages suffer badly from the facility. Originally, this agricultural area fed Baotou. When the lake was constructed in the 1960s, the villagers were not aware of the coming danger. In the 1970s, crop output in the surrounding fields began dropping and this declined to zero in 2000. More distant fields only yield 70 percent of local average production (Luo X and Meng J 2012; China Environmental News 2011).

[256] The bottom of the lake is not covered with a foil to prevent the water from seeping into the ground water. The wastewater enters the local environment through precipitation. The dust particles that are not covered by the water's surface are carried away by the wind in spring and winter and distributed in the surrounding area, in particular to the south and west. The waste contaminated water trickles through at 300 meters per year in the direction of the Yellow River which is 10 km away. To prevent overfilling or a destabilization of the structure, lake water is regularly released into the Yellow River (Ma PQ et al. 2009).

Among the villagers, ailments such as osteoporosis and loss of teeth are very common. The villagers have reported a higher rate of deaths from cancer. A former village chief said: "Many villagers contracted cancer, their immune system is weakened. In addition to the heavy air pollution, the water is polluted as well. Not even the livestock want to drink it." Moreover, the ground has softened due to seepage from the lake. Polluted water rises up to the surface so that cracks form in many housing structures and some houses collapse (Luo X and Meng J 2012; China Environmental News 2011).[257]

The environmental problems that have emerged from refining and separation are long-term issues whose material presence interferes with business operations and politics. Tailings lakes are difficult to manage. Every year Baogang has to increase the size of the lake's dam by 0.9 meters in order to contain the growing tailings (Jin Y and Li SB 2006). Managing the tailings lake has been a difficult and worrisome issue for Baogang and the local authorities.

Because of the tailings lake, the MEP did not approve Baogang in the list of enterprises fulfilling environmental requirements (see sub-section 10.4.3). The lake is a serious threat to the stability of the provincial and municipal governments and Baogang. A collapse would lead to the sudden outflow of masses of tailings extending several kilometers into the land and burying everything below it, including surrounding settlements and the nearby Lanzhou-Baotou railway line (Xu GX and Shuai CX 2005).

The vice mayor of Baotou city said: "If the dam collapses, the safety of drinking water used by citizens of Baotou will be directly affected"[258]. And the vice director of the Baotou Environmental Protection Bureau stated: "If cracks appear in the Baogang dam due to an earthquake and the dam collapses, the industrial wastewater would be an immediate threat to the Yellow River" (He GW 2010).[259] The dilemma is that dealing with the pollution is costly, but not dealing with it is becoming more costly.

10.5.5. Plans for Resettlement and Villager Resistance

For a long time, Baogang ignored the problems and the dissatisfaction of nearby villagers. The Baotou EPB carried out several inspections in the area in 1996, 2000, 2003, and 2006 (China Enterprise Bulletin 2011, Xu ZL and Su YC 2012). In 2002, the Bureau stated that it

257 "这环境污染得吓人啊，不少村民都得了癌症，生活在这里的村民不是免疫力低，就是抵抗力差。不仅空气中污染厉害，就连水质也受到了污染，家里养的牲畜都不喝。"

258 尾矿坝一旦决堤，污水将会漫过铁路，直接影响到包头市民的饮用水安全。

259 "包钢选矿厂尾矿坝处在地震断裂带，一旦发生垮坝事件，巨量的工业废水将对下游的包兰铁路及黄河带来严重威胁"。

was no longer suited for human life and the Baotou Research Institute for Agriculture mentioned that the decline in crop output was due to the tailings dam (Jin Y and Li SB 2006). Among other things, they discovered heightened levels of sulfate, chloride, and fluorides in local water wells and heightened radioactivity. However, villagers's protests and the monitoring findings failed to yield any tangible results. The strategy most villagers chose was to move away. The population of Xinguang Sancun, one of the affected villages, dropped from 2,000 to 300 within 10 years (Radio France International 2012).

Local people have become a serious problem for Baogang. At least since 2004, the nearby villagers have been petitioning the local government to deal with environmental pollution. This has resulted in a modest annual compensation payment from Baogang (Hui ZD 2006). But nothing changed, leading people to resort to physical resistance. In 2007, when Baogang wanted to further heighten the dams for an ash waste dump that belongs to Baogang's power plant and is next to the tailings lake, south of Xinguang One village, about 200 villagers tried to stop the construction. The municipal police sent in about 500 riot police and assaulted the protesters. Many people were very seriously injured and arrested (Liu LY 2007).

After this, the first plans to resettle affected people emerged. Baogang, the main operator of the tailings dam, wanted to resettle 5000 villagers from Dalahai, Xinguang One, Two and Eight to another place in the Kundoulun district. Baogang and the city government together provided 300 million and 200 million RMB each for the resettlement. They built a new housing complex for the villagers (Xinhua 2012f).[260] One villager was quoted as saying: "we will move from our old small homes to spacious and well-lit multi-storey buildings. This means a great improvement with regard to heat and water supply. This is really good!"[261] (Ding LD et al. 2012; China Environmental News 2011).

This is only one side of the story. By 2012, 70 percent of the villagers should have been resettled. However, as of 2013, the project was stalling and many of the project's apartments were still empty. The villagers were supposed to pay 800 RMB per square meter, about 80,000 RMB per flat. However, the villagers did not want to and often could not pay so much money for the new flats. In their view, the compensation of 60,000 RMB per mu (ca. 666 m^2) was too low. They feared losing their incomes if they sold their farm land (Xinhua 2012g).

This case shows that local people resist the way local governments and enterprises tackle environmental pollution. Since the impact on human health is the biggest problem linked to environmental pollution, it is quite common in China for local people to be resettled by

[260] Each villager shall get an area of 35 m^2. In order to allow them to work, they can also buy farm land or business rooms nearby. From 2009 to 2013, each villager obtains an annual compensation of 4000 RMB and parts of their health costs are covered.

[261] 即将从原来低矮的土房搬进的楼房，而且供暖、饮水等条件都会大大改善，真是太好了！

governments. However, many people do not want to be moved under the conditions offered to them. The common practice of polluting and then resettling clearly has its limits.

Meanwhile, Baogang and the local authorities are spending about 60 million RMB to deal with the tailings lake, including removing a processing plant, upgrading water treatment technology, drainage prevention, and greening the dam walls and surrounding areas. Moreover, Baogang is planning to recover the REE in the lake. This might compensate for some of the restoration costs although the value of these reserves might be overestimated. There is no long-term plan for how to deal with the dam after it is no longer in use or how to deal with the pollution of soils and groundwater by radioactive substances and heavy metals (Hu DJ 2012).

10.6. Conclusion

This chapter analyzed the central government's strategy to decrease environmental pollution. It finds that the government has improved environmental protection in recent years, but the overall pollution of the REE industry remains severe. The government uses emissions standards and environmental impact assessments (EIA) to implement its environmental protection strategy. But these regulatory instruments were introduced too late to prevent the severe environmental impacts before 2011. This is due to the technology lock-in of polluting technologies. Cleaner production technologies are more expensive. Moreover, many local governments have placed a priority on economic interests. The EIAs fail to integrate the people affected by the environmental impacts of mining into planning and decision-making processes over REE projects.

In 2011, the Ministry of Environmental Protection launched an investigation campaign that put enormous pressure on large enterprises such as Baogang. It was so powerful because it allowed only enterprises with good environmental performance to export REE. However, despite the increase in environmental investment, many enterprises, and in particular small enterprises, still exceed emissions standards. As many polluting enterprises have been approved by the MEP, it is conceivable that the central government is not totally committed to environmental protection where economic interests that are particularly important to a local community, such as tax incomes from enterprises, are concerned.

The second part of the chapter illustrated the long-term environmental impacts of mining using the two examples of Ganzhou and Baotou. Due to the immense destruction of the land caused by mining operations, solving all of the environmental problems will take decades or even longer. Moreover, attempts to end environmental conflicts with the local population through resettlement might incur opposition from villagers. This way of dealing with environmental issues is therefore not a solution to the environmental impacts of the REE industry.

11. Export Restrictions and Smuggling

11.1. Introduction

The central government's export strategy aims to reduce the outflow of REE from China (see figure 11-1). As chapters 6 and 7 have shown, the central government deems that the export of REE at low prices is problematic. It has decreased REE exports in recent years. To control exports, it has established a quota that prescribes a maximum volume of REE exports. Export licenses limit the number of export enterprises and export taxes raise the price of REE exports.

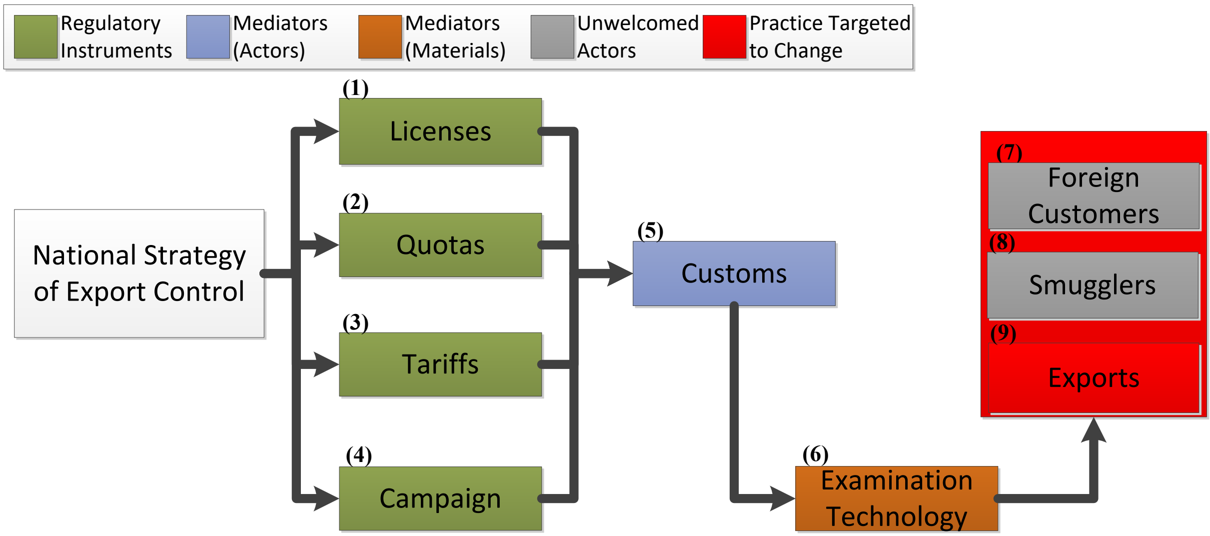

Figure 11–1: Translation process of the central government's strategy to control exports.

In contrast to industry reorganization, resource conservation and environmental protection, implementation of the national export strategy relies less on mediation by local governments. The relevant actors are first and foremost the General Administration of Customs (GAC) as a mediator and foreign customers and smugglers largely as actors, which the central government seeks to marginalize. Resistance against export restrictions comes from the national and international side: on the national side, smugglers illegally export REE. On the international side, international consumers and governments try to bring about the elimination of the export restrictions through international law. Two separate chapters analyze these two types of resistance. This chapter deals with the national strategy of export restrictions and the national resistance from smuggling. The next chapter examines the dispute between China and foreign governments.

This chapter shows that smugglers use the material characteristics of REE to bypass customs examinations. Many trading companies also use various legal loopholes found in REE export restrictions. Some customs officials join this network of resistance in exchange for bribes. The central government's policy shifts aim to intensify examination of exports in a campaign-style manner, tighten export regulations and research new devices for better examining the material composition of exported REE at customs.

The chapter finds that the central government's new approach to dealing with the illegal export of REE has considerably reduced smuggling. This is also due to a drop in demand from abroad.

The chapter starts with an outline of the national strategy for export restrictions and the three main regulatory instruments introduced to implement the strategy: the export quota, licenses, and taxes (11.2). The next section focuses on the customs and exporting enterprises as important actors for implementation (11.3). Then, the chapter turns to analyzing the extent of smuggling and finds explanations for this phenomenon (11.4). The final section shows how the strategic readjustment of the central government has reduced smuggling (11.5).

11.2. National Strategy of Export Restrictions

11.2.1. National Strategy

The national strategy seeks to limit exports. The central government argues that export restrictions support resource conservation, environmental protection and industry upgrading. The strategy dates back to a government notification of 2005 which prescribed limiting the trade of energy-intensive and pollution-intensive products. The notification stated that "the export volume of REE should be appropriately reduced"[262] (NDRC 2005). The draft of the Special Plan for the Development of the Rare Earth Industry by the Ministry of Industry and Information Technology (MIIT) planned to control REE exports at 35,000t annually (Tse 2011), which is about 27 percent of the REE production of 2009. This figure is almost half of all 2005 exports. To translate this strategy into practice, the central government used three regulatory instruments: the export quota, licensing and duties (Zhang L et al. 2015). These measures were

[262] 对稀土等产品出口数量要适当调减

lifted following a WTO ruling in 2014 (WTO 2014a, 2014b). This is addressed as part of chapter 12.

11.2.2. The Export Quota

The export quota is a quantitative limit on the export volume of a product. Chinese trade policy applies export quotas for a wide range of products including food, many metals, coal, oil and car parts.[263] The Ministry of Commerce used an export quota for REE for the first time in 1999 (MOFTEC 1998, 1999). The Commodity Catalogue for Export Licensing Management of 2012[264] listed 79 REE items subject to the export quota (MOC and GAC 2012).

Figure 11–2 shows the national export quota and actual exports from 2000 to 2013.[265] The quota was relatively constant from 2000 to 2004. The leap in the quota from 2004 to 2005 was due to a change in the calculation basis and the inclusion of foreign enterprises in the quota.[266] In other words, there has been no significant increase.

Since 2005, the MOC has successively decreased the export quota, with the steepest reduction of 40 percent occurring in 2010. Thereafter, the quota was almost static. In total, the quota decreased from 65,610t in 2005 to 30,999t in 2013. Overall, the domestic extraction target increased slightly, while the export quota dropped significantly.

[263] The export quota is based on Art. 19 of the Foreign Trade Law and Art. 36 of the Administrative Regulation on Commodity Import and Export Management (NPC 2004; State Council 2005b).

[264]出口许可证管理货物目录

[265] The quota is issued biannually.

[266] In 2005 the basic calculation unit was changed from REO content weight to gross weight.

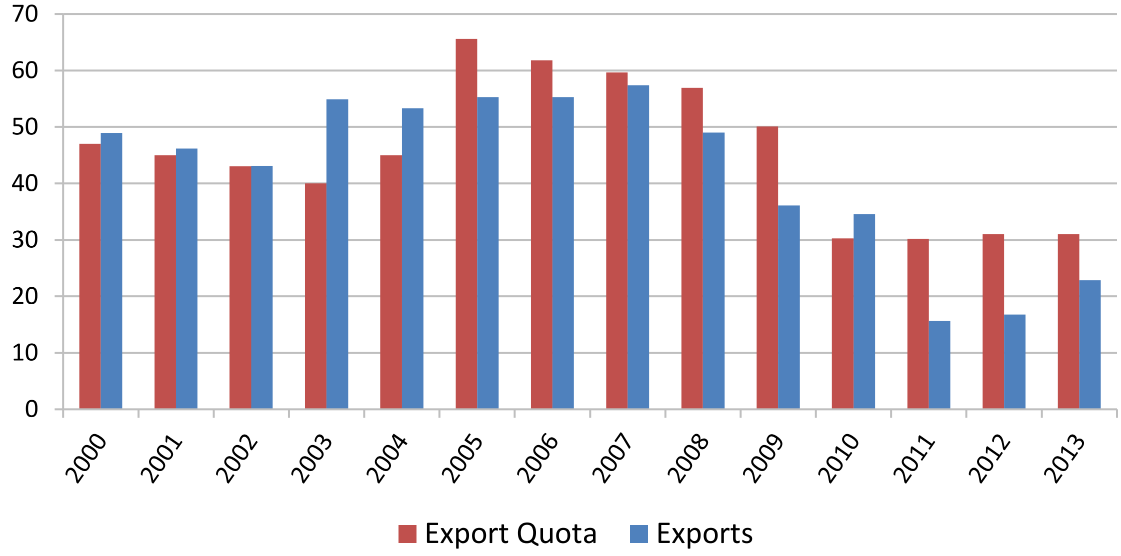

Figure 11–2: The export quota and exports from 2000 to 2013 in thousand tons gross weight (and REO content in tons until 2005 for the export quota). Because the export quota for 2002 could not be obtained, the value has been estimated by the author. Sources: Tse 2011, MOC 2007, MOC 2013, Su WQ 2009; NDRC 2009, 2010, 2011, 2012, 2013, 2014.

The government reformed the quota in 2012. In order to better control the outflow of single REE groups, the Ministry of Commerce (MOC) issued separate quotas for LREE and HREE. In 2013, LREE accounted for 27,382t (88.3 percent of the total quota) and HREE for 3617t (11.6 percent of the quota). This division of the quota indicates that the MOC intended in particular to limit the export of HREE. Another change in 2012 was the requirement for exporting enterprises to pass an environmental assessment by the Ministry of Environmental Protection (MOC 2012a, 2012b).

11.2.3. Export Licensing

The export quota was linked to a licensing system that functions as a filter for enterprises seeking to gain access to exports. Enterprises applied for a special REE export license which gave them a share of the national export quota.[267] The conditions for obtaining a REE export

[267] The application for export licenses occurs in two steps: local state-owned enterprises as well as private enterprises send their applications to the provincial commerce bureaus. These agencies carry out a primary examination of the applications. Finally, they send the shortlisted applications with their suggestions to the Foreign

license included ownership of a general export license, experience in exporting REE, proof that supplies of raw materials were obtained from officially registered mines, and compliance with environmental, land and social regulations. Moreover, export service firms had to prove a minimum registered capital of 50 Million RMB and an ISO 9000 certification. These requirements were not very demanding, yet the issuance of individual quotas depended on many factors. According to the MOC, the enterprise quotas were calculated on the basis of individual export volumes and values over the last three years. The MOC has reformed the calculation of the formula in recent years, but it is unclear to what degree this was practically applied (MOC 2012a).

The MOC reduced not only the volume of REE exports but also the number of exporting enterprises. This was on the one hand related to the strategy of industry reorganization in order to reduce the number of enterprises in the REE industry. On the other hand, this left enough export volume for big enterprises while decreasing overall exports. The number of licensed enterprises dropped from 47 in 2006 (plus approximately 10 foreign-invested enterprises) to 28 in 2013. If various subsidiaries of enterprise groups are considered as one enterprise, there were only 18 enterprises with export licenses in 2013 (including foreign-invested enterprises) (MOC 2005, 2013).

Figure 11–3 shows the distribution of the quota among enterprises in 2013. There were basically four groups of exporters. First, the large state-owned mining enterprises (SOEs) were large exporters, accounting for more than 40 percent of the export quota. The largest exporter was Baogang with 11.5 percent of the total quota (3566t), while Minmetals accounted for 6.6 percent, CNMC 5.3 percent and Chinalco 3.2 percent. The second most important group were foreign-invested joint ventures with 26.3 percent. The foreign-invested enterprises have a particular interest in exporting REE in order to supply their overseas downstream operations. The joint ventures of the Belgian-owned Rhodia were the second-largest exporter with 10.8 percent (335t) and Molycorp's joint ventures were third with 8.8 percent.[268] The third group were trade service firms which are themselves not involved in the REE upstream industry but in the trade of REE, for instance Sinosteel (3.4 percent) and China Jiangsu Non-Ferrous Metal Import Export (5.9 percent). Fourth were private-owned companies such as Ganzhou Qiandong

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Trade Department (对外贸易司) of the MOC and the China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters (CCCMC), which is tasked with re-examining the applications and proposing a summarizing opinion to the MOC for a final decision. Central state-owned enterprises (COE) apply directly to the MOC for licenses (MOC 2012b; CCCMC 2013).

[268] Molycorp purchased the Canadian mining company Neo Material Technologies in 2012. It also took over Neo's two subsidiaries in China, which own export quotas (Bradsher 2012b).

(3.5 percent). Many domestic producers did not have individual export quotas, such as the Ganzhou Rare Earth Group. They had to export their REE via trading companies.

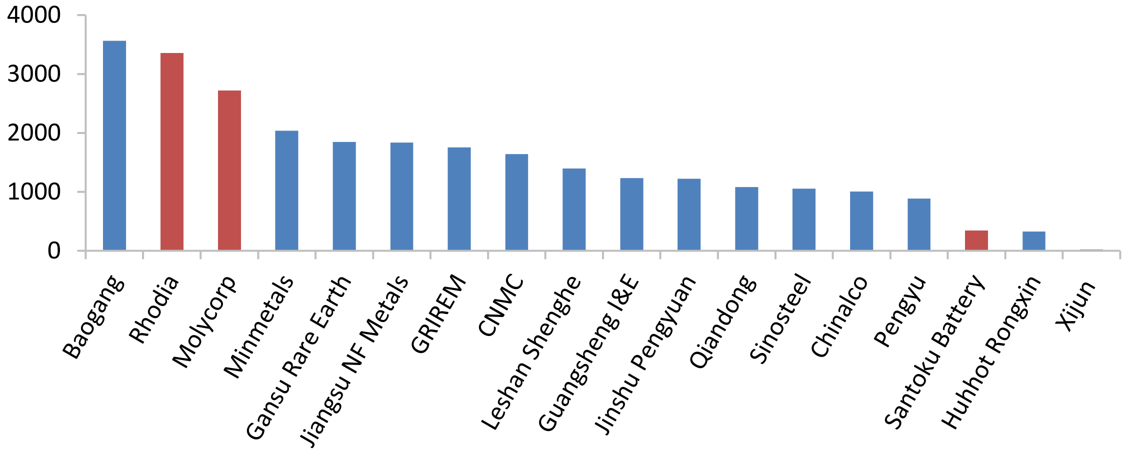

Figure 11–3: Enterprise-specific export quotas in 2013 in tons. Blue: Chinese enterprises; red: foreign-invested enterprises. Source MOC 2012a, 2013a.

11.2.4. Export Duties

Export duties are the third regulatory instrument for controlling exports.[269] Whereas the quotaand licenses limited the amount exported, the duties aimed at controlling exports through increasing the export price. REE have been subject to export duties since 2005. The central government used to promote exports through valued-added tax reimbursement, but successively lowered the reimbursement and totally dropped it in 2005 (GAT 2005; Dou XH 2005).

Corresponding to the successive decrease in the export quota, the export duties for REE have been increasing. As can be seen in Figure 11–4, the average export duty for REE products increased from about 10 percent in 2007 to about 20 percent in 2008 and have remained stable since then at a duty of between 15 and 25 percent. Moreover, the number of REE items subject to duties increased from 24 in 2007 to 57 in 2014.

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[269] Similar to the export quota and the licensing system, the duties are based on stipulations made in the Foreign Trade Law. The REE resources are listed in the Export Product Custom Duty List (关于 2013 年关税实施方案的通知) (Custom Tariff Commission 2012).

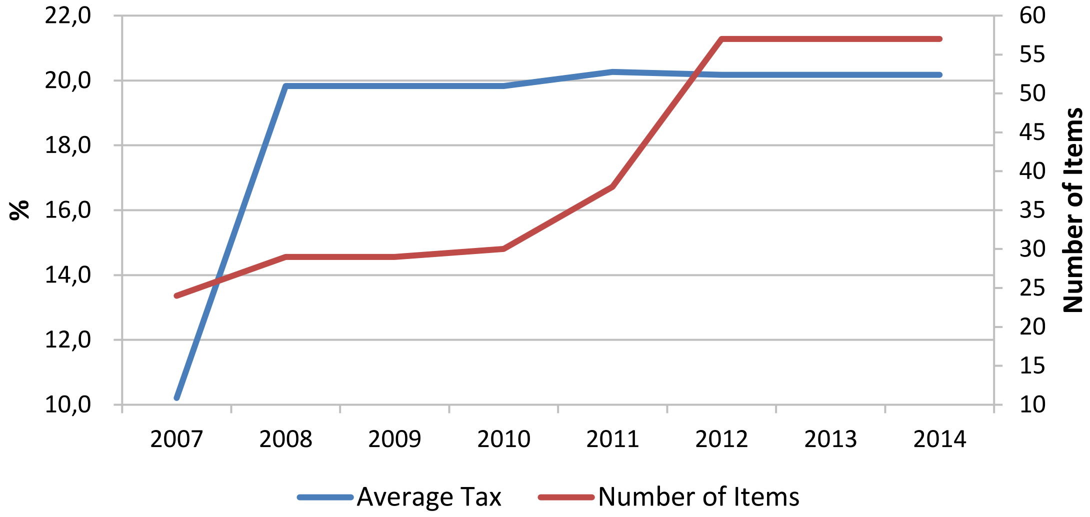

Figure 11–4: Average export duties for REE and the number of items from 2007 to 2013. Source: CRE 2011b, 2011c, 2013; Custom Tariff Commission 2012.

11.3. Enterprises and Customs

11.3.1. Problematization of Enterprises

The implementation of these regulatory instruments in export practices relied on the mediation of customs officials and the cooperation of exporting enterprises. The enterprises were central to the implementation of the strategy as they export the REE. Many enterprises criticized the quota. The Inner Mongolia Rare Earth Industry Association[270] criticised in 2004 that Inner Mongolian enterprises' share of the national quota was too low. A Baogang representative said that: "The quota which the state currently assigns to our company can only satisfy one third of the export volume, at most half. Only if the quota is increased 1.5 to 2 times can itmeet the enterprise's export demand"[271] (Liang XL and Yang XH 2005, pp. 12-13). In their view, the inability to meet many foreign orders due to the quota harmed the credibility of the enterprise. Other criticism held that the quota could not accommodate the market's supply-demand situation. Moreover, Chinese enterprises feared that the quota was leading to more competition from abroad as more projects were developed overseas (Lin H 1999).

[270]内蒙古自治区稀土行业协会

[271]目前，国家给我们企业下发的配额只能满足出口量的1／3，最多不过1／2，在现有的基础上再给1．5倍或者2倍的配额才能满足企业的出口需求。

The decreasing export quota since 2006 gave enterprises less and less export leverage. A representative of a Jiangxi refiner said: "We definitely will propose to increase the quota next year" (Zhu YC 2010).[272] But enterprises without any export quotas were even worse off. A director of a Guangzhou enterprise without a quota said that "now the quota is a difficult thing" (Consultative Conference 2010).[273]

Despite their opposition, the enterprises could not significantly influence the determination of the quota. Of the 34 enterprises that had individual quotas in 2009, only five had managed to increase their quota as of 2013. The big SOEs faced enormous quota reductions, for instance Minmetals by 57 percent and Baogang by 54 percent.

However, dissatisfaction with the quota did not necessarily lead to smuggling. In particular, the large REE enterprises have an interest in limiting smuggling: smuggling can bring down export prices and reduce revenues (REI 2012c).[274]

11.3.2. Customs Clearance

The Chinese customs facilities under the control of the General Administration of Customs (GAC) are the most important mediator for the national export strategy. Customs clearance is essential to the everyday implementation of the central government's export policy. It ensures that no REE that is not allowed to be exported crosses the border (see Figure 11–5).

The GAC is responsible for supervising and recording any kind of material flows crossing Chinese borders and for levying duties. The entire country has 46 customs units, with 600 subordinate customs units and nearly 4000 control points (GAC 2013). The clearance of REE commodities is limited to a few customs checkpoints in Tianjin, Shanghai, Qingdao, Huangpu, Huhehaote, Nanchang, Ningbo and Nanjing (MOC 2012c). According to the customs statistics, the checkpoints in Shanghai and Tianjin clear most of the REE exports. Larger quantities are also exported from Qingdao, Huangpu and Nanjing (Ruidao 2012a, b, c).

The customs examination process is also important for REE exports: Exporting enterprises declare goods to be exported at the local customs facilities with the required documents. These include the shipping order and shipping list, the export license, proof of the

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272 "我们一定会提建议，希望明年的出口配额可以扩大"

273 现在出口配额是一顿难求

274 A representative of Baogang said that "the illegal production and export channels of REE products have a huge impact on the REE market. We vehemently hope that the government will adopt strict measures to strike against illegal production and smuggling" (非法渠道生产和出口的稀土产品，对稀土市场冲击很大，我们强烈希望国家能采取严厉措施，打击非法生产和走私稀土的行为) (REI 2012d).

individual export quota and the place of production. In the next step, the customs personnel check the documents' completeness and validity. An export service enterprise might also assist the exporting enterprise.

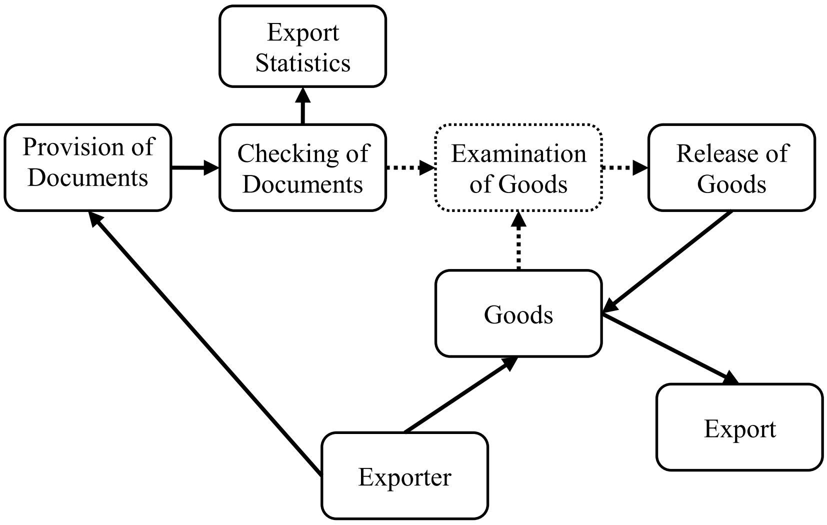

Figure 11–5: Simplified process of commodity clearance at Chinese customs. Source: Author's Illustration based on International Trade 2010.

The examination of goods is the most essential step. Exporters arrive at the customs point with containers. The examination verifies that the exported goods correspond with the information given in the declaration documents. This step is not comprehensive, since customs often only do random checks. After the examination of the goods, further steps are taken such as paying duties or applying for value-added tax reimbursements. After that, the goods are released and are ready for export (International Trade 2010).

11.4. Smuggling

11.4.1. The Extent of Smuggling

The central government's export restrictions have been successful at reducing the official exports of REE. Between 2005 and 2011, official exports decreased by more than half from 57,400t to less than 25,000t. However, actual exports are higher than official statistics due to smuggling. As many enterprises have different interests to those of the central government, some of them resisted the export restrictions. Smuggling is the result. Legal loopholes, which are in accordance with the export regulations but contrary to the national strategy for export restrictions also existed.

Smuggling has been a severe problem for the central government. According to the State Council, between 2006 and 2008 exports of REE were 25 to 40 percent higher than official export data. The smuggled amount decreased to about 17 percent in 2011 (State Council 2012a). Figure 11–6 shows the revised export data according to calculations made by the author using import data from UN Comtrade of all importing countries and national Chinese export data (UN Comtrade 2014; NDRC 2014): the smuggled amount was highest in 2006 and 2007, between 22,000 and 27,000t. Although there was more limited smuggling in 2008 and 2009, there was another increase in smuggling in 2010 and 2011 due to the tightening of export restrictions. However, in 2012 and 2013 smuggling decreased markedly. The smuggled REE are mostly destined for Japan and South Korea and lesser amounts to the US and the EU (Zhang GD 2010a). Figure 11-6 shows that even when smuggled REE is taken into consideration, exports decreased from their peak in 2005.

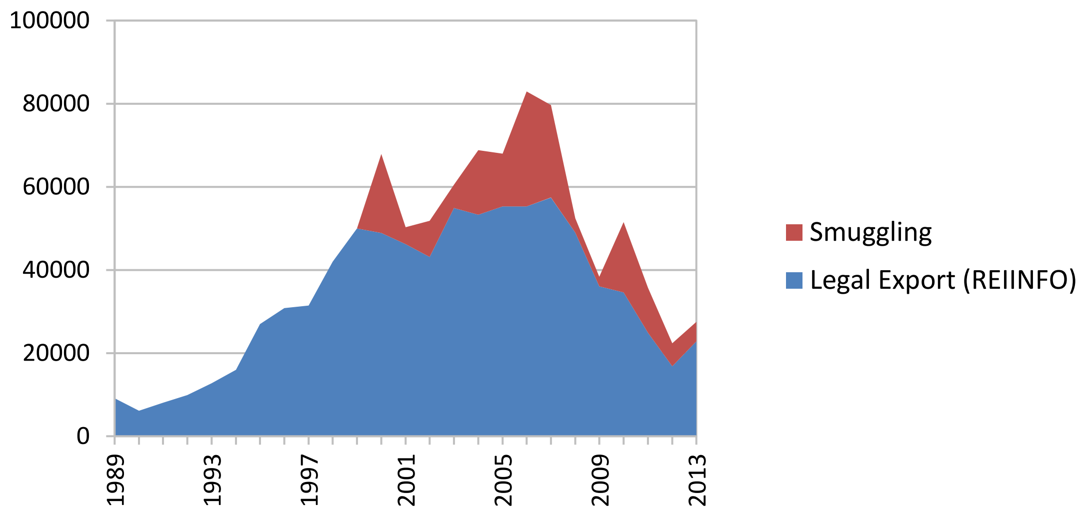

Figure 11–6: Official exports and estimates of smuggled REE in t. Wübbeke 2015.

Large networks are involved in smuggling, including many intermediary people. They include the people purchasing REE in the production areas, those receiving and transporting the goods and those declaring the goods with customs. There are export service enterprises specializing in smuggling REE. They have years of experience in exports and connections within the customs offices (Zhang GD 2010a).

For these networks, smuggling is a profitable business. A smuggler from a south China-based enterprise, for example, said that he could smuggle about 10 tons of REE per day to Hong Kong. For each ton of lanthanum carbonate, the service costs are about 3500 RMB. This is a cheap price given that the average export price for one ton of lanthanum carbonate was 144,000 RMB/t in 2012 (Zhang GD 2013a; Cheminfo 2012).

11.4.2. Counterfeiting Documents

REE smuggling often occurs not by circumventing customs control points, but by beguiling customs authorities. Smugglers attempt to avoid export goods examination in the process of customs clearance, and in this way to sidestep the process that validates the conformity of export documents to the REE being exported (see Figure 11–5).

Often, smugglers declare a different product than is actually exported. To make it more difficult, smugglers conceal REE within other products. There are even reports of REE having been declared as “furniture” or “floor tiles” (Wu YC 2013). The inability of customs to check all material flows that cross the border is welcomed by smugglers. It takes a long time for customs personnel to identify a specific trade commodity. Customs has to transfer the material to a special examination laboratory. It would considerably delay the flow of trade and require vast numbers of personnel to check all export items thoroughly (Zhang L 2013). A Qingdao customs official said that: “Rare earth products are often smuggled as different items, there are many situations where the name of the product has been changed. As smuggling activities involve many items, examination is made more difficult.”[275] (Zhang GD 2010b).

It is even more challenging to distinguish between various REE. Therefore, it is practically impossible to examine all mineral exports and other exports to ascertain whether they contain REE. Customs has to rely on random checks (Zhang GD 2013b).

11.4.3. Material Characteristics of REE Facilitate Smuggling

The material characteristics of REE support these smuggling activities. In their metallic form, REE elements have a similar appearance to iron oxide. REE concentrate is similar to talcum powder and diatomite and other minerals, which are not subject to export quotas. REE might also be bound in iron or aluminum alloys (Zhu HL et al. 2013, Customs Lawyer 2010).[276] REE can also be smuggled by reporting REE products with a lower REO content than the exported product. Due to the relatively low weight and volume of REE trade, there are also cases in which REE have been smuggled out by post, having been declared a REE product sample (REI 2012c).

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[275]稀土品种经常以其他名目进行走私，海关面对这种品名更换的情况很多，应该说我们面临的所有走私行为都是名目繁多的，这也加大了稽查难度“

[276] Depending on the alloy this can be legal if declared correctly (see below).

As an example, smugglers may fill a container with a large amount of another material, hiding the REE beneath or within it. In the declaration documents and the shipping order they indicate the cheaper material. Normally, customs personnel check the goods to be exported only superficially, for example by looking at the good's color. Even if customs conducts further examinations, they often do not discover the REE because a certain amount of luck and knowledge is needed to identify the REE from the covering material (Zhang GD 2013a, Wang JZ 2011, pp. 52-57).

11.4.4. Resistance by Customs Personnel

Customs personnel are not always effective implementers of the national strategy. The personnel are often not trained to identify REE exports. Moreover, there is the possibility that personnel take bribes from smugglers and turn a blind eye to the smuggled REE (Zhang GD 2013b). A salesman from a Ganzhou-based enterprise said: "If you want [to export] products I can help you take them. It is not a problem if you don't have quotas, using connections [to customs personnel] is possible as well"[277] (Zhang GD 2010a).

Another smuggler said that "If you have connections in the customs, you normally tell the customs personnel the container number beforehand. When you declare the goods, you make clear that this container contains REE and [ask them] to help the container pass"[278] (Zhang GD 2010a). Smuggling occurs not only at those border crossings where customs process the most REE exports, but also at other areas. These other areas may be preferable for smugglers who have connections to them since the officials working there are usually not very familiar with how to identify REE.[279]

11.4.5. Buying Quotas

Smuggling undermines goods examination by customs. Buying quotas was another illegal method of export before the export quota was dropped. Buying quotas was a common practice among REE enterprises that did not have an export license or had only limited quotas. These

[277] 你要产品我就可以想办法帮你拿，如果没配额，有关系也可以

[278]有海关方面关系的话，一般提前跟海关方面说好柜号，报关的时候指出这些柜是稀土，帮忙通过一下

[279] A smuggler said: "you certainly cannot export goods via Qingdao port, it is only possible in locations where we have good connections" (比如你想从青岛港出货，肯定不可以，只有我们关系比较熟悉的地方才可以") (Zhang GD 2010a). For instance, some smugglers use the customs facilities in Nanning, Fancheng or Wuzhou (cities in Guangxi province) (Zhang GD 2010a, Tu JB and He JB 2013).

enterprises buy quotas from REE enterprises or a corporate agent with an export quota. The enterprise with a quota then declares the REE as its own and helps the enterprise without a quota to export the REE. A representative of an enterprise from Guangzhou without a quota said that "selling and buying quotas is already an open secret in the REE industry"[280] (Consultative Conference 2010). This practice did not necessarily lead to the national quota being exceeded because only legal individual quotas were used, but it undermined the national strategy as it gave enterprises without quotas the opportunity to export. However, with the decrease in the national export quota since 2005 most enterprises use up their own quotas, making it more difficult to sell and buy individual quotas (Zhu YC 2010).

11.4.6. Loopholes in the Export Quota

REE products coul also be exported legally even if they exceeded the export quota. The problem was that not all REE products were included in the quota. The Commodity Catalogue for Export Licensing Management mentions several dozens of REE products included in the quota. The Chinese REE industry, however, produces about 1000 different kinds of products. Some REE were "invisible" to customs officials because they were not listed in the Catalogue for Export Licensing Management and some were not even been specified in the export statistics (Zhang L 2013).

For instance, when the MOC tightened the quota in 2010, many exporters began to export REE in the form of iron alloys. The quota covered REE alloys with a REE content greater than 10 percent but not alloys of less than 10 percent. To circumvent the quota, exporters smelt REE into iron alloys and extract the REE again from the iron alloy after export. In this way, they were able to legally bypass the quota until the government made changes to the quota and closed these loopholes. Other trade items, for example NdFeB alloy strip-cast permanent magnet material,[281] did not even exist as a single category in the customs statistics until recently (China Magnet 2011).

[280] 配额买卖早已是稀土行业公开的秘密

[281] 钕铁硼合金速凝永磁材料

11.5. Strategic Readjustment by Customs Agents

Before 2010, the government failed in its attempts to win enterprises and customs personnel over to its side so as to keep exports within quota limits. The central government started a strategic readjustment to tackle these challenges in 2010.

11.5.1. Intensification of Examinations by Customs

In early 2012, customs intensified its efforts to track REE smuggling activities. Customs discussed with the Ministry of Industry and Information Technology (MIIT), the Association of China Rare Earth Industry (ACREI) and 13 leading REE exporting enterprises how to improve measures against smuggling (REI 2012d).

Under the national campaign against smuggling in 2012, called "Shield of the National Gate,"[282] customs stepped up its actions against the trafficking of drugs, weapons, endangered species, scrap, cultural goods and minerals. This included an intensification of the examination of export commodities and better training of customs personnel. Customs also participated in the MIIT's campaign against illegal mining and trade of REE in 2013 (MIIT 2013c).

11.5.2. Redefinition of the Quota

Customs tried to readjust the national strategy to eliminate the legal loopholes in the quota system. Customs had systematically improved the Commodity Catalogue for Export Management, which defined the REE items to be subject to the quota (see sub-section 11.4.6). As *Figure 11*–7 shows, the number of trade items covered by the quota nearly doubled between 2005 and 2013. An interesting case is the export of iron alloys with less than 10 percent REE content. As mentioned in sub-section 11.4.6, the export of these alloys surged when the MOC decreased the quota in 2010 as the alloys offered a way of bypassing the quota. Customs increasingly included more and more iron alloys, such as NdFeB alloys, under the quota system from 2010 onward. REE iron alloys with a REE content of less than 10 percent were included only in 2011 due to the increasing exports of these goods (GAC 2011).

[282] 国门之盾

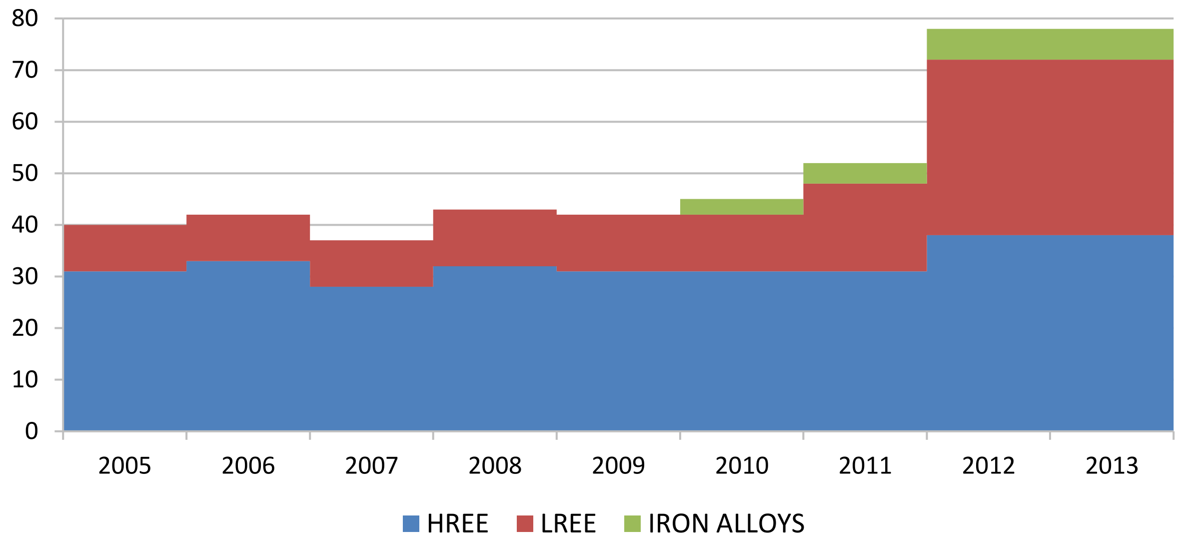

Figure 11–7: Number of REE items covered by the export quota and the licensing system from 2005 to 2013 by type of product. Source: MOC and GAC 2004 to 2013.

Through this measure, customs successfully responded to this method of bypassing the quota. After 2011, exporters could no longer legally export iron alloys with less than ten percent REE content if they exceeded the export quota. However, fighting "legal" smuggling is not easy. Exporters found new loopholes, bypassing the quota by exporting NdFeB melt-spun ribbons.[283] These ribbons are a raw material for the production of NdFeB permanent magnets, containing about 30 to 40 percent neodymium and had not been included in the export quota. Using this method, exporters exported large amounts of neodymium (Yang M 2012b).

11.5.3. Examination Technology

One particular central government response to smugglers is to minimize the effort required to examine the exported goods. The central government supports research on new examination technologies that can fulfill identification of REE more effectively. Under an MIIT research project, a subsidiary of the state-owned China Iron and Steel Research Institute Group developed the "Rare Earth High-Speed Identifier"[284] (see Figure 11–8) (Beijing Science and Technology Commission 2013; CRE 2012).

[283] 甩带片

[284] 稀土快速鉴别仪

Figure 11–8: REE High-Speed Identifier PORT-X300 by NCS Testing Technology Ltd. (2013).

The identifier is a portable device weighing 1.5 kilograms that can identify whether a material contains REE within 5 seconds and determine the concentration of a single REE within 5 to 20 seconds (NCS Testing Technology Ltd. 2013). This is a powerful tool for customs personnel as it makes the examination much less time consuming and more reliable than the chemical tests and the superficial checks of a material's outer appearance. With this new technology, customs personnel can perform on-site checks and do not need to transfer REE to special laboratories for testing. The device could significantly strengthen the examination of REE.

Various customs checkpoints have already successfully tested the device (Beijing Science and Technology Commission 2013). The identifier is very costly, at 200,000 RMB each, but the device might increase export revenues if it prevents smuggling (Wu YC 2012).[285] It is, however, still too early to evaluate to what degree the device can decrease smuggling.

11.5.4. Effect of the Policy on Smuggling

Compared to actions to address illegal mining and environmental pollution, the fight against smuggling has proven more successful. The government succeeded in decreasing the volume of smuggled REE from more than 27,000t in 2006 to less than 5000t in 2013. Better training of customs officials and the intensification of examinations through campaigns led to the uncovering of an increasing number of smuggling cases. In 2011, customs confiscated nearly 800t of smuggled REE and in 2013 more than 2300t (UN Comtrade 2014; NDRC 2014). Considering that 2300t have been confiscated by customs and more than 4,600t of REE have been smuggled, it can be assumed that smuggling would have been 50 percent higher in 2013 without customs' activities. However, the decrease in smuggling also results to a considerable

[285] Estimates suggest that the state foregoes about 400 Million RMB of revenue from export duties if 20,000t of REE are smuggled (Wu YC 2012).

degree from a decline in foreign demand for REE. Since 2011, the export volume has been only about half of the quota. Many enterprises with REE export licenses therefore had no incentive to smuggle REE (NDRC 2012, 2013). As the export restrictions were lifted in 2015, smuggling might be even less of a problem in the future.

11.6. Conclusion

This chapter examined the Chinese export restrictions on REE and the phenomenon of smuggling. It finds that smuggling used to be a big problem for the export restrictions, but smuggling has decreased considerably since 2010.

The government implemented its export restrictions through the export quota, licenses and taxes. Before 2010, smuggling undermined the controls due to untrained and sometimes corrupt customs personnel. Exporting enterprises used the similarity of REE's appearance to that of other metals to make the discovery of REE smuggling during export examination by customs personnel more difficult. Exporters used legal loopholes to export REE items that were not included in the export quota.

While this led to enormous volumes of smuggling between 2007 and 2009, the customs agencies readjusted their strategy: they trained their personnel to identify REE, intensified customs checks, improved the regulatory framework and acquired better examination technology. Although there small volumes of REE are still smuggled, the strategic adjustment had an enormous effect. The falling demand for REE from abroad also contributed to the drop in smuggling activity.

12. Export restrictions and the WTO

12.1. Introduction

This chapter deals with the resistance of foreign governments to the Chinese export restrictions through bilateral and multilateral mechanisms. Foreign governments successfully tried to get China to eliminate its export quotas, licenses and duties in order to secure a more stable REE supply for their home industries.[286]

Foreign enterprises are important customers for Chinese REE, but they are in a weak position because they have very limited influence on China's domestic policies. The most promising way for them to exert influence was to mobilize their own governments to discuss the problem with China at the bilateral or international levels. Foreign governments did increase their pressure starting around 2010 after China significantly decreased its export quota by 40 percent. In particular, the governments of the EU, Japan and the US openly criticized the Chinese strategy and sought to establish bilateral agreements (EU-China News 2011; Asahi 2011; Montgomery 2010).

When China's resistance to changing its position on export quotas did not weaken and bilateral talks failed, the EU, Japan and the US jointly filed a case with the Dispute Settlement Body (DSB)[287] of the World Trade Organization (WTO) in 2012. Within the DSB, China and the plaintiffs disputed with each other over the Chinese export restrictions. The plaintiffs accused China of violating several WTO rules. China countered by citing several exceptions in the WTO framework which allow export restrictions under certain conditions.

The DSB ruled in favor of the plaintiffs in March 2014 and confirmed the decision in August 2014. The resistance of the OECD countries had been successful. As a result of the decision, China was required to totally lift its export quota, licenses and taxes on REE (WTO 2014a, 2014b). Despite this successful resistance by the foreign governments, here it is argued

[286] In the disputes between China and the OECD countries, minimum export prices and other measures were also of concern. These are not discussed here because they do not have a prominent position in the dispute over REE and empirical examination of this measure is difficult.

[287] The DSB is an international mechanism that makes binding decisions over whether the members' trade policies are in accordance with WTO rules.

that China had already achieved much of what it aimed for with the export restrictions and that the DSB decision came too late to get China to export more REE.

This chapter will first analyze the strategy of OECD countries to convince China via bilateral talks to eliminate its export restrictions (12.2). It then turns to the initiation of the DSB case against Chinese REE export restrictions at the request of some OECD countries (12.3). The main part consists of an analysis of the resistance of OECD countries and strategic adjustments by China within the DSB panel (12.4).

12.2. The Dispute of 2010

12.2.1. Resource Security in OECD countries

The dispute over Chinese REE export restrictions in 2010 occurred in the wider discourse on resource security in OECD countries. After disregarding resource security issues for most of the previous two decades, OECD countries began to worry about their raw material supplies starting around the mid-2000s (Buijs and Siever 2011; Tiess 2010, pp. 191-192).[288]

The European Commission released its Raw Materials Initiative in 2008 (European Commission 2007, 2008), Germany disseminated the Raw Materials Strategy[289] in 2010 and Japan formulated its Strategy for Ensuring Stable Supplies of Rare Metals[290] in 2009. Some states also built up governmental bodies to better deal with supply security.[291] Raw material supply became a more and more important issue on the political agenda (German Ministry for Economy and Technology 2010; Japanese Ministry of Economy, Trade and Industry 2009; Hilpert 2013).

[288] OECD countries widely debated the supply security of oil and other resources after the oil shock of 1973, but there was less attention in the 1980s and 1990s. After the cold war and the retreat of the state from the resource sector, there was a belief that worldwide markets were opening up and resources would be distributed under free market rules (Buijs and Siever 2011).

[289] Rohstoffstrategie

[290] レアメタル確保戦略

[291] The German government set up the Raw Materials Agency (Rohstoffagentur) under the auspices of the German Institute for Geosciences and Natural Resources to evaluate the raw materials markets and provide better knowledge to the industry. The French Ministry for Economy, Finances and Industry founded the Strategic Metals Committee (Comité pour les métaux stratégiques) (German Institute for Geosciences and Natural Resources 2013; French Ministry for Economy, Finances and Industry 2011).

This renewed attention to supply security came about due to various reasons. First, OECD countries consider the supply of a range of materials as critical to the development of the high-tech industry. These "critical materials" are of "significant economic importance for key sectors" (European Commission 2008, p. 3), in particular for cutting-edge clean energy and information technologies (USDOE 2010, 2011; European Commission 2010).

Second, OECD countries are highly dependent on raw material imports. Import dependencies of over fifty percent for most metals make them highly vulnerable to increases in resource prices, which doubled between 2000 and 2008. After a steep decline at the beginning of the global economic crisis, prices again rose to high levels in 2009 (Sievers and Tercero 2013; IMF 2013b).

Third, the OECD countries criticize state interventionism in resource-rich countries (Argiatello and Fliess 2013). A range of countries try to better control their domestic resources through export restrictions and the transfer of mining assets to state-owned enterprises. Supplier countries want to generate huge revenues from high resource prices and possibly use natural resources as political instruments (Bremmer and Johnston 2009; Humphreys 2013). In addition, OECD countries are concerned about political instability in many supplier countries (European Commission 2008, p. 5).

Fourth, the OECD countries are convinced that the increasing demand from emerging countries contributes to a tense supply situation. Through foreign direct investment in the resource sector, emerging countries are competitors for overseas resources. The OECD countries see the strong involvement of state-owned enterprises in investment deals as very problematic (Leverett 2009).

China is at the center of these concerns, especially with regard to energy security (Mayer and Wübbeke 2013). The OECD countries attribute the increase in resource prices to a large degree to the huge demand from China, which is the largest consumer of many metals (Buijs and Sievers 2011). The EU Raw Materials Strategy stated that "in particular China accounted for more than 50% of the growth in world consumption of industrial metals between 2002 and 2005" (European Commission 2008).

The OECD countries see China's role as a resource supplier as problematic. Of the 14 materials which the RAND corporation classified as critical, eleven are produced by China (Silberglitt et al. 2013; Sievers and Tercero 2010). OECD countries see many of these materials as critical because China is their main producer. The Chinese government's decisions to restrict the exports of these materials have been a particularly contentious issue.

12.2.2. Beginning of the REE Dispute

REE did not play a prominent role in the resource security discourse of the OECD countries until 2010. Industry warnings against a possible supply shortage of REE did not enter the political realm. The topic occasionally flared up in the media without garnering much attention (Bradsher 2009). The US-China Economic and Security Review Commission admonished in 2009 the lack of an official response to China's export restrictions (US-China Economic and Security Review Commission 2009).

In April 2010, the United States Trade Representative (USTR) criticized China's export restrictions on REE (USTR 2010). The United States Government Accountability Office warned in the same month that the American defense industry was highly reliant on Chinese REE and that it would take up to 15 years to fully revive the American REE industry (USGAO 2010).

Concomitantly, an expert group chaired by the European Commission ranked REE as the material with the highest supply risk among 14 critical materials. It said that "for the critical raw materials, their high supply risk is mainly due to the fact that a high share of the worldwide production comes from China" (European Commission 2012). This problematization of REE by state institutions laid the ground for the subsequent politicization of REE.

The public outcry in OECD countries happened in the latter half of 2010. A first trigger was the Chinese Ministry of Commerce's decision to lower the export quota for REE by a further 40 percent in July 2010 (MOC 2010). This measure attracted the attention of most OECD media, albeit with a certain time lag (Asahi 2010; Bai 2010; Kaufmann 2010).[292] The concerns heightened when rumors about the Chinese ban on REE exports to Japan spread in September 2013. The reduction of the Chinese REE export quota boosted the resistance of OECD countries to the Chinese REE export restrictions (Morrison 2011).

After that, several leaders of OECD countries voiced their concerns about the Chinese REE export restrictions. US secretary of state Hillary Clinton saw this as a "wake-up call (about) being so dependent on only one source [China]". She further went on to say that she "would welcome any clarification of their policy and hope that it means trade and commerce around these important materials will continue unabated and without any interference"

[292] The Japanese newspaper Asahi, the German newspaper Spiegel and the news agency Reuters reported in August 2010 about the radical cut (Asahi 2010; Bai 2010; Kaufmann 2010) and The Economist followed with a report on skyrocketing REE prices in early September (Economist 2010).

(Gaouette 2010). The German minister of economy Rainer Brüderle warned against "a rare earth OPEC"[293] (Spiegel 2010).

The EU, Japan and the US argued that the export restrictions affected workers, manufacturers and consumers in their home countries, distorted free trade and supply chains, discriminated against foreign industries, led to price volatilities and created uncertainty in investment decisions in downstream industries (USTR 2013; European Commission 2012; BBC 2012; EU 2013a, p. 36).

12.2.3. The Failure of Bilateral Talks

In the following months, the OECD countries tried to use backdoor policies to convince China to reduce or totally lift its export restrictions. Although WTO consultations were an option, the OECD governments chose the bilateral path. To better coordinate their actions, the EU, Japan and the US established the annual Trilateral Conference on Critical Materials for a Clean Energy Future (European Commission 2013).

Various OECD politicians paid visits to Beijing to negotiate with China's leaders. In July 2011, the EU Commissioner for Trade, Karel de Gucht, travelled to China to discuss REE export policy with Minister of Commerce Chen Deming at the EU-China Economic and Trade Joint Committee. De Gucht said that the EU would be seeking a "negotiated solution" with China (EU-China News 2011). The US chose bilateral mechanisms as well (Martina and Lian 2011). The Japanese Prime Minister Naoto Kan talked about the issue with Prime Minister Wen Jiabao during a visit in May 2011 (Asahi 2011). The three governments dropped their initial idea to discuss the issue at the G20 (Montgomery 2010).

These bilateral talks did not convince the Chinese government to eliminate the export restrictions. It was easy for the Chinese government to rebuff the foreign governments' approaches, as the OECD countries could not put much pressure on China. The EU trade spokesman John Clancy said that

> This is highly disappointing and the EU continues to encourage the Chinese authorities to revisit their export restrictions policy to ensure there is full, fair, predictable and non-discriminatory access to rare earth supplies as well as other raw materials for EU industries (EU-China News 2011).

[293] "Seltene-Erde-Opec."

12.3. REE at the WTO Dispute Settlement Body

12.3.1. Raw Materials at the WTO

The WTO dispute over REE export restrictions was not the first of its kind.[294] In 2009, the EU, the US and Mexico requested the establishment of a DSB panel on "Measures Related to the Exportation of Various Raw Materials" (hereafter called "Raw Materials Case"). The case included nine materials,[295] but did not include REE, although it concerned the same export regulations that came under examination later on with regard to REE: the quota, taxes and licenses (WTO 2011). In the Raw Materials Case, the plaintiffs argued that these regulations violated General Agreement on Tariffs and Trade (GATT) rules and the Chinese accession protocol. In August 2011, the Raw Materials Case panel ruled largely in favor of the plaintiffs, denouncing the Chinese export barriers as illegitimate.[296] After a period of transition, the WTO reported that China had fully implemented the panel's decision (WTO 2013).

The outcome of this case had great implications for the REE dispute. After the ruling on the Raw Materials Case, the plaintiffs made clear that they saw this as a signal that China must eliminate its REE export restrictions (Chaffin and Beattie 2012).

12.3.2. Initiation of Consultations and Panel in 2012

In March 2012, the large consumer countries changed their strategy of resistance: the EU, Japan and the US commonly requested consultations at the Dispute Settlement Body (DSB) of

[294] The trade disputes over resource exports are part of the more general trade frictions which exist between China and the United States and the European Union. Some disputes concern steel, the automotive industry, solar and wind power equipment (Morrison 2011; Kong QJ 2012).

[295] The materials in question are bauxite, coke, fluorspar, magnesium, manganese, silicon carbide, silicon metal, yellow phosphorus, and zinc.

[296] The appellate body confirmed this decision in January 2012.

the World Trade Organization (WTO) over the Chinese REE export restrictions. The DSB established a panel to examine the case in July 2012.[297]

The plaintiffs argued that the Chinese export quota, licenses, duties and other measures violated WTO rules (Japan 2012).[298] GATT Article VIII and Article XI were at the center of the accusations. These prohibit any non-tariff barriers to trade, including quantitative restrictions and licensing (WTO 1994: Art. VIII, XI).

The plaintiffs furthermore stated that China was in violation Article X of GATT, which stipulates full public disclosure of trade regulations. While export duties are generally allowed under GATT, China agreed not to use these in its accession protocol. Paragraph 11.3 of the accession protocol states that "China shall eliminate all taxes and charges applied to exports"[299] (WTO 2001).

12.3.3. China's Strategic Adjustment

China reacted to these accusations by trying to convince the DSB panel that its export restrictions conformed to WTO rules. It positioned itself as a developing country that wanted to conserve its resources and protect its environment (CNTV 2012). China justified its export restrictions through exceptions that are prescribed by Article XX of the GATT. Paragraphs XX(b) and XX(g) define two exceptions that allow export restrictions under certain conditions: First, paragraph XX(b) refers to environmental protection measures, which are

> necessary to protect human, animal or plant life or health (WTO 1994: Article XX).

Second, paragraph XX(g) refers to measures

> relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption (WTO 1994: Article XX).

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[297] Subsequently, a number of third parties joined the original plaintiffs: Brazil, Canada, Colombia, India, the Republic of Korea, Norway, Oman, the Kingdom of Saudi Arabia, Chinese Taipei, Vietnam, Argentina, Australia, Indonesia, Turkey, Peru, and the Russian Federation (WTO 2013).

[298] There are many articles that the plaintiffs argued China was violating. Only the most important ones are discussed. In total, the plaintiffs referred to Articles VII, VIII, and XI of GATT and paragraphs 2(A)2, 2(C)1, 5.1., 5.2, 7.2, 8.2 and the reference made in paragraph 1.2 to the commitments found in paragraphs 83, 84, 162 and 165 of the Report of the Working Party on the Accession of China (Japan 2012).

[299] There are exceptions for many minerals, but REE are not included.

Article XX was at the center of the dispute. The Chinese government argued that its export quota aimed at resource conservation as described under paragraph XX(g) and export duties were implemented in the interest of environmental protection as under paragraph XX(b). Contrary to the Chinese position, the plaintiffs presented China's policy as motivated not by environmental concerns but by economic interests.

12.4. Dynamics of Dispute Settlement

12.4.1. The Core of the Dispute

The following section analyzes China's strategic readjustment and its response to the plaintiffs during the dispute settlement procedures. The positions of China and the plaintiffs with regard to paragraphs XX(g) and XX(b), and the chapeau of Article XX are examined. Table 12–1 shows the original text of these three parts of Article XX as a reference for the following discussion. Table 12–2 contrasts the different positions of China and the plaintiffs.

Article	**Text**
Chapeau of Article XX	"Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting Party of measures:"
Paragraph XX(b)	"necessary to protect human, animal or plant life or health"
Paragraph XX(g)	"relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption"

Table 12–1: The relevant Article XX and the paragraphs XX(b) and XX(g), which wereare at the center of the REE WTO dispute between China and the plaintiffs.

	Issue	Chinese position	Position of Plaintiffs
General Issues	Effect of Export restrictions	Export restrictions help resource conservation and environmental protection as part of a "comprehensive conservation policy for rare earths"	Export restrictions do not effect resource conservation or environmental protection but discriminate against some market participants and distort trade
	Size of Chinese Reserves	China has 23 percent of global reserves and REE face depletion within 15 years	China has more than 23 percent of global reserves and has REE for another 600 years
Chapeau Article XX	The relevance of Chapeau of Article XX	The chapeau is not relevant for the interpretation of paragraphs XX(b) and XX(g)	The requirements of the chapeau are relevant in addition to the paragraphs XX(b) and XX(g)
Paragraph XX(b)	Application of Paragraph XX(b) to the Chinese accession protocol	Article XX can be applied to article 11.3 of the accession protocol because the Chinese accession protocol is an integral part of GATT	Article XX is not applicable to article 11.3 of the Chinese accession protocol
	Meaning of "necessary"	Export duties are necessary in a "synergetic relationship" with other policies because the increased export prices lead to less foreign demand and in turn less production-related pollution	Export duties are not necessary. Increased export prices and less foreign demand do not necessarily lead to less production and pollution
Paragraph XX(g)	Meaning of "relating to"	Export measures are part of an integrated policy, there is no direct causality	Measures must be "primarily aimed at" resource conservation
	Meaning of "conservation"	Resource conservation refers to preservation of exhaustible resources and preservation for economic development	Resource conservation refers only to preservation of exhaustible resources
	Meaning of "in conjunction with restrictions on domestic production or consumption"	There is a balance between domestic and export quotas: The production quota is an effective means to restrict production. Domestic consumption is also restricted by the export quota. Resource taxes restrict production and consumption.	There is no balance between domestic and export quotas. The export quota is not balanced by domestic policies. Because accession rules are not based on conservation and the production quota is not effective, the principle of even-handedness is not fulfilled. The export quota is a restriction on foreign consumption, not domestic consumption. Resource taxes do not restrict production or consumption

Table 12–2: Positions of China and the plaintiffs on various issues.

12.4.2. Paragraph XX(g)

Paragraph XX(g) allows export restrictions in order to conserve resources. China argued that its export quota met the exceptions under paragraph XX(g). The plaintiffs in contrast held that the export quotas did not meet these exceptions. The dispute on paragraph XX(g) related to the linkage between the export quota and resource conservation, the even-handedness of the export restrictions, the meaning of "resource conservation" and "natural resources," and the size of the Chinese REE reserves.

Relationship between the Export Quota and Resource Conservation

China claimed that the export quota contributed to resource conservation through a threefold effect: First, the export quota reduced foreign demand for domestic REE extraction. Second, referring to the WTO safeguard rules,[300] China held that the quota "function[ed] as safeguard against unanticipated surging exports" to protect the Chinese downstream industry. Third, China saw the quota as a signal to other resource-abundant countries to develop non-Chinese sources of REE, decreasing the demand for Chinese supply (China's First Submission to the Panel, paragraph 151, cited in United States 2013c).

The plaintiffs opposed the Chinese argumentation: they focused on the legal meaning of the verb "relating to" at the beginning of paragraph XX(g). Referring to the interpretation of the verb "relating to" made in other WTO disputes, they argued that the export restrictions have to be "primarily aimed at" resource conservation and there has to be a clear linkage between ends and means (EU 2013a, p. 10). They contended that the Chinese quota did not make explicit reference to resource conservation and that China had not proven the causal linkage between the export quota and resource conservation. Instead, the plaintiffs thought that the quota rather led to an increase in domestic demand and therefore incited even more domestic production (EU 2013a, p. 28-29).

The plaintiffs also tried to depict China as a country that seeks economic benefits under the guise of resource conservation:

> the real objective behind China's export quotas on rare earth is not the alleged goal of conservation, but the very economically motivated industrial policy objectives that China pursues with regard to its rare earth exploitation by its domestic downstream industry (EU Second Submission 2013, p. 32).

[300] Art. XIX of the GATT allows temporary import restrictions if a sudden surge of imports substantially harms an industry (WTO 2014c). China attempted to use this rule for exports.

The plaintiffs tried to depict China's policy as "protectionist" and "resource nationalism":

> WTO Members live in a world that is increasingly threatened by the rise of resource nationalism. This resource nationalism manifests itself in this dispute in the form of export restrictions (EU Second Submission 2013, p. 32).

The US accused China of dividing the world into "the [resource] endowed and the [resource] un-endowed."[301] It presented resource nationalism as being opposed to the spirit of free trade embodied in GATT (United States 2013a, p. 1). China in contrast presented the plaintiffs as countries that do not care about the environment and preservation of resources:

> trade liberalization must be promoted at whatever cost – including Members to endure environmental degradation and the exhaustion of their scarce natural resources (China's First Written Submission, Paragraph 455, cited in United States 2013b, p. 7).

China contended that the export quota was indirectly related to resource conservation as part of a "comprehensive conservation policy," in which it was difficult to examine the causal effect of single instruments. China anticipated the argument that there was no explicit linkage between the quota and resource conservation and introduced in response an environmental component into the quota in 2012: exporting enterprises had to pass an environmental assessment in order to be allowed to export. The plaintiffs criticized this as "retro-fitting" the quota to resource conservation (United States 2013c, p. 32).

Even-Handedness of the Export Quota

Paragraph XX(g) stipulates that export restrictions must not only be implemented in "relation to" resource conservation, but also "in conjunction with restrictions on domestic production or consumption" (WTO 1994: Article XX). The panel in the previous Raw Materials Case used the concept of even-handedness to interpret the sequence "in conjunction with":

> [a member using the exception of paragraph XX(g)] would need to show that the impact of the export duty or export quota on foreign users is somehow balanced with some measure imposing restrictions on domestic users and consumers (WTO 2011, p. 132).

Even-handedness is different from identical treatment, but the burden on domestic and foreign market participants has to be "balanced" somehow (Palmeter 2003, pp. 184-185). China saw even-handedness as being delivered by the measures that control domestic REE production: industry accession requirements, extraction targets, enforcement actions, resource taxes and

[301] At the same time, the US omitted reference in this statement to the fact that it is also "endowed" with rich REE resources.

environmental standards (China First Written Submission, paragraph 164, quoted in United States 2013c, p. 45). Whereas China held that it is enough to have these regulatory operators in place, the plaintiffs claimed that these were not effective (EU 2013a, p. 45). They emphasized that domestic production had been continuously higher than the extraction targets and that none of the other measures would be effective in limiting production or consumption (EU 2013a, p. 42; US 2013c, pp. 44-55).[302]

As has been shown in the previous four chapters, bringing policies into actual effect is a complex process that involves many actors. Unfortunately for China, its limited ability to implement policy domestically weakens its stance in the defense of its export policy in the international arena. However, it should also be considered that the plaintiffs tried to downplay domestic achievements.[303]

The Meaning of Resource Conservation and Natural Resources

A central point of paragraph XX(g) is the meaning of the term "conservation." China argued that "conservation" relates to the preservation of natural resources and the control of resource use for China's own economic development. From this perspective, China would be allowed to limit exports in order to provide sufficient supply for its domestic downstream industry:

> the term "conservation" encompasses measures aimed both at *preserving* exhaustible natural resources in their current state, *as well as regulating their use* for economic development *today* (China's First Written Submission, paragraph 47, cited in EU 2013a, p. 10; italics in original).

To support this argument, China quoted a reference in the GATT preamble to economic development, the concept of sustainable development in the Rio Declaration and explanations

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[302] In particular this point of contention has been tied to scientific expertise in the dispute: The European Union brought in the expertise of Alan Winters, professor of economics at Sussex University and researcher with the World Bank, and the United States' Gene Grossman, professor of international economics at Princeton University. China requested the expertise of Jaime de Melo, a Professor emeritus of economics and member of the World Trade Institute. The expertise of these professors was pitted against each other in the submissions and other statements of the parties to the dispute. The European Union, for instance, held that de Melo's argument that the domestic production quota has an effect on consumption was merely "hypothetical," and that Winter's "scenario" was much more convincing (EU 2013b, p. 23). In the US's words, de Melo "failed to address properly a number of arguments" and he "incorrectly understands Professor Grossman" (United States 2013d, p. 43).

[303] The plaintiffs underemphasized that official Chinese production decreased significantly after 2010. Although illegal mining is still very common, the government policy had some temporary and local effects.

given by the panel decision in the previous Raw Materials Case (EU 2013a, p. 11). The plaintiffs instead insisted on a narrow reading of "conservation" only as preservation of exhaustible resources. They suggested that the Chinese interpretation misread the results of the Raw Materials Case (EU 2013a, p. 10-11, 2013b, p. 6).

Another contention revolved around the definition of the term "natural resource" used in paragraph XX(g). The plaintiffs reasoned that only the REE ores but not the processed and separated REE and semi-finished products could be considered a resource. They contended that even if the Chinese export quotas met the requirements of paragraph XX(g), they could only include ores (Japan Second Written Submission, cited in EU 2013b, p. 32).[304] From the view of the US, the fact that China included REE items besides REE ores in the quota (e.g. metals and alloys) but not further downstream products (e.g. magnets and phosphors) showed that China was not pursuing conservation but industry development (US 2013a, p. 3).

The plaintiffs sought to portray REE as a commodity which should be made available to global markets: "once these resources are mined, they become a 'good' or a 'commodity,' capable of being traded" (EU 2013a, p. 14). The plaintiffs used the decision of the Raw Materials Dispute to justify this argument: "When China joined the WTO in full exercise of its sovereignty, China made the concurrent decision that its sovereign rights over its natural resources would thereafter be exercised within the parameters of the WTO provisions, including those of Paragraph XX(g)" (WTO 2011, paragraph 7.405). China in turn emphasized the sovereign right over resources (EU 2013a).

Reserves

Related to the dispute around paragraph XX(g) and resource conservation was the assessment of the size of the Chinese REE reserves. This was not immediately relevant to the interpretation of paragraph XX(g), but it broached the issue of whether it is actually necessary to conserve China's REE resources. The plaintiffs contested the Chinese claim that its REE resources faced depletion in the short term. They positioned China as a resource-rich country, while China warned against depletion of its resources. China suggested that it accounted for only to 23 percent of global REE reserves, whereas the USGS cited a figure of 50 percent (REI 2012a; USGS 2013a). The European Union doubted the Chinese figure as "China has not offered any explanations on the way this reserves figure was adjusted, on what basis, or on what other additional data" (EU 2013b, p. 6). Moreover, the EU contested China's statement in its

[304] The EU's position was a bit more conciliatory. It said that processed and semi-finished products could be considered as natural resources under paragraph XX(g), but that "the further one goes from the natural resource, the greater degree of scrutiny is required into whether the relationship between the ends and means…is indeed genuine" (EU 2013b, p. 34).

first submission to the panel that the Chinese REE reserves would be depleted within 15 years. The EU said that this data was flawed as it reflected only the data for the Bayan Obo mine and that China would have REE for another 600 years at current production levels and 100 to 500 years for the southern provinces (EU 2013a, p. 7). Similarly, the United States called the Chinese reserves a “generous endowment in rare earth deposits” (United States 2013e).

12.4.3. Paragraph XX(b)

The dispute over paragraph XX(b) is about whether the paragraph can be applied to the Chinese accession protocol and whether the export duties are necessary for environmental protection.

The Relationship Between Paragraph XX(b) and the Accession Protocol

China justified its export duties with reference to the exceptions for export restrictions aimed at environmental protection given in paragraph XX(b). Different from export quotas and licensing, which are forbidden under GATT rules, the export duties violated commitments that China had made in its accession protocol, namely Art. 11.3. China held that Article XX applies to Art. 11.3 of its accession protocol because the accession protocol is an integral part of GATT (EU 2013c, p. 7). If paragraph XX(b) applied and its criteria were met, China could be allowed to use export duties to protect its environment.

However, China had difficulty maintaining this claim. The plaintiffs argued that Article XX applies only to statements of the GATT treaty and not the Chinese accession protocol. From this point of view, the Chinese attempt to use XX(b) in order to justify a violation of 11.3 in the accession protocol was inadequate (EU 2013a, pp. 86). The panel decision in the China Raw Materials Case, which decided that Article XX was not applicable to the accession protocol, supported the plaintiffs’ position (WTO 2011).

The Necessity of Export Taxes for Environmental Protection

In addition to disputing the applicability of paragraph XX(b) to China’s accession protocol, the plaintiffs argued that the Chinese export duties did not meet the requirements of paragraph XX(b) for environmental protection. That is to say, even if Article XX did apply to the Chinese accession protocol, the export duties would not qualify as a measure for environmental protection under Article XX. China held that the export duties protected the environment in synergy with other policies as the duties increased both domestic and foreign prices, decreasing the foreign demand for domestic REE extraction (Chinas Submission of 15 February 2013, quoted in EU Second Submission 2013, p. 90). The EU countered that this only increased prices for foreigners and that the assumption that decreasing foreign demand would lead to a decrease in production was erroneous. The EU said that China had provided no evidence regarding how these measures might help environmental protection (EU Second Submission 2013, p. 92). The plaintiffs' position converged here with the decision of the previous Raw Materials Case (EU 2013b, p. 28).

12.4.4. The Chapeau of Article XX

The dispute also concerned the chapeau of Article XX. The plaintiffs argued that the requirements of the chapeau were relevant in addition to the provisions of paragraphs XX(b) and XX(g). The chapeau requires that exceptional trade barriers do not result in "arbitrary or unjustifiable discrimination" (WTO 1994). In the EU's view, China's export policy would have to be transparent and predictable (EU Second Submission 2013, p. 25). China in contrast contended that the provisions made in the chapeau were not relevant to the application of the subsequent paragraphs (XX(b) and XX(g)) (EU 2013b, p. 3).

The plaintiffs interpreted the huge gap between domestic and export prices (FOB[305]) as evidence of "unjustifiable discrimination." China contested this position, arguing that export prices were not significantly higher than domestic prices. First, there were different views about the timescale to consider. Whereas China held that only prices in 2013 should be taken into consideration (EU 2013b, p. 18), the EU suggested that price differences from 2007 to 2013 at least were relevant. The reason for China choosing the shorter time period is that price differences were lower in relative terms in 2013 than in previous years (EU 2013b, p. 18).

Second, China suggested that there were uncertainties in the indicative prices provided by Metal Pages,[306] which the EU cited as a reference for its argument. China used newly available data on import prices (CIF[307]) in Europe to argue that Metal Pages had overestimated Chinese export prices and that the difference between domestic and foreign prices was not as high as assumed. The EU doubted the Chinese methodology of examining the CIF prices (EU 2013b, p. 20).

Moreover, the Chinese side argued that about ten percent of the export prices were due to extra transportation costs, which would have to be deducted when comparing to domestic prices. The EU denounced this methodology as arbitrary (EU 2013b, p. 22-23).

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[305] "Free on board" prices are export prices at the ports.

[306] Metal Pages is a mining consultancy that provides information on REE prices. Metal Pages builds the indicative prices on the basis of industry insider evaluations, even if a certain product is not traded.

[307] Cost, insurance and freight prices.

12.4.5. Outcome of the Case

In March 2014, the DSB panel ruled in favor of the plaintiffs. It found that the Chinese export quotas, licenses and duties violated WTO law. Accordingly, the panel found that Chinese export restrictions did not qualify for the exceptions made in paragraphs XX(b) and XX(g). In the view of the WTO, China could not prove that its export restrictions served environmental protection and resource conservation. In August 2014, the appellate body confirmed this decision (WTO 2014a, 2014b).

The outcome of the dispute shows that China's response to the WTO dispute settlement case was not successful. First, the previous Raw Materials Case, which China had lost, limited China's action space. The plaintiffs rooted many of their arguments in the decisions of this previous case. China's attempts to draw on the Raw Materials Case were, in contrast, unsuccessful (WTO 2014a, 2014b).

Second, the WTO does not allow export restrictions as a measure for industrial development. Therefore, China had to hide its strategic interest in promoting the domestic development of the REE downstream industry for economic reasons. It had to justify its export restrictions solely based on resource conservation and environmental protection considerations. However, economic interests were part of China's problematization of the REE industry (State Council 2012a).

Third, the burden of proof that Article XX applies to China's export restrictions rested with China. China had to prove that there was a clear and direct linkage between the export restrictions and environmental protection and resource conservation. Whereas China could argue for the existence of some linkages, it could not provide a sound argument for why the restrictions were related to resource conservation or necessary for environmental protection. It rather argued that the restrictions were part of a comprehensive policy framework in which it was hard to identify the clear effect of single policies. It was rather easy for the plaintiffs to show that China's export restrictions did not "primarily" aim at resource conservation and environmental protection.

Fourth, problems of implementation on the domestic front weakened China's stance in the Dispute Settlement Body. China could not convince the panel that the impacts were somehow equally balanced between domestic and foreign consumers.

This was a heavy blow against the Chinese export strategy. Whereas smuggling only weakens some parts of the export regime, the WTO decision challenged its entire architecture. Still, the export restrictions had considerable effect until the WTO ruling was reached. As the WTO DSB works rather slowly and the OECD response occurred only thirteen years after the export restrictions were put into place, the policy had considerable time to take effect. For one, the quotas spurred the development of overseas deposits and lessened the pressure on Chinese deposits (USGS 2014).

Second, many foreign enterprises doing business in the REE downstream industry had already transferred their production to China as a consequence of the export restrictions. Transferring them back would incur further costs and risk further political actions by China. Some countries, such as Japan, had already diversified their import sources, so that China's exports might not increase significantly even as it dropped the export restrictions (NDRC 2009, 2010, 2011, 2012, 2013, 2014).

12.5. Conclusion

Foreign governments and their industries were highly dissatisfied with Chinese export policy. As these actors had no opportunity to influence the domestic policymaking process, they exerted pressure on China at the international level. At first, they attempted to change the Chinese position and strategy through bilateral talks. When this proved unsuccessful, they launched an official case at the WTO DSB against the Chinese export policy. The foreign governments tried to convince the DSB panel that the Chinese policy contradicted WTO rules, while China's strategic readjustment tried to prove the opposite.

At the technical level, the dispute fundamentally revolved around the interpretation of the exceptions mentioned in Article XX of the GATT. The question was whether the Chinese export restrictions were related to resource conservation and necessary for environmental protection. China tried to position its export policy as a green project whereas the plaintiffs presented China as a country seeking economic development through protectionism. The Chinese had difficulty in convincing the panel of its interpretation of Article XX, because in the similar previous Raw Materials Case China had failed to show that its policy was in accordance with Article XX. Moreover, while Article XX would allow export restrictions only against the backdrop of resource conservation and environmental protection, China had to hide its motivation to use export restrictions as a means of strengthening its REE downstream industry. The plaintiffs in turn based their strategy on the previous case and pointed out that there was no clear linkage between export restrictions and resource conservation and environmental protection.

As a result, the DSB panel decided in March 2014 in favor of the plaintiffs and ruled that the Chinese export policy contradicted WTO law and should be abandoned. In 2015, China lifted its export restrictions on REE (Yap 2015). Despite the successful resistance of the plaintiffs, the export restrictions had an important effect by contributing to the realization of some of the Chinese targets. As the dispute settlement process was rather slow, the Chinese export restrictions had sufficient time to take effect, through promoting the global diversification of REE sources and decreasing Chinese exports.

PART IV

13.Conclusion

13.1.Policy Motives

In 2005, China's central government initiated a new policy to profoundly restructure the Chinese REE industry. At that time, the central government was tremendously dissatisfied with the development of the industry and had come to the conclusion that a fundamental change would be necessary. The policy lacked a comprehensive strategy in the beginning, but later, in 2009, several top-level documents established a formal strategic framework. The policy achieved a level of central control that was unprecedented in the history of the Chinese REE industry.

This policy came about as a result of two factors. The central government identified the lack of economic competitiveness and unsustainable utilization of resources as two core sets of problems. With regard to economic competitiveness, the central government – considering the increasing technological relevance of REE – came to view this group of metals as an important basis for economic development and national strength. Since the late 1990s, however, the government had become convinced that the approach to the development of the REE industry was not sufficiently or effectively serving this purpose. It identified a number of misguided developments that hampered REE from contributing more strongly to China's rise towards being a high-tech power. The government sought to abandon China's role as a supplier of very cheap REE for other countries and instead aimed to consume the REE itself for its emerging domestic high-tech industry, which could boost the economic transition and compete with foreign competitors in innovation and cutting-edge technology.

The central government viewed the industry's fragmentation among many small private mining enterprises as a major obstacle to the development of a technologically advanced, resource-saving and clean REE industry, and its role as a catalyst for the economic transition to an innovative economy. In addition, to ensure that China would make more profit out of REE and to avoid the reckless waste of precious resources, the Chinese government saw higher REE prices as an inevitable necessity. In this view, only if REE prices were set much higher than in the past would the Chinese economy benefit from its rich resource endowment.

The second major motive concerned resource conservation and environmental protection. The policy aimed at reducing the extraction level of REE resources. The government viewed the extraction level, especially at its peak in 2007, as too high. If China extracted most of its REE for export, China would not have enough left for its own consumption in the future. At the same time, a huge debate ignited about the environmental impacts of REE mining. In particular, the radioactive waste that was a byproduct of REE processing, with its impacts on Inner Mongolia and the Yellow River, furthered the conviction that the heavy pollution of the REE industry must end.

The policy that emerged was characterized by a strict approach of top-down decision making, coercive administrative instructions and a campaign-style investigation of the industry. The particularly thorough penetration of governance practices and economic activities was a forceful but necessary strategy to reestablish an influential role for the central government in the management of REE. The aggressive push for centralization was intimately linked to diminishing the influence of those forces that had shaped the development of the industry since the 1980s, namely sub-provincial governments as well as private and small enterprises.

The adopted policy instruments without doubt had the ambition and the potential to substantially disrupt and reorder the existing practices through coercive and often unpopular measures (see table 13-1). Setting a cap on extraction to an industry that was used to and in many ways addicted to excessive and rampant mining without any limits was a clear attack on the business models of many enterprises and the structure of local economies in mining areas. Many other top-down instruments, including export restrictions and environmental standards, tightened the conditions for operation in the REE industry. Particularly aggressive, and essentially violating any idea of a level playing field in a market economy, was the promotion of a concentrated industry structure lead by national champions to be implemented at the cost of the many private enterprises that had previously characterized the industry.

Industry Practice	**Government Strategy**	**Main Mediating Actors**	**Conflicts**
Industry Organization	Concentrate industry in the hands of COEs	Province- and state-owned enterprises	Central government and COEs vs. provinces Local governments vs. private enterprises
Production	Limit resource extraction through elimination of illegal mining	Sub-provincial governments	MIIT vs. MLR Central government vs. some sub-provincial governments and illegal miners Some sub-provincial governments vs. illegal miners
Environmental Protection	Improve environmental protection	Sub-provincial governments	Central government vs. some sub-provincial governments

			Central government vs. polluting enterprises Polluting enterprises and sub-provincial governments vs. affected people
Export	Decrease export and smuggling	Customs personnel	Central government vs. smugglers Central government vs. foreign governments

Table 13–1: Government strategy, main mediating actors and conflicts between actors.

If that strategy had been perfectly realized and if the policy instruments had actually served their envisioned purpose, then China would indeed have seen a sustainable and innovative REE industry with a few big players, delivering the material input to the country's high-tech industry and exporting only a marginal amount to customers in foreign countries.

13.2. Policy Implementation

Yet even as the policy manifested in a top-down manner, the implementation and enforcement of the strategic goals still had to rely on the collaboration of a wide set of actors that were involved in the concrete and local practices of mining and refining REE. The potential winners of the policy were naturally inclined to cooperate, seeking to reap individual benefits. Their hope to extend their market dominance at low costs made the big state-owned enterprises energetic supporters of restructuring the industry. Provincial governments also sought to strengthen their grip over the local REE mines through the policy.

At the same time, however, the coercive style of the policy affected the core interests of almost every actor – even the winners – and created a sizeable group of potential losers. The provinces feared that enterprises owned by the central government could take over their provincial mines, diminish the benefits for the local economy and outgun the province-owned enterprises. Governments of the cities and below perceived the new involvement of the central government as a threat to their age-old practice of weak regulation and close and supportive relationships with the mining industry. Small and private enterprises, legal or illegal, had an existential battle to fight as they were nearly non-existent in the central government's vision of a reformed REE industry. The limits on extraction and exports caused dissatisfaction in the entire industry, as did the tightened environmental regulations. Foreign enterprises consuming the Chinese minerals and their respective governments raised their concerns over restricted exports.

It is no surprise that many actors attempted to escape, undermine, delay or even to entirely block the implementation and enforcement of the policy. Depending on the influence of the actor in policy sub-areas and the conformity of interests, a patchwork of cooperation and conflict emerged. The interactions produced a policy outcome that markedly differed from the envisioned goals in some areas (see table 13-2).

Actor / **Practice**	**Provincial Governments**	**Local Governments**	**State-Owned Enterprises**	**Private Enterprises**	**Illegal Traders/Miners**	**Villagers**	**International Governments**
Industry Organization	✱		✽	∗			
Resource Conservation		✱			∗		
Environmental Protection		✱	∗	∗		∗	
Export					∗		∗

Table 13–2: Cooperation with and resistance against the central government by actors (top) and industry activities (left). ✽ = Cooperation with the central government; ✱ = Cooperation and Resistance; ∗ = Resistance against the central government.

The central government's least conflictual and most productive partnerships were with the provincial governments and the centrally-owned enterprises. Disparities in positions were visible even in these relationships, but both sides found bases for compromise. The central government had to accept that it could not reduce the number of industry champions to two or three as each province protected its own industry leaders. However, in exchange for the central government tolerating the role of provincial enterprises, the provinces took the large burden of promoting and carrying out the protracted process of industry reorganization.

In addition, interactions with state-owned enterprises were not solely characterized by harmony. These enterprises, especially the largest REE producer Baogang, attempted to escape the central government's grasp in environmental regulations. At least with regard to big polluting projects, the government enforced better environmental protection. The enterprises had to accept more pressure on the environmental side, but in exchange they received huge benefits from the central government's push for industry reorganization. These two partnerships actually enabled the central government to make big progress in industry reorganization.

Interactions with two other actors – the sub-provincial governments and small illegal miners – were much more difficult and eventually proved to be a major stumbling block in implementing policy. Tasked with the implementation of concrete on-site monitoring and investigations, the cities and counties in conjunction with the towns/townships and villages were a critical element of the national policy. However, for two main reasons these actors fulfilled their functions insufficiently, a situation the central government could not do much about.

For one, the capacities of financial and human resources as well as the equipment of local governments committed to the national policy were fairly limited compared with the tremendous tasks. Extensive raids could temporarily mobilize massive resources and clamp down on illegal miners. However, such campaigns were confined to limited times and spaces and even then could not eradicate the general overextraction of resources.

However, in many cases, local governments did not follow central policy. The networks that local officials and the mining industry were entangled in often worked as protection umbrellas against the interference of central government policy. Benefiting from or themselves engaging in rampant and mostly illegal mining activities, many local governments fulfilled their tasks only superficially, turning a blind eye to illegal operations. The campaigns by the central government, despite mounting pressure on corrupt local cadres, did not break the influence of these protection umbrellas.

On the international level, the Chinese policy met with opposition from foreign governments that were concerned about the fact that China was ending a decade-long implicit "agreement": it was no longer willing to deliver vast volumes of REE at cheap prices. Filing a complaint with the WTO was a particularly powerful way of forcing the Chinese government to maintain this implicit agreement and to lift its export restrictions. Despite its defence within the Dispute Settlement Body of the WTO, the Chinese government was unable to sustain the claim that its export restrictions conformed with WTO rules. Using international law, the plaintiffs succeeded in bringing down China's entire export regime for REE.

Apart from these difficult interactions with a range of actors, implementation and enforcement of the policy faced further challenges. In particular, the vast distribution of REE deposits and the rather cheap and unsophisticated extraction methods facilitated illegal mining while increasing the efforts necessary for effective supervision. Another issue that delayed but ultimately did not weaken policy implementation was the fragmented decision structure within the central government. The overlap of competencies between key agencies led to confusion over the use of national instruments to manage the industry, particulary at the beginning of the policymaking process. At least with the involvement of the highest state leadership in the policy in 2011, these government-internal conflicts became a rather minor issue.

13.3. Policy Outcomes

The vested interests that shaped the implementation process and enforcement decreased the ability of the central government to realize its policy goals. Despite some modest achievements that were visible until the end of 2013, the policy did not produce the intended results (see table 13-3). In terms of achievements, the central government made much progress on its goal to concentrate the REE industry in the hands of few large state-owned enterprises (SOEs), although it had to accept a role for province-controlled SOEs. Industry reorganization progressed better in northern China than in southern China because mining was much more scattered in southern China than in Inner Mongolia before the increase of central control.

	Outcome	Achievements	Non-Achievements
Industry Reorganization	Before 2010: fragmented REE industry After 2013: Mining concentrated in the hands of POEs; separation in hands of COEs	Industry concentration in mining significantly increased	Separation still fragmented; more industry champions than envisioned
Production	Before 2010: de facto non-conservation of REE After 2013: de facto weak conservation of REE	Official production decreased; intensive campaigns closed some illegal mines	Illegal mining is still very common
Environmental Protection	Before 2010: strong environmental pollution After 2013: better environmental protection in large enterprises	Environmental protection improved in large enterprises	Environmental pollution of the entire industry still severe
Export	Decrease in exportation and smuggling; however, elimination of export restrictions (2015)	Export and smuggling decrease	Export barriers eliminated according to WTO ruling

Table 13–3: Outcomes of the strong intervention of the central government in the four practices.

China was also able to cut its export of REE, even when taking smuggling into account. In addition, the policy was highly effective in fighting illegal mining. Official production significantly decreased and environmental concerns received more attention among enterprises. These achievements reflect a new level of managing the Chinese REE industry at the central level.

Yet the policy failed to fulfil most of its goals, or solved many problems only superficially. There was a large gap between official targets being reached and the situation actually changing on the ground. Official production decreased as intended, but intense enforcement campaigns could not wipe out widespread illegal mining (Su Bo 2013; Li XL 2016; Packey and Kingsnorth 2016). In most REE operations, pollution remained a persistent problem and the restoration of areas affected by mining will take decades (Zhang JG 2012; Wang KT 2012).

The government was also not successful at keeping REE at a high price for long. Figure 13-1 shows that the export prices for REE skyrocketed in 2011 and created enormous benefits for REE enterprises and local governments. Prices had already doubled for some rare earth elements in 2010, but they grew by more than 1100 percent for dysprosium oxide and 1000 percent for neodymium oxide compared to 2009. The other oxides also rose by 500 to 900 percent (Wübbeke 2015a). Export prices increased much more than domestic prices. However, after 2011 prices dropped. Prices in 2013 were well below the level aimed at by the central government. Among the causes of the drop in prices were weak foreign demand, the influence of illegal mining and the creation of overseas projects (Wübbeke 2015a).

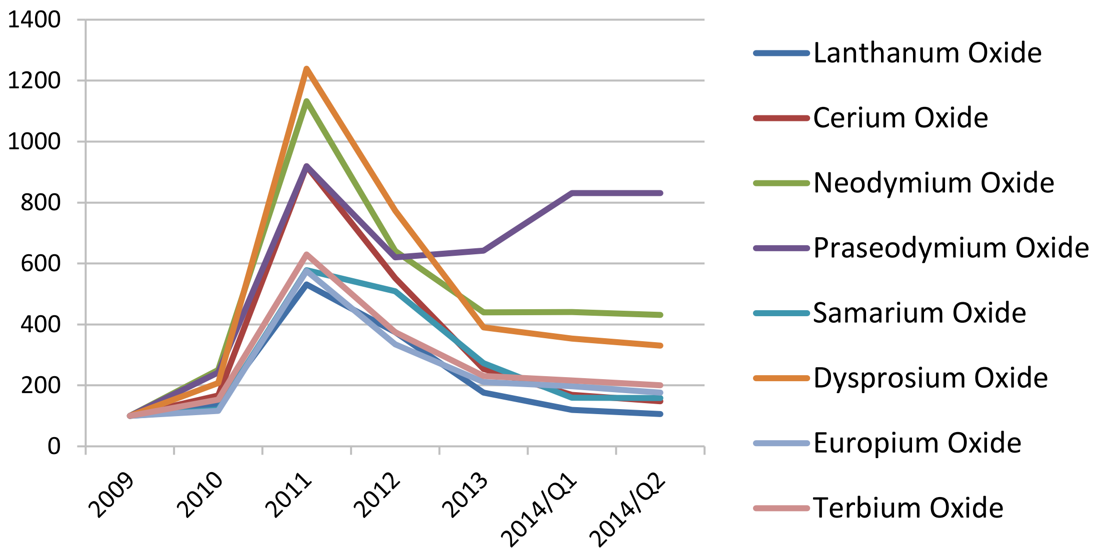

Figure 13–1: Domestic prices for single rare earth oxides from 2009 to 2014 (Source: Wübbeke 2015).

The under-achievements of most specific goals shows that the Chinese government did not successfully realize its goal of strengthening the REE industry's contribution to building a highly innovative economy and reducing environmental impacts. This study's analysis has mostly focused on the period until the end of 2013. However, recent developments do not indicate that the effectiveness of the policy had significantly increased by early 2016 (Li XL 2016).

13.4. Discussion

13.4.1. The Limits of Criticality Studies

The analysis of the Chinese policy on REE has wider implications for understanding a set of broader issues. One important topic concerns the motives and strategies of resource-rich countries in pursuing their export policies and the perception of critical resources in resource-consuming countries. Contrary to criticality studies that focus especially on the needs of consumer countries, this study has focused on a major supplying country. “Criticality” in the context of criticality studies usually refers to the supply security of raw materials for OECD countries. The aim of criticality studies is to assess supply risks and to improve the supply situation for American, European or Japanese industries. This Western-oriented perspective reduces the role of resource extracting countries to that of raw material suppliers but underemphasizes their own motives and interests in economic development by consuming these resources.

Whereas criticality studies perceive of the supplier countries as potential or existing sources of insecurity, this study shows that supplier countries themselves also have genuine interests in the stable supply of resources for domestic consumption. These countries see the use of raw materials for their own industries as an important step in promoting economic development and climbing the value-added chain.

In addition, a large part of criticality studies sees enhanced environmental policies in supply countries as a threat to supply security. This sole focus on supply security leads to a perspective that disregards or at least does not promote better environmental regulation in resource-rich countries. The findings of the dissertation prove wrong the assertion of some studies that supplier countries use environmental concerns only as an excuse for export restrictions that are essentially rooted in other motives, such as securing raw materials for their own domestic consumption (Argiatello and Fliess 2013; Fliess and Mård 2012; Jeonghoi 2010; Korinek and Jeonghoi 2010). Instead, environmental policy can be an important motive for a country to restructure mining industries and restrict the export of raw materials.

Considering the importance of developmental and environmental issues, criticality studies would be well advised to broaden their narrow focus on supply security, improve their understanding of the motives and strategies of supplier countries and find ways to integrate environmental policy and supply security for OECD countries.

13.4.2. Resource Conservation in Developing Countries

The experiences of China with reforming its REE industry also relate to the challenge of resource conservation in countries with rather poor economic conditions or rapidly developing economies. A central question is whether resource-rich countries of this type are able to reduce or avoid the extraction of a valuable resource and the related environmental impacts if they want to do so. This study suggests that it is very difficult for developed countries and countries that are close to becoming industrialized countries. Although the Chinese central government was determined to reduce production of REE, there were vested interests at the local level, in particular sub-provincial governments and illegal miners, that largely limited the success of this policy.

The difficulty of better implementing environmental and conservational policy aims is also apparent in other countries. A prominent example is Ecuador's attempt to suspend oil extraction in the pristine rainforest of Yasuní National Park. Ecuador was willing to forgo the huge benefits of extracting the oil in exchange for financial compensation from the international community. However, Ecuador raised only a tiny share of the money that would have been necessary to compensating for the economic losses. As a consequence, the Ecuadorian government decided to develop the oil reserves in the area despite the environmental concerns (Vallejo et al. 2015; Espinosa 2013; Vidal 2016).

Especially in developing countries, the extraction of natural resources even where the environmental impacts will be severe is promoted by botha need for economic development and the interests of international mining companies. While China is not in danger of solely focusing on mineral extraction as a pillar of the economy, many developing countries are not as able as China to diversify their economic structures and mainly concentrate on mineral extraction for creating jobs and generating tax revenues. However, as the literature shows, these developing countries, but also some industrialized countries, run the risk of becoming "rentier states" and suffering "dutch diseases." That is to say, benefiting from the rents of mineral extraction, these countries neglect the importance of developing a strong manufacturing industry (Corden 1984; Roemer 2015).

The inability to significantly slow down or halt resource extraction appears to support the hypothesis of the "tragedy of the commons": humans are unable to stop extracting a public good, even if that public good is eventually destroyed (Hardin 1968). This book moreover confirms that command-and-control mechanisms are not especially helpful in avoiding that tragedy (Ostrom 1999).

Although resource-rich countries face these difficulties, the tragedy of the commons is no unalterable fact. For China and many other countries the next decades will be central to finding new ways of limiting resource extraction in research and practice.

13.4.3. Resource Economy

The analysis of the development and policy of the REE industry also has wider implications for other resource industries in China. The experiences in REE have shown that it is extremely difficult to curb extraction and production. Especially in the steel, aluminium and cement industries, the Chinese government is faced with reducing enormous overcapacities (EU Chamber China 2016). Although the government has devised plans for diminishing these overcapacities through measures such as closing down or merging loss-making state-owned enterprises (Liu ZQ 2016), the prospects for success are rather grim.

The situation in these industries differs from the REE industry in that reducing the level of production is primarily related to the overall health of the economy and not resource conservation. Therefore, the process of reducing the overcapacities has to deal with several challenges additional to those typical of the REE industry. The elimination of overcapacities in large industries with systemic relevance, such as coal and steel, risks making millions of workers redundant and creating a potential basis for social unrest and political instability.

The industry reorganization experienced in the REE industry is also part of a broader trend in the wider Chinese economy. The government is determined to reshape industry structure in key industries and reform state-owned enterprises. Ongoing reform efforts signal a stronger participation of private capital in many industries, including those dominated so far by state oligopolies such as oil and telecommunications. However, the real motive and character of that reorganization and reform seems to be the forging of state-owned national champions, mostly at the cost of privatization and market forces, except for industries such as e-commerce. It can be questioned whether such a systemic violation of market rules and the creation of artificial oligopolies will make China's industry more competitive (Leutert 2016).

13.4.4. Central-Local Relations

The top-down approach of REE policy displays a very recent pattern of policymaking in China. The Xi Jinping administration, which has been in power since 2013, is shifting decision making from the local and ministerial levels to an inner circle of top-level Party leaders. This occurs in a style of permanent crisis mode, pushing a fundamental reform package with very specific instructions at the highest level known as "top-level design" (顶层设计). This increasingly limits the leverage and space for experimentation by local governments. There are signs that the "top-level design" approach under Xi could constitute a new form of policymaking in China. The key projects of the Xi administration, such as the anti-corruption campaign, are pervasive, radical and very dangerous for all cadres not playing by the rules (Naughton 2012; Ahlers et al. 2013).

Although this book deals only partly with the development of the REE industry under the Xi administration, it shows that centralization within single policy areas has its limits. Despite top-down decisions, management of the REE industry is still subject to the "implementation bias" characteristic of the Chinese political system. Regardless of the volume of policy documents or the massive resources the government mobilizes, the central government has to rely on partners at the local level. If it cannot win the cooperation of these actors, it will have a hard time implementing policies. The case of REE shows that centralization and massive efforts at the national level can often solve problems only to a limited degree and for a short time period. In China's anti-smog policy, for instance, Li Keqiang declared a "war against pollution" intended to radically reduce urban air pollution. The central government formulated rigid targets for air pollution and the new Environmental Protection Law enhanced enforcement mechanisms. Yet the non-compliance of many cities remains a recurring issue (Wübbeke and Klorer 2014). Considering this, centralization and concentration of power is a possible path for the future in China, but it has to rely on a critical mass of supporters. If it lacks these, centralization will not succeed in the long run.

13.4.5. Material Characteristics and Technology

The research into the REE industry confirms general findings in contemporary research on China: implementation is essential to policy (Ahlers and Schubert 2014; Göbel 2011). This book has devoted attention to factors that are commonly underemphasized in these studies and need more research: the role of geography, material characteristics and technology in implementation. While analyses of implementation mostly focus on the influence of human factors, and in particular political institutions, they often neglect the role of material conditions in the process of implementation. As has been shown, the material characteristics of REE facilitated illegal mining. In the same way, advanced technology can change implementation processes, and is becoming increasingly important with the digitization of the economy and governance. The Chinese government is increasingly using modern information technology to monitor social and economic activities in order to shorten the geographic distance between the national and the local level and improve efficiency. Such an IT-backed authoritarianism might create a dystopia of digital all-round surveillance, but could at the same time have positive effects for better implementing environmental protection and resource conservation (Meissner and Wübbeke 2016).

13.4.6. Innovation-Driven Development

Finally, the development of the REE industry is related to China’s transition towards an innovation-driven development model. With comprehensive policy agendas, for instance the Made in China 2025 strategy (State Council 2015), China seeks to achieve the status of a world leading manufacturing power that is on par with industrialized countries in terms of productivity and quality in the coming decades. As necessary material for a wide range of high-tech applications, REE-based materials and other advanced materials are the ingredients for important future technologies. China especially sees emerging industries, such as electric vehicles and renewable energies, as opportunities to leapfrog and lead in these technologies that will dominate the markets of the future.

REE policy is basically aimed at ensuring supply for these emerging industries. However, guaranteeing supply security is not enough for innovation and might even have detrimental effects in the short term. The increase in REE prices, for instance, might prevent the rapid depletion of resources in the long term. However, in the short term, the high prices sharply increase production costs for Chinese manufacturers of magnets and phosphors with temporary impacts on industries such as wind turbines and lighting (Wübbeke 2015a).

Promoting innovation is not as straightforward a process as the government policy may imply. In the field of REE, establishing innovative capacity in downstream industries is a major challenge. To be sure, there have already been some cases of success. The country is now, for instance, a leading manufacturer and innovator in LEDs, outpacing foreign competitors such as Philips and Osram. Also, beyond REE applications, China has been able to establish technological leadership in single technological areas such as telecommunications (Inter-lumi 2016). Even complex technologies including high-speed trains, mid-range airplanes, nuclear power plants and robots are increasingly made and designed by the Chinese (Wübbeke and Guan T 2016).

However, for most of these advanced technologies, Chinese enterprises have to rely on foreign core expertise and components, an innovation without a core. The top-down approach to innovation has helped China in the past to reduce the technological gap. However, if China is to become a true innovation power in the future it will have to find new ways of promoting research and development. The government has already identified and started to tackle a number of issues including the reform of the education system, the restructuring of the science and technology system, increasing incentives for innovation within enterprises and promoting a vivid startup scene (Wübbeke 2016).

Despite these efforts, however, China is in the midst of an economic restructuring that slows economic growth rates and creates the possibility of an enduring economic stagnation. Under such conditions, the government might be seduced into taking traditional measures of creating growth such as investment in infrastructure and equipment to generate short-term growth and new job opportunities. These measures, however, might delay the reforms necessary to establish innovation-driven development.

These battles will also be fought within the resources industries. Will China further stick to overcapacities of steel or instead shift towards manufacturing high-quality steel products? Is China just the refinery of the world for mass copper and aluminium products of can it deliver cutting-edge applications? In the REE industry, the issue is whether China exports REE as raw materials or as permanent magnets or even as the final products.

13.5. Outlook and Future Research

Faced with these challenges, the contribution of the ongoing policy efforts of the central government in the REE industry has been limited so far, but the jury is still out. The research ended at the end of 2013, but the government is as eager as before to realize its policy. Further policies to strengthen the center's grip over the industry were delineated in the 13th Five-Year Plan. However, illegal mining and environmental pollution prevail as constant challenges for the Chinese government (Li XL 2016). It remains to be seen what kind of strategic readjustments the government will adopt next and how effective the resistance of opposing forces will be. How China manages its exports without its previous export restrictions and how other countries react will be the hot spots of these interactions. Moroever, a big question is how technology will shift power relations in the implementation game, possibly giving the central government a final means to shrink the action space for non-cooperative actors.

The theoretical framework adopted here – problematization, strategy, and translation – could be promising for other policy areas too. Urban air pollution in China, for example, would be a promising field for testing this framework. Similar top-down strategies are visible in this case and there are intense implementation games of resistance and strategic readjustment between the central government, local governments and enterprises.

A final question is: What will the role of critical materials in the 21st century be? Currently, the public debate has lessened somewhat as global resource prices have plummeted and the supply situation for REE and other materials is less tense than it was before. In particular, the economic slowdown in China has contributed to a prolonged decline in resource prices (Hume and Sheppard 2015). However, it is very likely that resource prices will rise again sometime in the future, and countries will again have to find approaches to deal with the new challenges emanating from the use of critical materials.

14. Annex

14.1 Tables

Mineral	REO in %
Bastnäsite	75
Monazite	65
Parisite	61
Xenotime	61
Gadolinit	60
Euxenit	53
Fergusonit	53
Yttrocerite	53
Synchysite	51

Table 14–1: REE minerals and their REO content. Source: BGS 2011.

Mine	**Country**	**Enterprises**	**Production (in t REO)**	**Resources (in 1000 t REO)**
Active Mines				
Mt. Weld	Australia	Lynas	4000	1889
Buena Norte	Brazil	Indústrias Nucleares do Brasil S/A (INB)	300	20
Bayan Obo	China	Baogang	55300	43,500
South China	China	Many	45000	150
Sichuan	China	Many	10000	1500
Chavara	India	Indian Rare Earths	2800	NA
Lovozero	Russia	Lovozersky Mining	2500	NA
Mountain Pass	USA	Molycorp Minerals	4000	2072
Large Inactive Mines				
Nolans Bore	Australia	Arufa		1217
Kvanefjeld	Greenland	Greenland Minerals and Energy		6600
Sørensen	Greenland	Greenland Minerals and Energy Ltd.		2662
Nechalacho	Canada	Avalon Rare Metals Inc.		4148
Ashram	Canada	Commerce Resources Corp.		4700
Strange Lake	Canada	Quest Rare Minerals		4119
Lake Thor	Canada	Avalon Rare Earth		3282
Niobec	Canada	IAMGOLD Corporation		18363
Weishan Lake	China	China Iron and Steel Research Institute Group		4000
Mrima Hill	Kenia	Pacific Wildcat Resources Corp.		6145
Bear Lodge	U.S.	Rare Earth Elements Resources		1569
Dong Pao	Vietnam	Toyota; Sojitz; Vietnam government		7000
Mau Xe North	Vietnam			7800

Table 14–2: Selected global large REE deposits and active mines. Source: MEP 2009, pp. 10-12; Long et al. 2010, p. 13; Wu C 2008, p. 348; Technology Metals Research 2013.

	Sc	Y	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Glass and Ceramics																
Decolorizer				●												
Pigment				●	●	●						●	●			
Polishing				●												
Colorant					●	●										
Metallurgy																
Steel Additive				●												
Cleaning Agent				●												
Super Alloys		●	●	●												
Chemical Industry																
Catalytic Converter		●		●												
Battery			●													
Fuel Cell		○		○												
Oil Cracking		○	●	●												
Catalyst							●									
Magnets																
Permanent Magnets					●	●	●		●		●					
Magnetostriction		○						●	●	●	●	○	○			
Bubble Memory		○											○	○	○	○
Magnetooptics		○				○			○	○	○					
Elektronics																
Conductor		○	●	●												
Hydrogen Storage			●													
Exothermic Material		●	●													
Thermionic Emission Material		○				●			○							
Resistor		●														
Capacitor			●				●		○		○				○	
Sensor		●	○													
Optics																
Optical Glass		●	●	●					●							
Fiber Glass		●						●								
UV absorbing Glass				●	○	○										
Special ceramics		●	●	●	●											
Phosphors		●		●		●		●		●		○			○	
Laser		●				●					●	●	●		●	
Nuclear Industry																
Reactor structure materials		●						○	○							
Reactor control materials							●	●	○							
Reactor protective barrier							○	○	○							

Table 14–3: Use of REE in major fields of application. ● = Major component; ○ = Complementary use. Modified from Liu GH 2007, p.11.

Company	**Location**	**Production Capacity**
Baotou Huamei Rare Earth High-Technology Ltd. (包头华美稀土高科有限公司)	Baotou	40,000 t $ReCl3_3$, 40,000t carbonates
Baogang Rare Earth (包钢稀土高科技股份有限公司)	Baotou	15,000 t REO
Baotou Jinmeng Rare Earth Ltd. (包头市金蒙稀土有限责任公司) (private)	Baotou	10,000 REO
和发稀土加拿大分公司	Baotou	6000 t REO, 13000t $ReCl_3$
Baotou Rhodia Rare Earth Ltd.	Baotou	2000 REO
Leshan Shenghe Rare Earth Technology Ltd. (四川省乐山锐丰冶金有限公司)	Leshan	10,000 t $ReCl_3$
Sichuan Leshan Ruifeng Metallurgical Ltd. (四川省乐山锐丰冶金有限公司)	Leshan	8,000 t $ReCl_3$
冕宁飞天稀土实业有限公司	Mianning	6,000 t $ReCl_3$
四川省冕宁县方兴稀土有限公司	Mianning	5,000 t $ReCl_3$
中铝稀土（宜兴）有限公司	Yixing	7,000 t $ReCl_3$
淄博市临淄有色金属冶炼厂	Zibo	10,000 t $ReCl_3$
淄博加华新材料资源有限公司	Zibo	7,000 t $ReCl_3$
山东泰山稀土有限公司	Taishan	7,000 t $ReCl_3$
江西金世纪新材料股份公司	Nanchang	4,000 t $ReCl_3$
南益阳鸿源稀土有限责任公司	Yiyang	5,000 t $ReCl_3$
江苏扬州稀土分离厂	Yangzhou	4,000 t $ReCl_3$
江苏连云港稀土分离厂	Lianyungang	4,000 t carbonates
上海华瀛稀土厂	Shanghai	3,000 t ReCl3
江苏省国盛稀土有限公司 (Chinalco)	Taizhou	Handling 7,000t from Bayan Obo, 3,000t ionic RE
赣州稀土集团	Ganzhou	10,000 t
赣州县红金稀土有限公司 (Minmetals)	Ganzhou	4,000 t

Table 14–4: Large Separation and Refination Enterprises in tons REO. Sources: MEP 2009; Zhou X and Han XY 2010, Liao 2011.

Company	**Location**	**Production Capacity**
有研稀土新材料股份有限公司	Beijing	10,000
包头瑞鑫稀土金属材料股份有限公司	Baotou	8,000
江西省龙钇重稀土科技股份有限公司	Ganzhou	8,000
赣州科力稀土新材料有限公司	Ganzhou	5,000
赣州晨光稀土新材料有限公司	Ganzhou	5,000
包钢高科技股份有限公司	Baotou	4,500
丹东金龙稀土有限公司		3,000
赣州南方稀土高技术股份公司	Ganzhou	3,000

赣州虔东稀土集团公司	Ganzhou	3,600
西安西骏新材料有限公司	Xi'an	2,500
包头市玺骏稀土有限公司	Baotou	2,500
甘肃稀土公司	Lanzhou	2,000
包头三隆稀有金属材料公司	Baotou	1,500
内蒙古和发稀土科技发发股份有限公司	Baotou	1,000
包头市东宇稀土有限公司	Baotou	1,000
赣州嘉通新材料有限公司	Ganzhou	1,000

Table 14–5: Large REE metals producers in tons of metal. Sources: MEP 2009; Liao XG 2011; Wang K 2012.

Company	**Location**	**Production Capacity**
中科三环	Beijing, Tianjin, Ningbo	12,000
NEOMAX	Japanese	10,000t
TDK	Japanese	?
安泰科技公司	Beijing	10,000t
包头天和磁材技术有限公司	Baotou	10,000t
浙江英洛花磁业有限公司	Zhejiang	6,500t
江西金力永磁有限公司	Ganzhou	6,000
宁波韵升	Ningbo	5,750t
包钢稀土磁性材料	Baotou	5,000
包头金山磁材有限公司	Baotou	5,000
烟台正海	Yantai	3,500
包头韵升强磁材料有限公司	Baotou	3,000
包头市金蒙汇磁材料有限公司	Baotou	3,000
包头拓力拓科技有限公司	Baotou	3,000
运城恒磁科技有限公司	Yuncheng	2,600
赣州通诚磁材有限公司	Ganzhou	2,400
赣州市东磁稀土有限公四	Ganzhou	2,000
赣州拓盛高新稀土材料科技有限公司	Ganzhou	2,000
赣州昭日稀土新材料有限公司	Ganzhou	2,000
包头浦项永新稀土有限公司	Baotou	2,000
日本越化学工业	Japanese	1,000
Vakuumschmelze	German	1,000
包头市神头稀土科技发展有限公司	Baotou	1,000
江西荧光磁业有限公司	Ganzhou	1,000
赣州宏光稀土永磁材料有限公	Ganzhou	1,000
江西磊源永磁材料有限公司	Ganzhou	1,000

赣州红帆稀土科技有限公司	Ganzhou	1,000
龙南县银环科技有限公司	Ganzhou	1,000
包头天石稀土新材料有限公司	Baotou	1,000
赣州华京稀土新材料有限公司	Ganzhou	900
信丰县通宝稀土有限公司	Ganzhou	600

Table 14–6: Large NdFeB producers in China and abroad in tons of magnets. Sources Wang K 2012; Net Ease 2011.

Enterprise	**Location**	**Production Capacity**
江门科恒	Jiangmen (Guangdong)	863
咸阳彩虹	Xianyang (Shaanxi)	750
常熟江南	Changshu (Jiangsu)	550
杭州大明	Hangzhou (Zhejiang)	500
衢州奥仕特	Quzhou (Zhejiang)	450
靖江天彩	Jingjiang (Jiangsu)	426
无锡新威	Wuxi (Jiangsu)	200
苏州新纪元	Suzhou (Jiangsu)	180
上虞阳光	Shangyu (Zhejiang)	162
上海跃龙	Shanghai	120

Table 14–7: Large Chinese producers of REE phosphor powder by actual production in tons of powder (2007) (Jiangxi New Materials Golden Century Materials 2011).

Company	**Location**	**Production Capacity**
包头天骄清美稀土抛光粉有限公司	Baotou	5000
Mitsui Chemical	Japan	4500
Showa Denko	Japan	4000
AGC Seimi Chemical	Japan	3500
Rhodia	France	3000
甘肃稀土公司	Lanzhou	2500
兰州德宝化工有限公司	Lanzhou	2000
包头市华星稀土科技有限责任公司	Baotou	1500
包头物华特种材料有限公司	Baotou	1000
内蒙古威能金属化工有限公司	Baotou	1000
包头市新源稀土高新材料有限公司	Baotou	1000
包头市金蒙稀土有限责任公司	Baotou	1000
蓬莱北沟镇福利化工厂	Yantai	1000
山东新方圆稀土	Yantai	1000
宜兴新威利成稀土有限公司	Yixing	1000

包头罗迪亚稀土有限公司	Baotou	1000
包头市佳鑫纳米材料有限责任公司	Baotou	800
甘肃金阳高科技材料有限公司	Lanzhou	800
上海华明高纳稀土新材料有限公司	Shanghai	800
成都君臣科技有限责任公司	Chengdu	600
上海界龙精细研磨材料有限公司	Shanghai	600
包头市志仁稀土抛光粉有限责任公司	Baotou	500
包头启通稀土有限责任公司	Baotou	500
甘肃联合新稀土材料有限公司	Lanzhou	500
安阳惠泽	Anyang	500
乐山义维化工厂	Leshan	300
成都镧兴稀土材料有限公司	Chengdu	200
安阳恒利	Anyang	200

Table 14–8: Large REE polishing powder producers in China. Source: Dou N 2011a, 2011b.

	General Water Emission Standard 1996 in mg/L (Grade I and II)	**REE Industry Emission Standard 2011 in mg/L**
pH	6-9	6-9
COD	100-300	60
Ammonia	15-25	25
Nitrogen	NA	50
Particulate Matter	100-300	40
Fluoride	10-20	5
Oil	10	3
Zinc	2-5	0.8
Phosphor	NA	0.5
Cadmium	0.1	0.05
Lead	1.0	0.5
Chromium	1.5	1.0
Arsenic	0.5	0.3
Mercury	0.05	NA
Uranium & Thorium	NA	0.1

Table 14–9: Comparison of the Integrated Wastewater Emission Standard of 1996 (Grade I and II) and the Emission Standards of Pollutants from Rare Earth Industry of 2011 (NEPA 1996a; MEP 2011a).

	Integrated Emission Standards of Waste Air 1996 in mg/m³	Emission Standards of Pollutants from REE Industry 2011 in mg/m³
SO²	550	500
Particulate Matter	120	50-80
Chloride	9	7-9
Chlorine	65	30-50
Nitrogen oxide	240	200-240
Th, U	NA	0.1

Table 14–10: Comparison of the Integrated Emission Standard of Air Pollutants of 1996 (Grade I) and the Emission Standards of Pollutants from Rare Earth Industry of 2011 (for various steps of the production chain) (NEPA 1996a; MEP 2011a).

Name of Environmental Impact Assessment Project	Date
中色股份所投资的中色南方稀土（新丰）有限公司7000t/a（吨/年）稀土分离项目	23.03.2011
牦牛坪稀土矿矿产资源综合开发项目	13.05.2012
广州建丰五矿稀土有限公司稀土项目	02.06.2011
福建省长汀虔东稀土有限公司年处理 13000 吨稀土废料综合利用项目环境影响评	15.06.2012
福建省长汀金龙稀土有限公司年产 6000 吨稀土特种金属及合金项目环境影响评价	23.07.2912
中铝广西有色崇左稀土开发有限公司六汤稀土矿环境影响后评价	07.09.2012
福建省三明金明稀土有限公司年产 1000 吨荧光粉项目环境影响评价	14.09.2012
中铝广西有色稀土开发有限公司江苏国盛稀土分离生产线异地升级改造项目	26.11.2012
汨罗市华鑫稀土新材料有限公司年产 2200 吨稀土金属与合金扩建项目	27.03.2013
赣州中凯稀土材料有限公司年综合应用 2000 吨稀土荧光粉废料项目第二次环境信息公告	06.03.2013
赣州稀土矿业有限公司赣州稀土矿山整合项目（一期）	19.03.2013
包头钢铁（集团）有限责任公司“十二五”结构调整稀土钢总体规划实施项目	May 2013
厦门钨业股份有限公司年产 1000 吨动力电池用稀土储能材料产业化项目	30.05.2013
冕宁县牦牛坪稀土矿产资源综合开发项目采选工程	05.07.2013
五矿稀土江华有限公司河路口矿公众参与简本	29.07.2013
浦项（包头）永新稀土有限公司钕铁硼磁钢扩建项目环境影响评价	06.09.2013
州市永源稀土有限公司 3000 吨/年稀土分离项目 环境影响后评价	09.09.2013
西鼎立稀土新材料科技有限公司年产 2000 吨高性能钕铁硼永磁材料项目环境影响评价	27.09.2013
广东省平远县仁居稀土矿年产 1000 吨 REO 项目	01.09.2013

Table 14–11: Selected Environmental Impact Assessments in the REE industry from 2011 to September 2013.

14.2 Figures

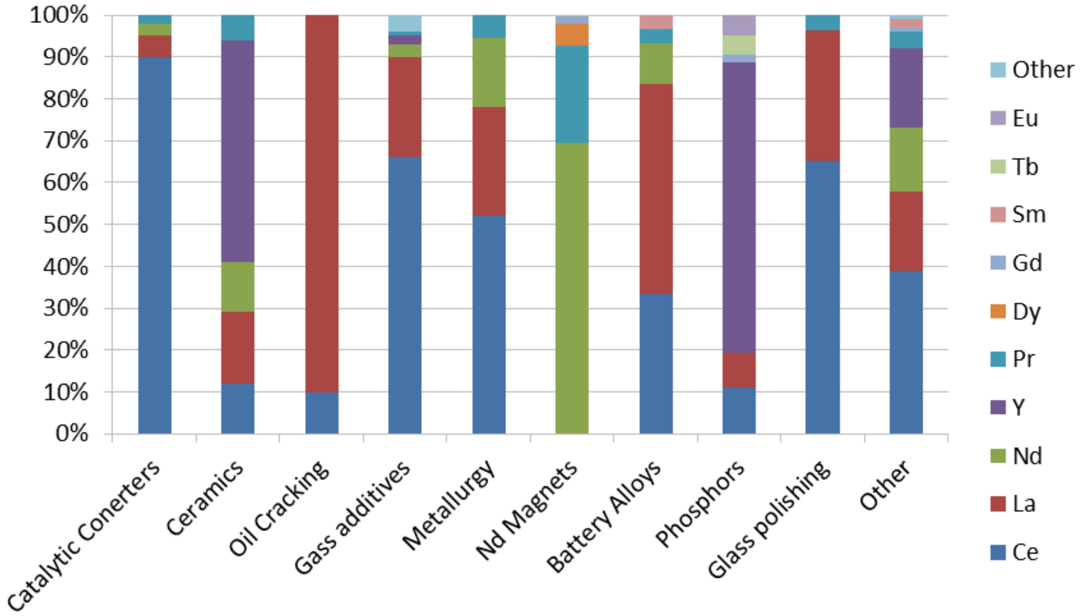

Figure 14–1: Worldwide composition of REE use for applications in 2008. Source: Goonan, p. 3.

Figure 14–2: Aerial view of restored and destroyed mining areas in Dongjiang town in Xinfeng county in 2013 (Source: Google Maps).

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16.Curriculum Vitae

Der Lebenslauf ist inder Online-Version aus Gründen des Datenschutzes nicht enthalten.