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China's Green Transition: Analysing Chinese Minerals Policy, and its Impact on Zambia

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Abstract

This study concerns the dynamics of Chinese strategic minerals policy and its effects on Zambian copper mining between 2016-2020. The essay employs a complementary—theories congruence analysis using Resource Security Theory, Debt Trap Diplomacy, and the Pollution Haven Hypothesis in order to analyse China's actions and ascertain their effects on Zambia.

In brief, the study found that China has a large presence within Zambian copper mining through the use of state-owned enterprises, aiding China in its goal of supplying domestic copper demand, and thus addressing resource security. These state-owned enterprises act within the Belt and Road Initiative framework. China is not using Debt Trap Diplomacy in Zambia, but may be able to in the future. China's presence is negative for the Zambian environment. The moving of mining from China to Zambia has a positive impact on the Chinese environment. Chinese state-owned enterprises are far less stringent in abiding by environmental laws in Zambia than in China. The study shows that Resource Security Theory and the Pollution Haven Hypothesis hold strong explanatory value for the case of China in Zambian copper mining. Debt Trap Diplomacy proved a weaker theory, as natural resources have not been exchanged for debt write-off.

Abbreviations

RST – Resource Security Theory
DTD – Debt Trap Diplomacy
PHH – Pollution Haven Hypothesis
SOE – State-Owned Enterprise
BRI – Belt and Road Initiative
EKC – Environmental Kuznets Curve
FDI – Foreign Direct Investment

1. Introduction.....1
1a. Research Problem.....1
1b. Aim and Assumptions.....2
1c. Research Question.....3
1d. Disposition.....3
2. Previous Research and Theories.....4
2a. Previous Research.....4
2b. Theories.....6
2bi. *Resource Security Theory*.....6
2bii. *Debt Trap Diplomacy*.....7
2biii. *Pollution Haven Hypothesis*.....9
3. Method.....11
3a. Methodology.....11
3b. Empiric Material.....13
4. Analysis.....15
4a. Section One: The Goals and Perspectives of China.....15
4ai. *The National Plan, Summarised*.....15
4bi. *Solution One*.....16
4bii. *Solution Two*.....18
4biii. *Solution Three*.....20
4biv. *Solution Four*.....20
4bv. *Solution Five*.....22
4bvi. *Solution Six*.....24
4b. Section Two: China in Zambia.....25
4bi. *Resource Security Theory*.....25
4bii. *Debt Trap Diplomacy*.....29
4biii. *Pollution Haven Hypothesis*.....32
5. Results and Conclusion.....36
5a. Results.....36
5ai. *Theories and Theoretical Synthesis*.....36
5b. Conclusion.....39
5bi. *Conclusion*.....39
5bi. *Generalisability and Further Research*.....40
Bibliography.....41

1. Introduction

"Resource security has always been the core issue of national sustainable development." – Chinese National Plan for Mineral Resources (2016-2020)

The Chinese industry has an insatiable appetite for metals. Domestic Chinese sources are running out, and depleting them would present a threat to future resource security by ensuring dependence on the international market. This essay focuses on how China seeks to offset this issue with investments in Zambia, the methods involved, and the environmental impacts. The essay does this by means of a congruence analysis with three complementary theories; Resource Security Theory, Debt Trap Diplomacy, and the Pollution Haven Hypothesis.

1a. Research Problem

Resource Security in a Green World

The relevance of this study concerns investigating the dynamics of strategic minerals in a world with globalised industry and a growing demand for 'green' technologies. The essay investigates the involvement of state-owned enterprises in such strategic industries to assess the intentions of their parent states, and the impact on smaller, resource-rich countries as a result of this. The direct involvement of states within these 'green' industries, seeking resource security and perhaps greater market shares to better geopolitical positions, presents a burgeoning issue of an environmental arms race. The use of loans and investments through international projects such as the Belt and Road Initiative to further such ambitions becomes a critical issue. States purposely moving industry abroad to extract natural resources seems reminiscent of the Colonial Era, especially when contrasting the relative power and influence of the nations involved – in this case, the great power China versus the developing nation Zambia. A further angle that this essay looks at is if pollution at home drives China to move industry abroad, improving its own conditions at the cost of others.

Why China and Zambia?

Looking at state-driven investments, China presents several factors making it an attractive research candidate. China has a great number of state-owned enterprises. Building on the work of Bass and Chakrabarty, national interests are represented by SOEs, meaning that the investment foci of China as a nation are potentially easier to track than that of others (Bass & Chakrabarty, pp. 961). Contrasting the behaviour of SOEs to the goals stated in policy documents, it can be deduced whether SOEs are used as political tools serving a grander strategic plan. Analysing this behaviour by applying theoretical filters gives clarity regarding Chinese actions abroad.

China's investments in Africa are hotly debated. It could be argued that nations such as Zambia's neighbour the Democratic Republic of Congo would be an even more relevant case of Chinese direct investments in mining, especially within the context of the Green Transition and level of Chinese ownership (Ericsson et al., pp. 170). The D. R. Congo, however, has already been extensively covered due to this fact, while the case of Zambia has not. Furthermore, the *National Plan* promotes exploration of key mineral zones in countries neighbouring existing operations (Ministry of Land and Resources, pp. 79). Choosing Zambia thus serves to fill a knowledge gap, and could furthermore perhaps be used as a comparison to the D. R. Congo in future research. Additionally, the D. R. Congo is primarily known for its cobalt production; copper as a critical material is far less prominent in academia. China is the foremost consumer of copper globally (Nornickel, pp. 60-63). This feeds into investigating Zambia and China particularly, due to Zambia's status as the world's biggest exporter of raw, or unrefined, copper. Zambia is also the 8th biggest producer of refined copper, and a developing country ([1]Flanagan).

1b. Aim and Assumptions

The essay aims to apply Resource Security Theory, Debt Trap Diplomacy, and Pollution Haven Hypothesis to the *National Plan for Mineral Development,* and to Chinese involvement in Zambian copper mining. This is done through a congruence analysis to provide analytical filters

to Chinese minerals policy and its effects. The *National Plan* has faced little academic scrutiny; the essay aims to highlight the large-scale effects of the document's implementation.

In terms of strategic assets, rare earth- and battery metals such as lithium and cobalt face much academic focus when looking at clean energy; this essay aims to shine a light on copper, as it too is listed as a critical metal for such developments ([1]International Energy Agency).

The essay posits that the actions of SOEs can be used to track the intentions of their parent states. The essay also posits that Chinese actions in Zambia are carried out primarily through the use of SOEs. Furthermore, the essay builds on the work of Bass & Chakrabarty, co-opting their Resource Security Theory and attempting to introduce energy metals in place of the theory's original focus on petroleum. Furthermore, the essay aims to illustrate how a paradox emerges regarding pollution; developed nations cutting their own by increasing it somewhere else.

1c. Research Question

How can China's *National Plan* and actions in Zambia through it be understood using Resource Security Theory, Debt Trap Diplomacy, and the Pollution Haven Hypothesis?

1d. Disposition

The study is divided into five main parts. Part one (1) presents the topic, research problem, aim and assumptions, and research question. Part two (2) concerns previous work within the field, and the theories used in the essay. Part three (3) concerns the methodology and material employed. Part four (4) first identifies the solutions in the *National Plan* and then conducts a congruence analysis based on the three theories selected for the essay by applying them on the *National Plan* and the case of Zambia. Part five (5) summarises and presents the results of the analysis, answers the hypotheses and research question, concerns generalisability, mentions potential future research, and concludes the essay.

2. Previous Research and Theory

2a. Previous Research

The *National Plan* is part of the*13th Five-Year Plan*. China's Five-Year Plans, drafted consecutively, lay out the overall policy and strategic direction of China, both economically and socially (Kennedy & Johnson, pp. 1-2). Analyses of the *13th Five-Year Plan*'s energy policies have been made, primarily focusing on either the expansions in petroleum extraction during its tenure, or the planning of and need for renewable energy. Examples of the former include the 2022 *Natural Gas Progress of SINOPEC during the 13th Five-Year Plan* by Guo et al., and of the latter the 2019 *Optimisation of China's Provincial Renewable Energy Installation Plan for the 13th Five-Year Plan based on Renewable Portfolio Standards* by Fan et al. Both could be useful if looking at other aspects of the solutions to Chinese resource security as presented in the *National Plan*; for example, the development of renewable energy infrastructure can be connected to the creation and optimisation of green mining, and strides within petroleum extraction can also be considered as addressing aspects of Chinese resource security.

Of the studies looking to pick apart and ascertain strategic intentions within the *13th Five-Year Plan*, the most notable is the 2016 Center for Strategic and International Studies (CSIS) report *Perfecting China, Inc.: The 13th Five-Year Plan,* written by Scott Kennedy and Christopher K. Johnson. *Perfecting China, Inc.* is an expansive study of the Five-Year Plan as a whole. It concerns some areas relevant to this essay, for example changes instituted to SOEs, environmental regulations, and the importance of the Chinese Five-Year Plans as policy documents. However, to the best of the author's knowledge, no analyses of the *13th Five-Year Plan* have looked specifically at the minerals section (in this essay referred to as the *National Plan).* Apart from sections of *Perfecting China, Inc.*, none have looked at the foreign policy ramifications of the primarily domestic policies within the *13th Five-Year Plan* – but there is an extensive literature regarding Chinese resource security, and the influence of China within the global minerals trade. The 2019 study *China's Domestic and Foreign Influence on the Global Cobalt Supply Chain* by Gulley et al. was hugely beneficial for the shaping of the second section of this essay, as it grapples with a similar industry and research problem, and provides methodological inspiration for calculating the degree of Chinese influence within mining.

However, in contrast to this study, the article looks at cobalt in the D. R. Congo instead of copper in Zambia.

Regarding Chinese mining on the African continent, research includes the Ericsson et al. 2020 article *Chinese Control Over African and Global Mining – Past, Present and Future.* In it, the authors provide statistics on Chinese corporations active in Africa, the primary minerals extracted, the Chinese share in ownership in the sector, and some critical reflections regarding the future of such operations (Ericsson et al., pp. 153). Deborah Bräutigam has conducted extensive research on the topic of potential Chinese Debt Trap Diplomacy, including in Zambia, and heads the China Africa Research Initiative connected to Johns Hopkins University (Bräutigam, pp. 1349). Norris' 2010 *Economic Statecraft with Chinese Characteristics* delves into the dynamics of state-controlled investments through commercial or semi-commercial actors in connection to grand strategy – specifically Chinese (Norris, pp. 83).

China directing its foreign direct investments for policy purposes, among them the securing of strategic resources, is by now a well-established idea; Deng's 2007 article *Investing for Strategic Resources and its Rationale: The Case of Outward FDI from Chinese Companies*, although by now quite dated, still provides insight into the dynamics of and reasons for Chinese strategic investments. Furthermore, it shows that the phenomenon by itself is nothing new, either lending credence to the idea of China having been demonised recently, or of China as a chess master. However, an interesting development to note is that when the article was penned, Deng found that the primary target of investment were nations with a high technological standard, and investment foci were within technology rather than natural resources (Deng, pp. 80). This can be used as an indicator of China's rapid progression from a developing to 'recently developed' nation in only a few decades. The bottlenecks for Chinese growth were in Deng's article a low technological base and quality; the bottlenecks now are a lack of resources to produce high-technology products (Deng, pp. 77).

The previous research employing the theories used in the essay is discussed below.

2b. Theories

2bi. Resource Security Theory

Bass and Chakrabarty's 2014 *Resource security: Competition for Global Resources, Strategic Intent, and Governments as Owners* concerns resource security, especially in relation to state-owned enterprises (Bass & Chakrabarty, pp. 961). The essay uses Resource Security Theory as presented by Bass and Chakrabarty (Bass & Chakrabarty, pp. 962-963). Resource Security Theory presents analytical tools suitable for looking at the actions of state-owned enterprises securing critical materials, the use of domestic resources, dependence, as well as delving into the differences between exploitation and exploration (Bass & Chakrabarty, pp. 962-963).

Resource security, according to Bass and Chakrabarty, is the safeguarding of supply relating to materials deemed critical for important industries, so as to prevent dependence on other actors (Bass & Chakrabarty, pp. 961-962). Related to resource security is Resource Dependence Theory – an older theory incorporated into Resource Security Theory, stating that larger firms with more resources become less dependent on others, creating incentive for firms to expand (Bass & Chakrabarty, pp. 961). Resource Security Theory applies this to state-owned enterprises, making the connection between the strategic intents of governments, and expansion to reduce dependence (Bass & Chakrabarty, pp. 962). To quote, "when resources are exploited and consequently consumed, the long-term strategic benefits, including enhanced geopolitical position and power, are correspondingly depleted" (Bass & Chakrabarty, pp. 962). This creates incentive for states to look abroad for resources so as to not deplete their own stocks – alternatively, to reduce the stocks of others, increasing relative advantages. Bass and Chakrabarty also discuss the apparent paradox that an investment abroad is a wasted investment that could instead have been made at home; however, when taking resource depletion into consideration, this is not the case (Bass & Chakrabarty, pp. 976).

The focus on the acquisition of strategic resources by governments through state-owned enterprises makes the theory highly relevant when looking at Chinese commercial actions abroad, as this essay aims to use investments through SOEs as an indicator of strategic intent and action. Bass and Chakrabarty's study is more quantitative than this essay, though it presents several metrics applicable to this case, such as resource richness of the target country and extent

of state ownership (Bass & Chakrabarty, pp. 969-970). Furthermore, many of the quantitative aspects of the study can be found in other works regarding Zambia; for example, Ericsson et al. provides data on Chinese exploration in the country. Resource Security Theory also presents an opportunity for theory development, as the article focuses on petroleum and predates the widespread adoption of electric vehicles. This provides an interesting contrast as to whether nations are treating materials critical to clean energy today in the same manner as they did petroleum ten years ago. It does however also highlight the increasing priority given to minerals and metals, perhaps serving to illustrate the long-term strategy behind acquisitions within the sphere (Bass & Chakrabarty, pp. 966).

Resource Security Theory has primarily been used within economics and management theory, but has also seen limited use connected to diplomatic theory. Worth noting is its hitherto overshadowed status in comparison to Resource Dependence Theory, which it in part builds upon. As such, a successful employment of RST could hopefully serve to prove its usefulness.

Based on the prerequisites for RST, the three hypotheses become:
H1: China has insufficient domestic resources to satisfy industrial demand
H2: China invests via SOEs in Zambian copper mining; especially in exploration
H3: Zambian copper extracted by Chinese state-owned enterprises is imported to China.

2bii. Debt Trap Diplomacy

The Debt Trap Diplomacy Hypothesis is a notion that China purposely works to indebt resource-rich developing nations via infrastructure projects and loans. This is done in order to 'trap' them and gain access to something, usually of national importance to the target, and of strategic use to China (Bräutigam, pp. 1357). The idea was coined in 2017 by Indian scholar Brahma Chellaney, and has seen extensive narrative use primarily by Western powers, including in policy circles (Singh, pp. 240-241). It is supposedly made possible by the Belt and Road Initiative, through which China can launch investments and infrastructure projects (Wang). The misappropriation of such funds, or the building of 'unnecessary' projects, are seen as drivers of the phenomenon, thus making corruption a valuable indicator in assessing the possible use of DTD (Bräutigam, pp. 1353-1354).

The use of Debt Trap Diplomacy would serve China by means of gaining access to, or increasing ownership in, important resources. It can be seen as an alternative means of investment, wherein initial investment targets or loans are potentially unrelated to important resources, but the compensation for when those investments and loans are left unpaid are very much connected to such strategic materials.

Furthermore, part of Debt Trap Diplomacy is the apparent use of Chinese labour in Chinese-led projects, instead of educating and employing locals. This is hypothesised to cement a reliance on China due to both not building up local competence as well as Chinese undercutting of local firms (Norris, pp. 193). This can be firmly connected to Bass and Chakrabarty's notion of SOEs operating differently from commercial actors also in the fact that they do not need the same profit margins (Bass & Chakrabarty, pp. 964-965).

Debt Trap Diplomacy is contested, owing to its modern and divisive nature. There is extensive literature disproving the notion, at least on a case-by-case basis, with scholars believing it to be anti-Chinese propaganda. An example in this category is the aforementioned work of Singh (Singh, pp. 240-241). There is, however, literature highlighting the concept's viability, e.g. a 2022 study on Zimbabwe, Cameroon, and Djibouti (Al-Fadhat & Prasetio, pp. 16-17). This makes it an interesting concept to apply as a 'least likely'-theory in the congruence analysis. The Debt Trap Diplomacy straddles the line between economics and International Relations, being treated as a potential foreign policy tool. There is a lack of insight into how China uses its economic might, both creating potentially unmerited worries regarding China utilising the aforementioned trapping, and perhaps a dangerous lack of understanding when, if, it does (Bräutigam & Xiaoyang, pp. 800).

To test the validity of the theory, the three hypotheses for DTD were:
H1: China uses the BRI to access Zambian copper industry
H2: Zambia has a large outstanding debt to China
H3: China leverages Zambian debt to acquire copper.

The exchange of natural resources for debt write-off can be considered a smoking gun-test for the theory, reflected in H3. Failing it discredits the theory.

2biii. Pollution Haven Hypothesis

The Pollution Haven Hypothesis [PHH] is an economic theory coined by Arik Levinson and M. Scott Taylor in 2008. It states that industries relocate from more to less developed countries as a means to remain competitive by 'escaping' stricter environmental regulations (Jeetoo & Chinyanga, pp. 58170). The PHH, owing to its dual nature focusing on the environmental impact of economics, has mostly been used within economic academia. It is contested by some researchers claiming that the introduction of foreign capital and technology will prove environmentally beneficial for the developing world; this relates to the Environmental Kuznets Curve [EKC], often connected to the PHH (Li, Qiao, Li et al., pp. 2). The EKC concerns the connection between economic growth and environmental degradation. The 'curve' component is due to the hypothesised turning point where a nation becomes developed (or polluted) enough to either start prioritising the environment, or to employ less polluting techniques and technology (Jeetoo & Chinyanga, pp. 58171). A recent study looked specifically at applying the PHH and EKC to BRI countries, concluding that foreign direct investment [FDI] negatively impacted Sub-Saharan Africa environmentally (Li, Qiao, Li et al., pp. 8). It was found that the EKC did not correlate for the region, meaning that there was no sign of environmental degradation slowing with more FDI; instead, it increased (Li, Qiao, Li et al., pp. 8).

However, the primary metric for measuring environmental degradation for both the PHH and EKC is CO_2 emissions; this is quite lacklustre in terms of mining, as the primary environmental challenges presented by such is pollution and not emissions (Lindahl, pp. 6). Luckily, the study by Jeetoo and Chinyanga also includes resource depletion as an indicator (Jeetoo & Chinyanga, pp. 58175). The study by Li, Qiao, Li et al. used SO_2 emissions (Li, Qiao, Li et al., pp. 5). Mineral resources depletion is defined by the World Bank as the ratio between the value of a mineral stock to its remaining lifetime. A low value is thus preferable, implying greater stocks and/or a more sustainable rate of mining. The two ways of improving the value of depletion should accordingly be exploration in order to uncover greater mineral stocks, or a reduced rate of extraction. Mineral depletion can also be used to gauge a nation's dependence on a specific mineral, providing a metric for both economic vulnerability and sustainability (Boos & Holm-Müller, pp. 887). A lower value implies less dependence and more sustainability. Furthermore, the fact that untouched reserves are easier to extract resources from can be taken into account,

as is done in debates of 'peak minerals', or the supposed turning point where extraction becomes more expensive than the value of resources extracted (T. Prior et al., pp. 578-579).

The goal of using the PHH in this essay is to explain the environmental aspect of China investing in Zambian copper mining, positing that China is tightening its own environmental regulations as a result of pollution and decreasing profitability, causing China to intensify copper mining in Zambia, increasing the Zambian resource depletion rate while decreasing its own.

The three hypotheses for PHH were thus:

H1: China is making environmental laws stricter

H2: Zambia has a higher mineral depletion than China

H3: China displays less environmental strictness in Zambia.

3. Method

3a. Methodology

The essay is constructed as a case study using congruence analysis with a complementary theories-approach. Choosing a single-case structure was due to wanting to investigate China's actions in Zambia particularly, and to limit the scope of the essay to one specific material sourced from one specific region. A congruence analysis - a small-N research approach - contrasts hypotheses deduced from abstract theories to empirical evidence provided by case studies. The greater the congruence between these theoretical predictions and the observed patterns in the empirical material, the greater the explanatory power of the related theories (Blatter & Haverland, pp. 144-146). Each theory in this essay was assigned three hypotheses to test. Testing these hypotheses answers the research question. Congruence analyses have two subtypes – competitive and complementary. A competitive approach proceeds to, after having assessed the explanatory power of at least two theories for the same empiric material, compare the theories' relative strengths. As such, the research process risks becoming biased in favour of one over the other, and perhaps assigning undue credit to a theory as all-encompassing. Clarifying, it shifts focus from the utilisation of theories as explanatory tools to instead argue their relative values. A complementary approach instead moves more towards a synthesis between theories rather than their competitive separation, finding strength by producing complementary implications (Blatter & Haverland, pp. 145). I argue that a theoretical synthesis better reflects a case encompassing several subjects at interplay, such as in the essay. Furthermore, a complementary approach makes room for new or overlooked theories in order to build more well-rounded syntheses (Blatter & Haverland, pp. 145). As such, a complementary congruence analysis was deemed appropriate. Using the competitive approach instead could have yielded a weighing of e.g. environmental versus economic drivers by pitting PHH against RST. "*How can we explain X using Y?*" is a typical research question for a complementary-theories congruence analysis; Blatter and Haverland provide a list of examples of research questions used in previous congruence analyses in their book (Blatter & Haverland, pp. 150-151). This guided the shaping of this essay's research question, so as to make sure it was compatible with the method employed.

The use of a ‘least-likely’-theory provides a critical perspective to the essay, and is meant to test a longstanding narrative; in this case, that China is purposely indebting the developing world for its own gain, instead of making genuine investments. Using a ‘least-likely’-theory in congruence analyses finds support in the work of Blatter and Haverland, wherein the use of such a theory acts to challenge widely held assumptions (Blatter & Haverland, pp. 176-177). However, if the essay instead finds that China indeed uses Debt Trap Diplomacy in Zambia, that fact could be incorporated into the two remaining theories regarding pollution havens (where China exports dirty industry abroad, ergo exploiting an underdeveloped country), and resource security (wherein China invests strategically to access natural resources it deems critical). This would then instead contribute to a theoretical synthesis.

Choosing a congruence analysis instead of e.g. process tracing comes down to the essay not primarily concerning the inference of causal processes. Process tracing, although having advantages such as easily introducing smoking gun tests, primarily concerns drawing up a chronological ordering of factors to explain an outcome (Blatter & Haverland, pp. 81). This essay makes no attempts to clearly chronologically order its three theories, as the factors driving them can be deemed both simultaneous and self-reinforcing. This can be acknowledged as a potential weakness of the essay; future studies could well investigate the causality of Chinese minerals policy and activities in Zambia, especially if a theoretical synthesis can be achieved.

To better grasp the *National Plan*, section one of the analysis gives special attention to the solutions to Chinese resource security as presented in the document. These solutions can be contrasted to the three theories of the congruence analysis, acting as an empiric framework to contextualise the case of Zambia. The essay posits that these solutions are factors guiding Chinese actions in the country, and can be used as a medium through which to apply the essay theories. The *National Plan* is complemented by additional data on the respective subjects it covers to both better understand its context and contrast its content to academically credible sources.

An important notion that the essay partially rests on is that the actions of state-owned enterprises can be used to gauge and track the goals and intentions of the states that own them; this is a key takeaway from Bass and Chakrabarty’s Resource Security Theory. The use of a relatively unknown theory within a congruence analysis lends further academic value to this study, highlighting its potential use within an adjacent field (Blatter & Haverland, pp. 197-198).

3b. Empiric Material

The data collection of the essay's congruence analysis is designed around academic work and historical sources. A precedent of this type of material sourcing is the book *Liberal Peace, Liberal War: American Politics and International Security* by John Owens. It concerns why liberal states rarely war amongst themselves, though frequently with illiberal ones (Bukovansky, pp. 740-741). Although using a competing-theories approach, the material used is primarily historic and academic as opposed to for example experimental. A criticism of the book is its clear purpose of testing hypotheses and weighing theories rather than providing a richer narrative, missing context and becoming path-dependent (Bukovansky, pp. 740-741). The hope in using a complementary-theories approach was to avoid just this. However, as a congruence analysis is by nature theory-focused, there is always a risk of the 'theoretical filter' missing aspects of the empirical material falling outside its scope (Blatter & Haverland, pp. 154). The only remedy to this is more cases and more theories, in a manner similar to how more data points in a quantitative study improves reliability.

A famous example of a congruence analysis with a complementary approach is *Essence of Decision: Explaining the Cuban Missile Crisis* by Allison and Zellikow. The book is partially a pushback against the theoretical dominance of economics within political science, instead emphasising decision-making and psychology. Thus, while there are methodological similarities between this study and the book, it has little theoretical value for this essay.

The guiding document for analysing Chinese critical materials policy is the *National Plan for Mineral Resources (2016-2020).* The *National Plan*, approved in 2016, comprises statistics, aims for Chinese politics, and strategies to reach them. It is part of the *13th Five-Year Plan.* Owing to its nature as a policy document, the *National Plan* is clearly political and thus a potentially biased source; seeing as it is publicly available, it is possible that some nuances have been omitted so as to preserve secrecy and public image. The *National Plan* also concerns fossil fuels like coal and petroleum to a large extent, subjects which, as mentioned, have been more extensively covered than minerals and metals. The translation used as the basis of this essay is enclosed as an appendix, and the original Chinese version can be found in the bibliography.

The *14th Five-Year Plan Raw Material Industry Development Plan*, approved in 2021, is the most recent of the strategies guiding Chinese mineral policy, and the successor to the *National Plan*. The main difference to the previous *National Plan* is the emphasis on digital integration of infrastructure and in processing (Ministry of Industry and Information Technology, pp. 6-7). The plan seemingly focuses more on modernisation of existing systems, rather than a large-scale revamping as can be seen with the *National Plan* (Ministry of Industry and Information Technology, pp. 7). It further continues to emphasise the 'greening' of industries related to minerals (Ministry of Industry and Information Technology, pp. 8-9). It largely continues on the same path as the *National Plan*, also explicitly mentioning resource security, encouraging 'rational' development of domestic mineral resources, recycling, and international cooperation (Ministry of Industry and Information Technology, pp. 10). Both the *National Plan* and the *14th Five-Year Plan* were found through the International Energy Agency's Critical Mineral Policy Tracker ([2]International Energy Agency). Choosing the *National Plan* as the document informing this essay is due to it being more comprehensive than the *14th Five-Year Plan*, and that it is completed, meaning the policies within have been fully implemented and their effects can be assessed. We know through the *14th Five-Year Plan* that the *National Plan* was considered a success; for example, it is mentioned that the capacity of certain important minerals has improved (Ministry of Industry and Information Technology, pp. 12).

4. Analysis

4a. Section One: The Goals and Perspectives of China

4ai. The National Plan, Summarised

The following parts, 4aii – 4avi, delve deeper into the solutions to resource security in the *National Plan*, supplemented with additional sources. The theory hypotheses are applied continually. To begin the analysis, the solutions are identified and placed into theoretical categories, matched with theory hypotheses they can be used to answer. This is to structure the analysis and provide a framework. The solutions provide important context to how and why China would involve itself in Zambia.

The *National Plan* proposes six main 'solutions' to the problem of resource security;

1) "focus on prospecting and conserve minerals important for strategic emerging industries,
2) promote both technological and administrative innovations in the mining industry so as to effectivise and better competitiveness,
3) better coordinate the development and layout of mining in connection to regional and industrial development,
4) accelerate and promote green development of mining, and increase both conservation and recycling,
5) deepen international mining cooperation through the Belt and Road Initiative by strengthening development of overseas mineral resources and 'deep integration'; emphasise 'win-win'-results,
6) promote mining development primarily in poorer areas so as to boost the local economy" (Ministry of Land and Resources, pp. 11-13).

Especially number 5 on this list is highly relevant when looking at Chinese actions in Zambia, seeing as though it concerns international ties. As such, Solution 5 will be heavily featured in section two of the analysis, focusing on China in Zambia.

	Resource Security Theory	Debt Trap Diplomacy	Pollution Haven Hypothesis
Hypothesis 1	Solution 1 Solution 6	Solution 2 Solution 5	Solution 2 Solution 3 Solution 4
Hypothesis 2	Solution 2 Solution 5 (section 2)	Solution 5 (section 2)	Solution 5 (section 2)
Hypothesis 3	Solution 5 (section 2)	Solution 5 (section 2)	Solution 5 (section 2)

Table 1. Table of essay theories, hypotheses, and solutions, categorised.

4aii. Solution 1: "Focus on prospecting and conserve minerals important for strategic emerging industries"

Resource Security Theory

H1: China has insufficient domestic resources to satisfy industrial demand

The Chinese stance on utilising its domestic resources is split. Just as thinkers in the US have expressed concern over increasing reliance on materials sourced overseas, China not extracting domestic minerals in an appropriate proportion to imports risks increasing dependency, threatening resource security (Ericsson et al, pp. 173). On one hand, lithium extraction, e.g., is highly encouraged, as well as research into technologies key to more efficient extraction of the metal (Ministry of Land and Resources, pp. 54-55). However, much of this encouragement concerns exploration instead of exploitation, and there is still an emphasis on protection (Ministry of Land and Resources, pp. 54-55). Exploration, according to Bass and Chakrabarty, is the acquisition of resources with a long-term thinking, not necessarily being available for use immediately; exploitation increases the short-term resource security by immediately using resources for production (Bass & Chakrabarty, pp. 964). Exploration is the same as prospecting. Exploration, especially with a focus on minerals relating to strategic emerging industries, is considered very important to China according to the *National Plan*, seen as a step towards future-proofing the industry (Ministry of Land and Resources, pp. 28). Exploration is the

favoured investment target for SOEs according to Bass and Chakrabarty (Bass & Chakrabarty, pp. 965). Simultaneously, China exhibits protectionism in its mining policies. For example, some mineral species, such as those relating to rare earth elements, are to be totally state-controlled with carefully managed reserves and new mining capacities (Ministry of Land and Resources, pp. 66). The *National Plan* states that the management of exploration and mining areas must be strict, as well as the scale of mining rights (Ministry of Land and Resources, pp. 40). Inefficient mines and mine construction projects are strictly prohibited; 'inefficiency' includes excessive energy consumption, pollution, and a non-comprehensive use of resources. Any doubts thereof must be dispelled before gaining mining rights (Ministry of Land and Resources, pp. 67-68).

Focusing on critical metals, China's status as the world's leading producer of Lithium-Ion batteries is an example of how exports place a drain on the supply of materials critical in the *National Plan* (Ministry of Land and Resources, pp. 47). While the Chinese market is huge, the country's industrial nature and net exporter leads to a bleed on the resources extracted within the nation's borders by them leaving the country as goods. To combat this issue, the *National Plan* argues for the introduction of a more circular economy wherein less important material flows out of China than in, and a greater emphasis on recycling, but as long as China's economic power and influence rests on its exports, resources will inevitably be shipped out (Ministry of Land and Resources, pp. 74-76).

Summarising, the in-border reserves and production capacity cannot satisfy demand. The use of domestic resources is in some cases encouraged, and in others outright banned, as the depletion of critical materials would cement dependence on international markets. China throttles its extraction of important metals in order to secure future domestic supply. In turn, an expansion of safe sourcing abroad is required. This solution can be slotted into the Resource Security Theory category's H1 – that China has insufficient domestic resources to satisfy its industrial demand.

4aiii. Solution 2: "Promote both technological and administrative innovations in the mining industry so as to effectivise and better competitiveness"

Resource Security Theory

H2: China invests via SOEs in Zambian copper mining; especially in exploration

China's goal is to by 2025 effectively partake in governing global mining, becoming a force to be reckoned with in the industry (Ministry of Land and Resources, pp. 17). To achieve this, its mining companies must expand and effectivise activities through administrative innovation. China's economic system of 'state capitalism' largely relies on the use of state-owned enterprises (Lin et al., pp. 1-2). Globally, SOEs have proven less productive than their private counterparts. This has not been true in China, giving rise to the 'Chinese Puzzle' (Lin et al., pp. 3). This clashes with Bass and Chakrabarty's notion that SOEs are less both efficient and profit-driven, often willing to pay more for less (Bass & Chakrabarty, pp. 964-965). The hybrid nature of state capitalism is mirrored in the goals of China's SOE usage; Norris states that the efficiency of commercialisation and the stability of state control are merged, creating companies with the aim of international competition and the ability to undercut (Norris, pp. 169). Furthermore, state support allows for longer-term investments to be made, in turn decoupling Chinese SOEs from having to generate initial high profits (Lin et al., pp. 3). This fact is supported by Resource Security Theory, and comes into play when discussing the undercutting of markets and lending by Chinese firms (Bass & Chakrabarty, pp. 964-965).

Debt Trap Diplomacy

H1: China uses the BRI to access Zambian copper industry

The dynamics of dealing with state- versus privately owned firms differs in that a state-owned firm has a direct political link to its parent country; Bass and Chakrabarty write that a difference between SOEs and private firms engaging with resource-rich countries is that SOEs can actively serve a greater political intent and advance the geostrategic position of the home country by doing so (Bass & Chakrabarty, pp. 965). This gives added incentive for SOEs to operate abroad beyond the economic aspects. However, Bräutigam argues that Chinese SOEs are freer in their

actions than many believe, with the 'China Inc.' view of Beijing directing all its assets towards strategic goals being an oversimplification (Bräutigam, pp. 1352). She calls this 'fragmented authoritarianism'. Worth noting is her following statement that control is difficult - not impossible (Bräutigam, pp. 1352). Fragmented authoritarianism speaks against the notion in RST that SOEs can be used to effectively gauge the strategic intent of their parent states.

As part of the preparations for the undertaking of the Belt and Road Initiative, many mergers between Chinese SOEs occurred (Lin et al., pp. 9). This can be connected to the *National Plan* stating the need for creating more internationally competitive enterprises, and to the greater ease of controlling a few large firms rather than many smaller ones (Ministry of Land and Resources, pp. 8-9). The BRI provides a framework with clear investment targets through which SOEs can operate abroad, supported by various policy banks (Al-Fadhat & Prasetio, pp. 9-10).

Pollution Haven Hypothesis

H1: China is making environmental laws stricter

Concerning technological innovations, Beijing recognises a continuing need for fossil fuels. Perhaps owing to its self-proclaimed hybrid status of 'newly developed country', China is branching out both towards 'green' energy and improving preexisting technologies like coal and gas (Ministry of Land and Resources, pp. 65-70). The *National Plan* even refers to natural gas and coal gangue, the leftovers of coal mining, as "clean energy" (Ministry of Land and Resources, pp. 65). This seems almost contradictory, as the document also repeatedly states that a move away from such sources should be carried out as swiftly as possible – for example, the total amount of coal mining is to be controlled, and a low-carbon energy mineral system is seen as a long-term replacement (Ministry of Land and Resources, pp. 41-42). It could be argued that this speaks against the H1 of the Pollution Haven Hypothesis by means of Chinese domestic emissions not being excessively capped.

4aiv. Solution 3: ”Better coordinate the development and layout of mining in connection to regional and industrial development”

Pollution Haven Hypothesis

H1: China is making environmental laws stricter

Going by Norris, a further nuance in the CCP prioritising acquiring natural resources is the stability of the regime itself, ensured by continuing economic growth and a visible improvement to the lives of the average Chinese citizen (Norris, pp. 170-171). A dilemma occurs when resource extraction creates pollution, worsening quality of life. Reducing pollution is thus both imperative and shows the CCP in a good light. Norris mentions the Chinese oil industry's declining output; a parallel could be drawn to mining in China (Norris, pp. 170-171). The *National Plan* states that the output of Chinese mines is less than 40% of maximum capacity, primarily small- or medium-scale, and still highly polluting (Ministry of Land and Resources, pp. 8). It stands to reason that, similar to when Chinese oil companies first started looking beyond their borders, Chinese mining companies have further incentive for going abroad due to the state of mining within the country, with more untapped resources and less politicking overseas (Norris, pp. 182). The greater ease of extracting resources in less-depleted regions finds further support when looking at the 'peak minerals' theory mentioned in connection to the Pollution Haven Hypothesis; as high-grade and easily accessible ore is used up, less optimal substitutes are used instead, either forcing more intensive mining due to needing more ore for the same amount of metal, or cost-cutting in other areas (T. Prior et al., pp. 578). This supports PHH H1 regarding increasing stringency for domestic Chinese mines.

4av. Solution 4: “Accelerate and promote green development of mining, and increase both conservation and recycling”

Pollution Haven Hypothesis

H1: China is making environmental laws stricter

The ecological difficulties facing China are numerous. With a population exceeding one billion and having faced possibly history's most intensive industrialisation, the combination of a

growing Chinese middle-class with an improving standard of living, and industry supporting that growth, pollution in all its forms has led to a dire situation (Li et al., pp. 846-847).

The connection between the environment, mining, and the supply of critical minerals is manyfold. With the middle-class gaining the financial means and incentives to purchase luxury goods such as cars, it is imperative for the CCP to make electric vehicles a viable alternative to internal combustion engines, as air pollution and CO_2 emissions are already an issue (Rohde & Muller, pp. 1). China, as the biggest global producer of both batteries and electric vehicles, thus has a massive demand on battery metals to satiate. While the nation has large reserves of many of the necessary materials within its borders, extracting them presents other challenges. Mining has traditionally been incredibly environmentally destructive (Ministry of Land and Resources, pp. 8). As such, the *National Plan* makes clear that making mining in China 'as clean as possible' must accelerate (Ministry of Land and Resources, pp. 12). Areas with "strong environmental carrying capacity" are still to be the sites of medium- to large-scale mines, however (Ministry of Land and Resources, pp. 47). The issue of mine size was mentioned earlier, with the *National Plan* noting that 88.4% of Chinese mines were small-sized or below (Ministry of Land and Resources, pp. 8). Wishing to do away with many of the smaller and instead develop larger-scale mines is likely due to wanting to limit pollution to a few concentrated areas (Ministry of Land and Resources, pp. 47). Fewer and larger mines give an additional advantage similar to that of merging SOEs - easier control, and thus easier enforcing of environmental regulations. Ericsson et al. argue that these stricter environmental standards will cut into the profits of Chinese mines, especially the smaller ones (Ericsson et al., pp. 174). Going by the *National Plan'*s stated need for Chinese mining companies to be internationally competitive, this gives yet another incentive to reduce the number and increase the scale of domestic mines (Ministry of Land and Resources, pp. 8-9).

Summarising, China is facing a dilemma wherein satiating the demands of the domestic market through internal resources leads to environmental damage; accordingly, dirty domestic industries must be scaled back and/or streamlined. More stringent environmental policies are to be introduced, threatening to cut into profits. This, in turn, requires a restructuring of mining in China; from many small mines, to fewer, larger ones. However, these new, stricter regulations could be 'escaped' by electing to go abroad. This fits the notion of PHH and its H1.

4avi. Solution 5: "Deepen international mining cooperation through the Belt and Road Initiative by strengthening development of overseas mineral resources and 'deep integration'; emphasise 'win-win'-results"

Debt Trap Diplomacy

H1: China uses the BRI to access Zambian copper industry

The Belt and Road Initiative [BRI] was launched by China in 2013 to revitalise the ancient Silk Road trade route and project Chinese influence globally (Wang). China regards Africa as an important arena for exercising its soft power, and the displaying of China as a shining example of a previously developing country that 'made it' is a key part of making the Chinese model attractive (Bräutigam & Xiaoyang, pp. 802). The *National Plan* mentions the BRI to a large extent, finding the initiative critical to ensuring a continued and increasing supply of critical materials by means of strengthening Chinese mining industry, its competitiveness, and international cooperation (Ministry of Land and Resources, pp. 13).

Recognising globalisation having led to international cooperation in mining, the *National Plan* makes the need to capitalise on this phenomenon clear (Ministry of Land and Resources, pp. 16). The means of doing this is based on promoting exploration and exploitation of important minerals, including copper, by building relevant infrastructure, and creating "a global mining cooperation system that is compatible with China's economic development" (Ministry of Land and Resources, pp. 16). So-called "win-win results" and mutual benefits are emphasised, leading to a deeper integration between the countries of the BRI and China (Ministry of Land and Resources, pp. 13). The investment targets of the BRI are laid bare in the *National Plan*, mentioning a "joint investment model of mining, electricity and waterway ports" (Ministry of Land and Resources, pp. 79). Note the subsequent infrastructural focus. Furthermore, cooperation in implementing the full mineral extraction chain of exploration, development, smelting, processing, and manufacturing locally in other countries is emphasised, including the building of various projects to demonstrate Chinese advances (Ministry of Land and Resources, pp. 79). The use of Chinese SOEs for mining ventures in conjunction with the BRI is encouraged by the *National Plan* (Ministry of Land and Resources, pp. 79). Furthermore, several statements are made regarding strengthening coordination and interconnection of overseas mining markets and operations (Ministry of Land and Resources, pp. 82-83). This

implies Bräutigam's idea of fragmented authoritarianism, with Beijing struggling to effectively coordinate and control its SOEs, to be at least partially correct. The establishing of larger 'groups', 'regions', or 'areas' could all be seen as parallels to the merging of SOEs into larger, more singular entities so as to concentrate both power and control – similar to the situation with Chinese mines (Ministry of Land and Resources, pp. 82). This resonates with Norris' note regarding the Chinese goal of creating enterprises both competitive and controllable (Norris, pp. 169).

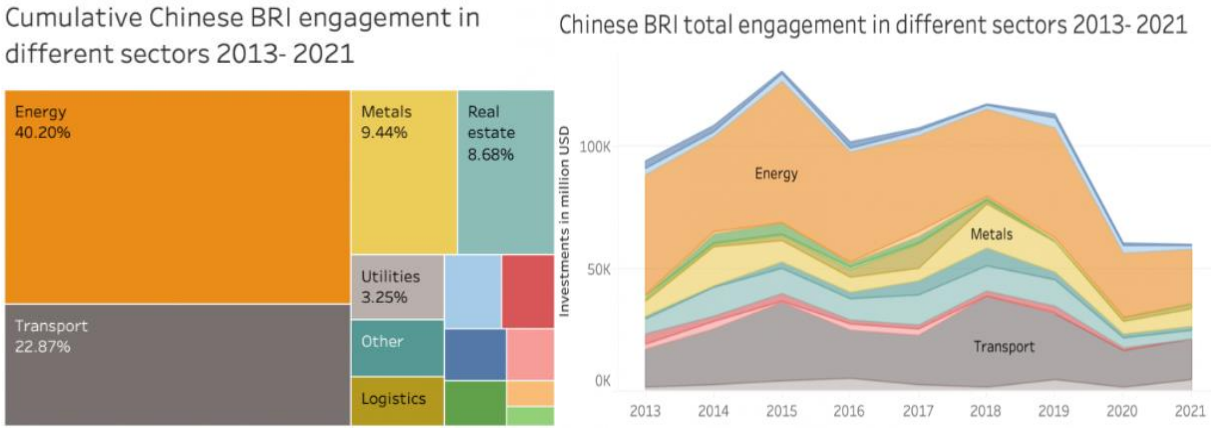

Fig. 1 & 2. Diagrams of investment targets of the BRI 2013-2021 (Wang).

As seen in the graphs above, metals were the third largest target for investments within the BRI between 2013-2021, with expenditure peaking in 2018 (Wang). A crunch in the BRI budget came between 2019-2020, likely due to the outbreak of COVID-19. Zambia joined the BRI in 2018; coincidentally, the same year that metal investments peaked (Nedopil).

Summarising, the Belt and Road Initiative is explicitly used by China to further the extraction of and access to critical minerals in nations connected to it, supporting H1 of DTD. The BRI decreases China's dependence and increases its power. Win-win deals are emphasised, infrastructure and a helping hand to develop mineral extraction in the countries involved provided, and increased productivity for Chinese-owned firms leads to increased tax revenues for the host countries. Section two of the essay expands on Solution 5, looking at the case of China in Zambia specifically.

4avi. Solution 6: "Promote mining development primarily in poorer areas so as to boost the local economy"

Resource Security Theory

H1: China has insufficient domestic resources to satisfy industrial demand

A pattern regarding the geographical locations of proposed domestic mines is that they are all far from Beijing, and include both Xinjiang and Tibet (Ministry of Land and Resources, pp. 54-55). The former is notable for accusations of ongoing human rights abuses, and the latter for being considered unlawfully occupied territory by some (Walker). The *National Plan* indeed mentions a prioritisation for mineral development in "ethnic" and "border areas" (Ministry of Land and Resources, pp. 85-85). This could be argued as China displaying tendencies towards the Pollution Haven Hypothesis. Expanding domestic copper production is specifically mentioned in the *National Plan*, and provides some statistics. Notably, Mongolia and, again, Xinjiang, are mentioned as important locations for this expansion (Ministry of Land and Resources, pp. 48-49). Copper ore production is to be stabilised at 600-700 000 tons per year, and the capacity of ore increased by 80-100 000 tons yearly through exploration (Ministry of Land and Resources, pp. 48-49). According to the Chinese National Statistics Bureau, China's copper production in 2021 exceeded 10 000 000 tons for the second year in a row, implying a similar number for 2020 (Zhang & Chow). However, according to a 2020 report on the copper market by mining giant Nornickel, only approximately 20% of the copper originated from China, the remaining 80% coming from outside sources for refining (Nornickel, pp. 60-63). This overlaps with the 1 800 000 ton Chinese copper ore production reported in 2020 (GlobalData). As such, the copper mining in China must have been accelerated by more than what was originally planned in the *National Plan*, as even a 100 000 ton increase per year between 2016-2020 would only have yielded an output of 1 100 000 tons, going by the 700 000 ton stabilisation (Ministry of Land and Resources, pp. 48-49). The *National Plan* expected a 13 500 000 ton consumption of refined copper in 2020 (Ministry of Land and Resources, pp. 6). According to the NorNickel annual report, China accounted for 54% of global refined copper consumption at approximately 12 500 000 tons (Nornickel, pp. 60-63). As such, domestic Chinese mining accounted for little over a tenth of the total copper consumption in 2020, despite the increases wrought by the *National Plan*. This further shows that domestic Chinese copper mining cannot supply the demand, in support of RST H1.

4b. Section Two: Applying the 'National Plan' - China in Zambia

4bi. Resource Security Theory

H1: China has insufficient domestic resources to satisfy industrial demand

H2: China invests via SOEs in Zambian copper mining; especially in exploration

H3: Zambian copper extracted by Chinese state-owned enterprises is imported to China

Building on the fifth solution of the *National Plan* - regarding the use of international ties to shore up mineral production - the case of Zambia is looked at specifically.

China has been involved in Zambia since the African nation's independence in 1964 (Matambo, pp. 45). Zambia, as its neighbour the Democratic Republic of Congo, is situated in the Central African Copperbelt – the world's largest copper reserve, also holding approximately 40% of global cobalt supplies (Geology for Investors). Landlocked, Zambia's economy largely hinges on its copper production, implying a high mineral depletion (Bräutigam, pp. 1358). In 2020, the country was the world's biggest producer of raw copper and 8th biggest of refined. As mentioned in the introduction, China is the world's biggest importer of both, meaning that a large share of Zambia's economy depends on China (Nornickel, pp. 60-63). Zambia privatised its copper mines to combat an economic downturn due to crippling debt in the 1990's, paving the road for foreign investors (Bräutigam, pp. 1358). Accordingly, the Zambian government cannot offer copper as security when taking loans (Bräutigam, pp. 1358). However, the state-owned Zambian Consolidated Copper Mines Investment Holdings**,** or ZCCM, was set up after the completion of privatisation in 2000, with stakes in many of the larger mines ([2]Extractive Industries Transparency Initiative, pp. 40).

As mentioned, China has huge resource reserves, but the concentration per capita is low. Comparing their respective resources per capita contrasts the situations of China and Zambia, and can be connected to the 'resource richness' metric of RST (Bass & Chakrabarty, pp. 969-970). Owing to 2016 being the first year of the *National Plan* and 2020 being the last, the two can be compared to assess the situations before and after its implementation. According to the USGS, China in 2016 had 28 000 000 tons of copper ore in total reserves, and Zambia 20 000 000 ([2]Flanagan, pp. 55). In 2020, China had 26 000 000t, and Zambia 21 000 000 ([3]Flanagan, pp. 55). China's 2016 population was 1.39 billion according to the World Bank, and Zambia's

17 million; China's in 2020 was 1.41 billion, and Zambia's 19 million ([1]World Bank). As such, China's copper per capita in 2016 was 0.02t/person, and Zambia's 1.05t/person. In 2020, that number in China decreased to 0.018t, and in Zambia increased to 1.1t/person. Two main points can be deduced from this. First, per capita, China is poor in copper in comparison to Zambia. Second, China's domestic reserves are decreasing, while Zambia's have increased. This increase reflects exploration efforts outpacing exploitation in Zambia, but not in China. This speaks against the notion of China's mineral depletion lessening while increasing Zambia's, but also goes hand in hand with China's supposed focus on exploration in Zambia. It further lends credence to RST H1 regarding insufficient Chinese domestic reserves, and H2 regarding Chinese investments in Zambian exploration.

A pertinent question is the number of the Chinese state-owned enterprises in Zambia. China's entry into Zambian copper mining came in 1998 with the purchase of the Chambishi mine in the Copperbelt region (Yao & Holden). By 2021, China Nonferrous Mining Corp. Ltd. owned the largest number of Chinese overseas copper mines at 18; 17 of these located in the Copperbelt region (Yao & Holden). China Nonferrous Mining Corp. Ltd. is a subsidiary of the state-owned China Nonferrous Metal Mining Group (SWFI News). Bass and Chakrabarty found in their study that SOEs are more likely to engage in exploration than exploitation, and to invest in exploration in countries where they have previous experience (Bass & Chakrabarty, pp. 965). According to Ericsson et al., the previously mentioned China Nonferrous, together with the Zhonghui company, stood for 17% of the total investments into exploration in Zambia in 2010 (Ericsson et al., pp. 174). In 2014, Chinese exploration had expanded further, with investments comprising more than 20% of that year's total (Ericsson et al., pp. 174). This focus on exploration correlates with the *National Plan* – recall that Solution One concerned increased encouragement of prospecting. The Chinese exploration budget in Africa peaked in 2014, having slowly decreased since (Yao & Holden). This seems to speak against the narrative of Chinese expansion in African mining. Worth noting here is that 2014 predates the *National Plan*, but is likely part of the 'Going Out'-initiative that China has been conducting since the late 1990's (Gulley et al., pp. 318). The same initiative is mentioned in the *National Plan,* the acceleration of which is seen as part of creating an international presence and competitiveness (Ministry of Land and Resources, pp. 82). Resource Security Theory was penned in 2014; it could be argued that a shift away from exploration towards exploitation might have occurred, at least in Zambia.

By 2018, halfway into the *National Plan*, Chinese companies controlled approximately 30% copper mining in Africa (Ericsson et al., pp. 170). According to Ericsson et al., this figure was even smaller in Zambia at less than "12% of the total value of minerals and metals produced", meaning that other multinational corporations when taken together control a much larger share of metals in the nation (Ericsson et al., pp. 170). However, based on the 2020 EITI report, a different picture emerges, at least in respect to copper. The report lists the ten biggest copper mines in Zambia, as well as their annual output ([2]Extractive Industries Transparency Initiative, pp. 64).

Commodity	Company	Unit	Production Quantity	Production Value (US $ million)
Copper	KALUMBILA MINERALS LIMITED	Metric tonne (MT)	251,175.36	1,549.37
	KANSANSHI MINING PLC	Metric tonne (MT)	221,487.44	1,366.24
	LUMWANA MINING COMPANY LIMITED	Metric tonne (MT)	124,969.86	770.87
	KONKOLA COPPER MINES PLC	Metric tonne (MT)	63,027.71	388.78
	LUANSHYA COPPER MINE	Metric tonne (MT)	56,612.06	349.21
	NFC AFRICA MINING PLC	Metric tonne (MT)	48,883.47	301.54
	MOPANI COPPER MINES PLC	Metric tonne (MT)	34,479.89	212.69
	LUBAMBE COPPER MINE LTD	Metric tonne (MT)	21,062.13	129.92
	SINO METALS	Metric tonne (MT)	13,087.30	80.73
	CHIBULUMA MINES PLC	Metric tonne (MT)	2,218.38	13.68

Fig. 3. List of the ten biggest Zambian copper mines in 2020 and their outputs ([2]Extractive Industries Transparency Initiative, pp. 64).

Of these ten, seven are Chinese-owned or affiliated. In 2019, the Chinese SOE Jiangxi Copper Company Ltd. bought into First Quantum Minerals, a Canadian-registered company, becoming the largest shareholder at 18.3%, with 36.1% of their total sales going to China (Market Screener). Note that 'total' includes production outside Zambia. This alone directly proves that Chinese involvement in the copper sector in Zambia increased during the 2016-2020 period of the *National Plan*, with several of the biggest mines owned by First Quantum. Kalumbila Minerals Limited, now known as FQM Trident Limited, is 100% owned by First Quantum Minerals (International Mining). Kansanshi Mining Ltd. is 80% owned by FQM and 20% by ZCCM ([1]ZCCM Investment Holdings PLC). NFC Africa Mining PLC is 80% owned by Chinese Nonferrous Metal Mining Group, or CNMC, and 20% by ZCCM ([2]ZCCM Investment Holdings PLC). Luanshya Copper Mine is 80% owned by CNMC and 20% by ZCCM ([3]ZCCM Investment Holdings PLC). Lumambe Copper Mine Ltd. is 80% owned by EMR Capital - a Hong Kong-based private firm – and 20% by ZCCM ([4]ZCCM Investment Holdings PLC). Sino

Metals are 100% owned by CNMC (China Nonferrous Mining Corporation Limited). Chibuluma is 100% owned by Metorex, a South African subsidiary of the Chinese state-owned Jinchuan Group (Metorex).

Ownership share as a measure of control is standard practice in economic academia according to Gulley et al. (Gulley et al., pp. 319). The Chinese share of the copper produced in these mines can be calculated and compared to the stated total Zambian output using these statistics.

Mine and total output, in Metric Tons	**Chinese share, in Metric Tons**
Kalumbila: 251 175.36t	$251\ 175.36 \times 0.183 = 45\ 965.09$t
Kansanshi: 221 487.44t	$221\ 487.44 \times 0.183 \times 0.8 = 32\ 425.76$t
Luanshya: 56 612.06t	$56\ 612.06 \times 0.8 = 45\ 289.65$t
NFC: 48 883.47t	$48\ 883.47 \times 0.8 = 39\ 106.78$t
Lumambe*: 21 062.13t	$21\ 062.13 \times 0.8 = 16\ 849.70$t
Sinometals: 13 087.30t	$13\ 087.30 \times 1 = 13\ 087.30$t
Chibuluma: 2 218.38t	$2\ 218.38 \times 1 = 2\ 218.38$t
	Total Chinese Share: 178 092.96t, excluding Lumambe 194 942.66t including Lumambe

Table 2. Table of Chinese shares of the ten largest Zambian copper mines in 2020.

According to the EITI report, the total copper output of Zambia in 2020 was 837 003.6 metric tons ([2]Extractive Industries Transparency Initiative, pp. 65). As such, the Chinese share directly state-owned was 21.28% - if the privately owned Lumambe mine is included, this number jumps to 23.29%. Furthermore, the fact that seven out of the ten largest mines have a connection to China shows an interesting pattern. According to the UN ComTrade database, China imported 200 000 metric tons of unrefined copper from Zambia in 2020 ([2]World Bank). This made Zambia the biggest homogenous source of raw copper for China (Observatory of Economic Complexity). This number is very close to the total Chinese share of Zambian copper, 178 092.96t to 194 942.66t, calculated in Table 1.

Addressing H2 and H3 of RST, first, it is clear that China has a deep involvement in Zambian copper mining through its SOEs and shares in mining companies; possibly deeper than

previously thought. China has invested heavily in exploration in Zambia. As such, H2 can be considered confirmed. Second, the copper imported to China from Zambia is at least in majority extracted by Chinese-owned or affiliated firms; thus, H3 is confirmed.

4bii. Debt Trap Diplomacy

H1: China uses the BRI to access Zambian copper industry

H2: Zambia has a large outstanding debt to China

H3: China leverages Zambian debt to acquire copper

According to Bräutigam, in International Relations, debt is a means of power (Bräutigam, pp. 1348). Debt Trap Diplomacy relates to how loans given to further development are used to ensnare the loantaker with debt (Alden, pp. 3). In recent times, especially China has been accused of such practices, primarily using massive infrastructure projects as part of its Belt and Road Initiative (Alden, pp. 5). However, the story of Chinese infrastructure in Zambia began as early as 1967, with the building of the Tazara Railway between the country and Tanzania (Tanzania Zambia Railway Authority). The railway was financed by a Chinese interest-free loan, showing that the phenomenon stretches back a long time (Tanzania Zambia Railway Authority).

Debt Trap Diplomacy in Zambia is highly contested. Bräutigam, for example, bases her argument against it on the private nature of Zambian copper production (Bräutigam, pp. 1358). Instead of directly owning production, the Zambian government collects revenue by taxation and the mine shares held by ZCCM ([2]Extractive Industries Transparency Initiative, pp. 23-25). In 2018, Zambian officials stated that "no state assets or state enterprises" risked being taken as collateral payment for any loans, as they had not been included as security (Bräutigam, pp. 1358). Harkening back to ownership statistics, it is worth noting that the status of ZCCM as a Zambian SOE could perhaps indeed allow for a Chinese claim to 100% of several of the largest copper mines in Zambia by virtue of the company being an asset of the Zambian state; the mine shares thus technically being state-owned. Perhaps the company would not have to be taken over, simply a selection of its assets. Further worth noting is fears presented throughout economic academia regarding the relative unknowns of how China exercises its economic influence through loans and the BRI, due to the deals often not being disclosed to the public

(Bräutigam & Xiaoyang, pp. 800). This relates to the level of corruption in Zambia. According to the Corruption Perception Index, the nation scored a 33 out of 100, making it less corrupt than most neighbouring countries, but far more so than the global average (Transparency International). Corruption in the country only increased between 2016-2020, having remained on the same level since (Transparency International). The high levels of corruption and the political gains to be made by Zambian officials undertaking large-scale infrastructure projects have created the perfect climate for Chinese lenders. Looking specifically at Zambia, roadbuilding has for some time been an important political issue and means of winning votes; combining this fact with the Chinese willingness to issue large loans for infrastructure projects, an incumbent government could easily gain political advantages by entering into agreements (Bräutigam, pp. 1353-1354).

Zambia's debt to China increased by $1 billion between 2015 and 2016 – a huge increase in a short timespan (Ofstad & Tjønneland, pp. 5). In 2017, 27% of Zambian debt was owed to China (Shieh et al., pp. 17). Zambian external debt in 2020 exceeded $12.7 billion (Summary of the Republic of Zambia's Public Sector Debt as at End-2020, pp. 1). Of this, approximately a third was owed to China. The estimated number in 2021 was $5.05 billion, with total Zambian external debt that year at $16.86 billion (Cinotto). This tells us two things – one, that China accounts for a substantial portion of the Zambian economy's functioning as its biggest lender. Two, Zambian debt increased dramatically between 2016-2020, much of it to China (Ofstad & Tjønneland, pp. 2-5). Zambia already by 2019 was the fourth most indebted African country to China (Bräutigam, pp. 1347). The majority of these loans, are from Chinese state-owned and operated banks with very low interest rates (Cinotto). These low interest rates are possible thanks to the direct involvement of the Chinese state, as the market alone cannot afford the long timescales involved (Lin et al., pp. 3). This resonates very well with RST claiming that SOEs can better afford longer-term investments.

The reasons for developing nations to turn to China for loans are manyfold. According to Norris, the Chinese modus operandi when granting large loans concerns undercutting the market with lower rates. The catch is that the projects undertaken with the loan are to be carried out with Chinese companies; primarily SOEs (Norris, pp. 193). These favourable terms help cement a friendly relationship between the governments, and funnels money back to China. A reason for Zambia in particular to consider Chinese loans is the reclassification of Zambia from a low-income to a lower-middle income country by the World Bank in 2011, due to the nation's

fast-growing economy (Ofstad & Tjønneland, pp. 2-5). This excluded Zambia from international loans with very low rates (Ofstad & Tjønneland, pp. 2-5). Chinese loan offers were more forgiving than others as a result (Ofstad & Tjønneland, pp. 2-5). Looking at Chinese thoughts on debt sustainability gives further insight into the differences between their loans and those from entities like the World Bank. In 2019, China stated that unsustainable debt in the now not necessarily means unsustainable debt in the future (Bräutigam, pp. 1351). This implies a longer-term outlook on investments than that of other entities. Interestingly, this could be connected to the EKC; a turning point in profitability is implied, provided enough investment. It also further shows an aspect of SOE and directly state-related activities; China can afford lower interest rates and longer-term thinking due to the backing and political stability of the Chinese state (Lin et al., pp. 3). For example, a big part of what makes Chinese companies attractive in Zambia is the ability of these companies to receive financial backing from the Chinese state (Lifuka, pp. 5-6).

In the case of Zambia, owing to the private nature of its copper industry, the Zambian government profits off taxes and shares in its SOE, the aforementioned ZCCM ([2]Extractive Industries Transparency Initiative, pp. 23-25). Win-win results for Zambia, accordingly, becomes a simple equation: the more productive the companies within the nation, the more taxes collected. As such, there is a clear economic incentive for the Zambian government to encourage productivity within the sector; however, it only partakes in a relatively small share of the profits. This resonates with Bräutigam's critique of the long-term sustainability of Zambian mining strategy relying on foreign companies to produce copper, rather than a buildup of national capital and capacity (Bräutigam, pp. 1359). However, it could be argued that an additional weakness exists: if Zambia hypothetically was to nationalise its copper mines, the door to use Debt Trap Diplomacy would swing open. Perhaps this is the 'real' trap Zambia has found itself caught in, and the only party in a true 'win-win situation' is China.

To summarise, many of the prerequisites for the use of Debt Trap Diplomacy exist in Zambia. For H2, a large outstanding debt to China exists, and has only grown. It is clearly connected to investments in for example infrastructure, as part of the BRI. These investments also target mining, in support of H1. However, despite an established Chinese presence within several important sectors in the country, a high level of corruption, Zambia as a developing country, investments and loans lacking transparency, and resources of strategic value to China – China

has not collected on Zambian debt thus far. Nor is it certain that copper could be secured if it did so. As such, H3, the smoking gun test, can be considered disproven, gutting the theory.

4biii. Pollution Haven Hypothesis

H1: China is making environmental laws stricter

H2: Zambia has a higher mineral depletion than China

H3: China displays less environmental strictness in Zambia

Mining and ore processing invariably produces waste. In the developing world, perhaps especially when managed by foreign actors, this issue risks growing even larger (Lindahl, pp. 6). According to Mwaanga et al., mining in the Copperbelt has a poor environmental record, irrespective of the mines being state- or privately owned (Mwaanga et al., pp. 3). A study by the Geological Survey of Sweden from 2014 identified several challenges directly connected to the mining and smelting of copper in Zambia. These include air pollution, soil contamination, water pollution, and metal accumulation in food (Lindahl, pp. 8-11). Air pollution stems from the toxic gasses released when copper ore is roasted, primarily in the form of sulphur dioxide, SO_2 (Lindahl, pp. 8). Recall the Chinese ambition of expanding refining, including roasting, as part of its operations abroad. SO_2 is mildly toxic, though more so in children, and irritates airways (Lindahl, pp. 8). Furthermore, SO_2 in the atmosphere reacts with water to form acid rain, which in turn can have an adverse effect on agriculture, fishing, forests, and buildings (United States Environmental Protection Agency). In fact, infrastructure damage in China in 2013 due to acid rain was estimated at $5 billion, and up to 10% losses in some agricultural sectors due to particle deposition; all the more reason for domestic 'greening' of mines and expanding production abroad (Mwaanga et al., pp. 7-8). Soil contamination is a result of dust and particles from smelters and dry waste pits. In the Copperbelt region, surface soil has in some cases contained 50 times more copper than deeper down (Lindahl, pp. 26). The environmental impact of mining remains long after operations have ceased. A main issue stemming from legacy large-scale mining in Zambia is waste dumps containing the leftovers from mining and smelting; when these come into contact with water, various toxic chemical compounds leach into the surrounding area (Lindahl, pp. 7-8). Water contamination can occur for example due to tailings dams in direct connection to bodies of water; this was the case of the Chinese-owned Musakashi Tailings Dam, found to be a direct cause of pollution and crop

damage (McKinney et al.). This is an illustrative example of how differently China treats mining abroad versus at home. As seen in the section above, the rules for domestic mining are strict. However, the only legal requirement for Chinese SOEs operating abroad in terms of environmental impact is that they follow the host country's laws (McKinney et al.). Chambishi in Zambia is an example of not even these guidelines being properly followed, having been proven numerous times to be in breach of Zambian environmental policy (McKinney et al.). This fact could either be further proof of Bräutigam's aforementioned arguments regarding fragmented authoritarianism, wherein the Chinese government to some extent struggles to control its SOEs, or it could be proof of China's disregard towards environmental outcomes outside its borders. The latter is supported by comparison to the *National Policy*'s banning of inefficient and polluting mining in China. As mentioned by Ericsson et al., more stringent policies at home will likely make overseas operations more attractive by contrast – especially if they receive encouragement and funding (Ericsson et al., pp. 174). Related to this is the concern that developing countries may use less strict environmental regulations to create more attractive investment climates (Mahadevan & Sun, pp. 5). Returning to corruption, a recent study showed that African countries with low institutional quality are negatively impacted environmentally by FDI, while those with less corruption can fare better (Bouzahza, pp. 106). Zambia is counted among the former (Bouzahza, pp. 109). These factors clearly support PHH H3.

Below is a graph of mineral depletion in China and Zambia over a period of 50 years; note that China's depletion rate decreased steadily between 2016-2020, while Zambia's increased quite markedly (IndexMundi). This confirms PHH H2, despite Chinese reserves diminishing. The sharp drop between 2018-2019 is likely attributable to the COVID-19 pandemic; a similar drop was observed in the BRI budget mentioned above. Ironically, Zambia joining the BRI in 2018 and subsequently displaying lower mineral depletion could be construed as an argument against Chinese activities in the nation intensifying under the BRI framework, further discrediting DTD.

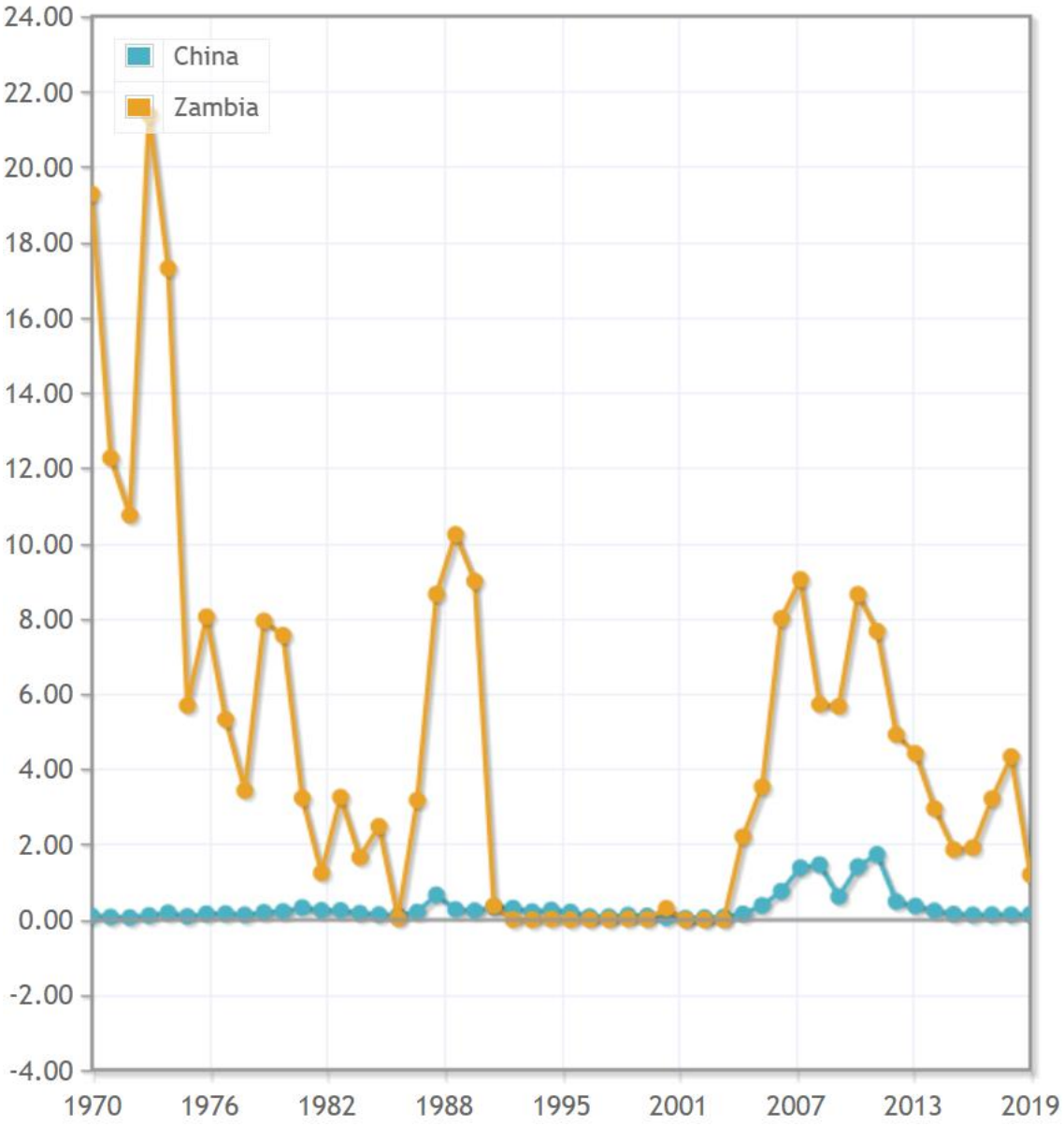

Fig. 4. Graph of Chinese and Zambian mineral depletion 1970-2019 (IndexMundi).

While not yet outright banned, Chinese domestic fossil fuel extraction and usage is not receiving much investment for expansion, but rather for effectivisation. However, for overseas investment, such restrictions are not in place; rather, they are encouraged (Gallagher, pp. 269). In addition to toxic pollution, a study on the carbon emissions of countries involved in the BRI from 2020 also raised the concern that Beijing is exploiting the laxer environmental laws of developing countries through the initiative (Mahadevan & Sun, pp. 2). The study showed that lower-middle income countries experienced an increase of carbon dioxide emissions as a result of Chinese foreign direct investment, while the most polluting regions in China have reduced their CO_2 emissions in relation (Mahadevan & Sun, pp. 8). Zambia, counted among lower-

middle income countries during the time of the study, would thus be included. This fits the PHH very well. It should however be noted that the newest of the Chinese-owned copper mines are highly advanced, in line with the stated goals of the BRI introducing advanced technologies (Ministry of Land and Resources, pp. 13). This could also be an example of the demonstration projects with the purpose of showcasing Chinese competence (Ministry of Land and Resources, pp. 79). It could also be seen simply as improving productivity, benefiting both China and Zambia – a win-win result.

To summarise, Zambia's environment suffers due to its copper mining, and Chinese investments to expand this mining furthers this issue. Furthermore, Chinese FDI has been proven to decrease Chinese carbon emissions, while increasing them in countries like Zambia. The strict environmental standards companies are held to in China are not applied in Zambia; Chinese SOEs do the bare minimum in abiding overseas environmental legislation. Connecting this to the PHH hypotheses, H1 finds support; China is making domestic environmental regulations stricter. H2 is proven; Zambia indeed displays a higher mineral depletion than China, increasing between 2016-2020, while China's decreased during the same period. For H3, it becomes apparent that China indeed does not apply the same level of environmental stringency to its overseas operations, confirming the hypothesis.

5. Results and Conclusion

5a. Results

5ai. Theories and Theoretical Synthesis

Resource Security Theory - Strong

H1: China has insufficient domestic resources to satisfy industrial demand

This hypothesis was confirmed. China throttles domestic extraction of important minerals due to diminishing reserves and fears of future dependency on the international market. Little over a tenth of the copper consumed by China in 2020 originated domestically, despite increases wrought by the *National Plan*. Chinese copper reserves diminished between 2016-2020, further worsening its copper per capita.

H2: China invests via SOEs in Zambian copper mining; especially in exploration

This hypothesis was confirmed. Chinese SOEs invest heavily in exploration and can afford longer investment timescales. Zambian copper reserves increased between 2016-2020 due to exploration efforts. Chinese SOEs are heavily involved in Zambian copper mining and have ownership shares in most large-scale mines in the country. China owns more of Zambian copper mining than expressed in academic literature.

H3: Zambian copper extracted by Chinese state-owned enterprises is imported to China

This hypothesis was confirmed. The amount of Zambian-produced copper owned by China through its SOE mine shares correlates very closely with the amount of copper China imported from Zambia.

Debt Trap Diplomacy - Weak

H1: China uses the BRI to access Zambian copper industry

This hypothesis was confirmed. Zambia is part of the BRI since 2018, two years into the *National Plan.* Chinese SOEs invest in Zambian copper mining through the BRI. Investments by SOEs are in essence investments by the Chinese state.

H2: Zambia has a large outstanding debt to China

This hypothesis was confirmed. Zambian debt to China is the single largest for the country at approximately a third of the total outstanding debt. It only grew between 2016-2020. China actively funds large infrastructure projects in the country. China can afford low interest rates on its loans due to them being state-issued through SOEs and policy banks. This makes China an attractive lender. Zambia's corruption likely plays a part in undertaking large, expensive infrastructure projects.

H3: China leverages Zambian debt to acquire copper

This hypothesis was proven false, invalidating the theory, as it proves that China has not actually utilised DTD irrespective of the potential to. Zambian copper mines are privately owned, meaning that the state cannot offer them as collateral should they fail to pay back loans. However, the Zambian state owns minority shares in many of the mines through an SOE of its own. China has not claimed natural resources in Zambia in return for writing off debt.

Pollution Haven Hypothesis – Strong

H1: China is making environmental laws stricter

This hypothesis was confirmed. China is making stricter demands on how and where to extract mineral resources. This is done both to reduce pollution generally, and to concentrate it in fewer places by increasing the scale of mines while reducing their number. Stricter environmental laws cut into mining profits; combined with the *National Plan'*s emphasis on international profitability, incentive is created for firms to go abroad.

H2: Zambia has a higher mineral depletion than China

This hypothesis was confirmed. Zambia, owing to its economy largely hinging on copper production, has a high mineral depletion rate. This rate increased between 2016 and the outbreak of the COVID pandemic. Chinese mineral depletion decreased during the same period.

H3: China displays less environmental strictness in Zambia

This hypothesis was confirmed. Chinese SOEs do the bare minimum when applying environmental stringency, with the simple directive 'to follow the host nations' laws'. At times, not even this applies, aided by Zambia's corruption and lack of enforcement. Chinese SOEs can be directly linked to environmental degradation and increased emissions in Zambia.

Theoretical Synthesis

Theoretical synthesis is the ultimate goal of a complementary congruence analysis (Blatter & Haverland, pp. 204). It can be argued that Resource Security Theory and Pollution Haven Hypothesis could be connected through such, as they both display high congruence with the case. Pollution from domestic mining in order to assure resource security can be offset by instead moving such mining abroad. SOEs from developed nations seeking to satiate resource security by securing materials abroad seems to drive pollution in those nations targeted. Debt Trap Diplomacy is harder to incorporate into the potential synthesis, seeing as though it proved a weaker theory than the others. Had it been used, however, it could have served neatly as a tool to forcibly insert dirty industrial practices abroad, and to access strategic resources, being used as another kind of investing strategy.

5b. Conclusion

5bi. Conclusion

The essay has looked at Chinese mineral policy through the *National Plan for Mineral Resources* and Chinese activities in Zambian copper mining. These were analysed by means of a congruence analysis using Resource Security Theory, Debt Trap Diplomacy, and the Pollution Haven Hypothesis, to ascertain multiple areas of interest within the case; resource security, geopolitics, and the environment. Concluding the congruence analysis and answering the research question **"How can China's *National Plan* and actions in Zambia through it be understood using Resource Security Theory, Debt Trap Diplomacy, and the Pollution Haven Hypothesis?"**, the essay confirms both Resource Security Theory and the Pollution Haven Hypothesis for the case of China in Zambia, due to the theories' high congruences as a result of their hypotheses being confirmed. Most of the prerequisites for Debt Trap Diplomacy exist, but DTD has not been utilised, and it is unlikely that copper mines could be secured by China calling in Zambian debt. As such, Debt Trap Diplomacy cannot be used to explain China's actions in Zambia – at least not yet. How the theories can be used to understand the *National Plan* and Chinese actions in Zambia is thus that, according to RST, China has a large presence within Zambian copper mining through the use of state-owned enterprises, aiding China in its goal of supplying domestic copper demand, and thus resource security. These SOEs act within the Belt and Road Initiative framework. China is not using Debt Trap Diplomacy in Zambia as it has not claimed any natural resources in return for writing off debt, but may be able to in the future. China's presence in Zambian copper mining is negative for the Zambian environment, and the moving of mining from China to Zambia has a positive impact on the Chinese environment by means of reducing domestic pollution, in line with Chinese environmental policy. China through its SOEs does not display the same stringency adhering to environmental laws in Zambia as it does domestically.

5bii. Generalisability and Further Research

The essay shows that both Resource Security Theory and Pollution Haven Hypothesis are useful theories when looking at Chinese actions abroad, and in the wider academic spheres concerning strategic materials acquisition. It thus shines a light on a lesser-known theory in the form of RST as an analytical tool. Resource Security Theory in this essay was modified from the original focus on petroleum to copper; the focus could be modified yet again, implying a degree of flexibility in the theory. In a similar vein, PHH could likely be modified to focus on different kinds of pollution, as with using SO_2 emissions instead of CO_2. This would make room for many more cases in the environmental discourse.

A competitive comparison between the theories could easily be made, with Debt Trap Diplomacy being the weakest. This was in line with DTD taken as the least likely theory. A process-tracing method looking at the same case with the same theories could prove interesting in chronologically ordering the theories, such as was done with the theoretical synthesis above.

The empirical generalisability of the study is potentially quite high, as it focuses on many aspects not unique to Zambia, such as being a member country of the Belt and Road Initiative, a resource-rich developing country, and having a large outstanding debt to China. Further research on the topic could include looking at the Western narratives regarding China in Zambia, and the potential hypocrisy of criticism against Chinese companies in the country, as the majority of mines are owned by other nations. This could be looked at in connection to the securitisation of natural resources and their deployment as political weapons. Looking further at Zambia in particular, a comparative case study between the D. R. Congo and Zambia regarding cobalt could prove interesting, seeing as though Zambia is poised to become the 2nd biggest producer in the world (Investing News Network). The DTD could be tested further by investigating whether Zambia's privatisation of copper could act as a safeguard against its employment, and the potential dynamics of SOE vs. SOE representing different countries.

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