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A battery industry in the Central African Copperbelt?

Regional and geopolitical dimensions

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Acronyms

AfDB	African Development Bank
Afrexim Bank	African Export and Import Bank
AMV	African Mining Vision
AAC	Anglo-American Corporation
AUC	African Union Commission
CAC	Central African Copperbelt
CBC	Congolese Battery Council
DRC	Democratic Republic of Congo
EV	Electric Vehicles
EITI	Extractive Industries Transparency Initiative
FQM	First Quantum Minerals
IMF	International Monetary Fund
IRH	International Resource Holdings
KCM	Konkola Copper Mines
MIBA	La Minière de Bakwanga
MMD	Movement for Multiparty Democracy
NCCM	Nchanga Consolidated Copper Mines
RCM	Roan Copper Mines
SADC	Southern African Development Community
UAE	United Arab Emirates
UNCTAD	United Nations Conference on Trade and Development
UNECA	United Nations Economic Commission for Africa
UNIDO	United Nations Industrial Development Organization
VAT	Value-Added Tax
ZCCM	Zambia Consolidated Copper Mines

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Abstract

The Democratic Republic of Congo (DRC) and Zambia as important Africa copper and cobalt producers are embarking on plans for a regional battery value chain. They aim to transition their countries from being extractive sites to becoming industrial producers of batteries and battery precursors. In a context of increasing demand for battery minerals due to the green transition, their mineral commodities are of growing strategic importance to global supply of critical minerals and to national and regional plans for socioeconomic transformation. DRC and Zambia are thus mobilizing investment for a battery industry, concurrently attracting investment in mining in the Central African Copperbelt (CAC). Their plans emerge at a time of intense global trade competition and war in Europe, lending a geopolitical dimension to their efforts. Both countries once had dominant state mining enterprises, but now private mining investment predominates. Regional and local concerns regarding the benefits of mining as well as its governance unfold alongside geopolitics. These will influence how DRC and Zambia navigate their drive for a regional battery industry. The paper provides a contextual overview of DRC and Zambia's plans and their mining sector. It highlights the partnerships they are building and concludes with recommendations to address the challenges and opportunities that will arise in their agenda to build a Central African Copperbelt battery industry.

Introduction

The Democratic Republic of Congo (DRC) and Zambia, important African copper and cobalt producers are since 2021 concretely embarking on plans for a regional battery value chain. Their agenda is to shift their countries from being extractive locales to becoming industrial producers of batteries and battery precursors. Global demand for battery minerals such as cobalt, nickel, manganese and lithium, driven by global decarbonization efforts which has seen increased global investment in an electric vehicle industry and renewable energy has made these minerals strategic to the green transition. They are thus seen as critical to the green industrialization agendas of the European Union, the United States of America (USA), China, countries with important vehicle industries such as Japan and South Korea, and leading fossil fuel economies investing in a shift, such as the United Arab Emirates (UAE) and Saudi Arabia.

Importantly, minerals such as cobalt, of which the DRC is the world's leading producer, are strategic to both DRC and Zambia's national and regional plans for socioeconomic transformation1. To this end, both countries, which share a copper mining belt, a region known as the CAC are jointly mobilizing investment for a regional battery industry, at the same time as they are attracting investment in mining. Both countries, until the late 1990s, once had dominant state mining enterprises, but now private mining investment dominates. Local and regional concerns about the benefits accrued from mining, as well as its governance dominate discussions. This now plays out alongside geoeconomics, such as the global trade competition between the USA and China.

Since the early 2000s, China, because of domestic demand catalyzed by a fast-growing economy has grown its mining investments in copper and cobalt in the CAC. China is now the lead global processor of cobalt. China's growing dominance has become a key concern for the security of supply of critical minerals for the USA and its allies, especially in the context of Russia's invasion of Ukraine. Emerging from this geostrategic competition and playing out within the region is the USA in December 2022 joining the DRC and Zambia joint understanding to develop a battery industry. Additionally, in October 2023 the European Union signed country partnerships with Angola, DRC and Zambia to develop critical raw mineral supply chains, and together with the USA infrastructure development plans for a railway to the Atlantic Coast, the Lobito Corridor. Around the same period has seen the elevation of bilateral ties with China for both DRC (in May 2023) and Zambia (in September 2023) to that of a 'comprehensive partnership', and later, in March 2024, with Angola.

Additionally, Tanzania and Zambia announced in November 2023 that they had been in discussions with China to rehabilitate the TAZARA railway to the Indian Ocean. In September 2024, on the sidelines of the Forum on China-Africa Cooperation both countries signed an MoU with China for the concession. These mineral and infrastructure partnerships, including the large investments in energy projects and purchase of key mining assets by Gulf countries such as the UAE and Saudi Arabia in the region, will have implications on how DRC and Zambia navigate their drive for a regional battery industry and how this sector will intersect with aspirations to grow and transform their economies. Moving in the direction of battery production, Zambia announced in May 2024 that electric vehicle battery production would begin in the country within the

1 The DRC in 2018 declared cobalt, germanium and coltan strategic by ministerial decree No. 18/042 of November 24, 2018. In August 2024 Zambia also launched a National Critical Minerals Strategy (2024-2028) which sees the country's critical minerals (which includes lithium, graphite, nickel, cobalt, tin, copper, manganese, sugilite, uranium and rare earth elements) as strategic to the countries own socio-economic transformation.

year at multi-facility economic zone established in partnership with Jiangxi province in China.

While global geoeconomics strategic interests now dominate the discussion in this area, of key concern to both the DRC and Zambia, since the reprivatization2 of their state mining industries in the 1990s to 2000s has been on what benefit to society has been mining. Playing out at national and local levels has been discussions on redistribution of resource rents, how to tax the mineral sector, tax avoidance, to renationalize mining or not, as well as issues of governance and regulation of mining concerning corruption, child labor (especially in artisanal and small-scale mining) and environmental pollution. Additionally, at a regional and continental level in the wake of disruptions to global supply chains, experienced acutely for African countries during the COVID-19 pandemic, has been how to industrialize. The paper centers these discussions and their context to give background to the opportunities and challenges DRC and Zambia face as they embark on plans to establish a regional sustainable battery minerals value chain. It draws on a review of academic, policy papers, news articles and webinars on the topic and on the regional expertise of the authors who have conducted long-term in-depth social science and mining research in Africa's Copperbelt.

2 Privatization, which we refer to, throughout the paper in relation to the mining sector in DRC and Zambia, refers to the "process through which the ownership and operational management of the state-owned enterprises are transferred partially or totally to the private sector" (see Khatrawi 1989). This transfer can result in a variety of corporate entities including joint ventures. Reprivatization in this case, refers to a reassertion of private sector dominance in an area previously nationalized.

Chapter 1. **The Background to DRC and Zambia's battery plans**

DRC and Zambia, have since attaining political independence in the 1960s from Belgium and the United Kingdom respectively struggled to ensure that their mineral resources contribute to the welfare of their populations and achieve a socio-economic transformation. Both countries have primarily been producing minerals at the lower end of the value chain (Makgetla et.al. 2019, UNCTAD 2023), reflecting continuities from a legacy of colonial mineral extraction. Amid growing global demand for copper, cobalt and other minerals, and a push from communities to benefit from mining, DRC and Zambia have thus mobilized efforts to shift their legacy of being primarily extractive locales, to becoming industrial players. To this end, the DRC declared cobalt a strategic mineral in December 2018 (Foreign Policy 2019; Journal Officiel de la RD Congo 2018; Shengo and Kime 2022). It is also pursuing a strategy of regional market integration, in both Southern and East African economic groupings, seeing this as a path towards stabilizing security, especially in the eastern part of the country (Omondi 2022). As for Zambia, it has been engaged since late 2021 in a proactive drive for expanded mining and exploration (Vandome 2023). For the governments of DRC and Zambia, mining is therefore a strategic economic sector. They crucially see mining investment as the catalyst for industrialization, investment in the countries' energy sectors and an important form of revenue.

DRC and Zambia's intentions to add value to their minerals are not only part of a bilateral agenda, but they are also located within the African Union's 2009 African Mining Vision (AMV) that aims for minerals to "underpin broad-based sustainable growth and socio-economic transformation" (Pedro 2016). The AMV was developed by teams from African Union Commission (AUC), African Development Bank (AfDB), United Nations Industrial Development Organization (UNIDO) and the United Nations Economic Commission for Africa (UNECA) (Pedro 2016, p16), following civil society pressure from mining-affected communities in Africa calling for better redistribution of resource rents and governance of the sector. UNECA and the African Export and Import Bank (Afrexim Bank) have more recently been at the forefront of technical assistance to the DRC and Zambia battery plans3.

In addition to this multilateral assistance, DRC and Zambia have entered several international economic cooperation agreements to further these plans. Notably, the joint December 2022 MOU between the DRC, Zambia and the USA to establish a battery industry in the CAC, which was followed with partnership agreements with the EU and with China. However, while offering opportunity to both countries, these partnerships also expose them to some geopolitical risk. The unique concentration of global cobalt reserves in the region covering the DRC's and Zambia's Copperbelt (Burgess 2010) is increasingly as a risk for supply and ethical sourcing for those industries reliant on this mineral in Europe and the USA. This saw, in 2022, the creation of the Minerals Security Partnership, an alliance of Western countries and allies that include Australia, Canada, Finland, France, Germany, India, Japan, South Korea, Sweden, the United Kingdom, the USA, and the EU. This alliance does not include African resource-rich countries, though Angola, Botswana, the DRC, South Africa, Tanzania, Uganda, and Zambia are seen as strategic to their global mineral supply

3 "ECA and Afreximbank sign Framework Agreement to establish Special Economic Zones for the production of Battery Electric Vehicles in DRC and Zambia", 27 March, 2023. https://www.uneca.org/stories/eca-and-afreximbank-sign-framework-agreement-to-establish-special-economic-zones-for-the

chains (Vivoda 2023). This occurs within the context of heightened trade competition between the USA and China, with the latter having been one of the largest sources of foreign direct investment in CAC over the last two decades and the dominant final processor of battery minerals (Castillo and Purdy 2022; Foreign Policy 2019). These dynamics are lending a geopolitical slant to cobalt. David Haglund (1986), writing over three decades ago, in an article on what he called the new geopolitics of minerals, argued that in the future it was political dynamics, such as the assertion of economic independence in formerly colonized countries, that were likely to shape the strategic significance of minerals.

Both DRC and Zambia seek a development framework for their mineral sector that translates into meaningful quality of life and standard of welfare in mining communities and beyond, something both countries perceive to have been in decline (Dibwe Dia Mwembu 2001; Mususa 2021). This has led them to adopt a pragmatic approach to their international relations. It has seen DRC and Zambia strengthen economic ties with China (Eisenman & Kurlantzick 2006; Vaidyanathan & Agarwal 2021). At the same time, seeking to attract diversified EU and USA investment to the region – and expand relations beyond development aid. In their mining sectors DRC and Zambia, even with limited state regulatory capacity are implementing and experimenting with regulatory measures to address the negative environmental and social impacts of mining. These environmental and social governance frameworks are in line with the parameters of the EU battery regulations under development (da Silva Lima et.al. 2022). DRC and Zambia are also courting Chinese investment and expertise higher up the mineral value chain, in battery technology and manufacturing where they see China having a global lead. This pluralistic approach however, has led to some concern that it could make the regional more vulnerable to geopolitical currents, in particular fallouts from trade competition between the USA and China (Fajgelbaum & Khandelwal 2022). Given the extractive legacy of colonialism both leaders of the DRC and Zambia have also called for a departure from past practice of treating the region as an extractive locale. With this tricky global context to navigate, DRC and Zambia are nevertheless leveraging regional and international partnership to create economies around an African minerals value chain.

Driving these efforts in both DRC and Zambia are local and national debates on how to make the mining industry a tool, not for exploitation but for broader socio-economic transformation. These have re-emerged since about 2004, when driven by economic growth in Asia, has seen increased mineral exploration and new mines coming into production in the countries (Negi 2014; Shengo & Kime 2022). This resurgence of mining happened not too long after, and alongside the transformation of the political and economic life in the region, re-ushering in multi-party politics in Zambia, which saw the end of post-independence leader Kenneth Kaunda's rule (1964-1991). The shift saw the emergence of a burgeoning civil society in both countries. However, it also occurred alongside radical austerity policies, implemented in both countries through IMF/World Bank-supported structural adjustment policies. In the DRC,, the transition saw the further weakening and fragmentation of a state that, under Mobutu Sese Seko (1965-1997), had been besieged by a collusive corruption (Askin & Collins 1993). In Zambia, where the state had previously held a significant presence under Kenneth Kaunda's government, a weakened regulatory context also opened to allegations of corruption under the new rule of Frederick Chiluba (1991-2002), who oversaw the privatization of the country's parastatals (Haglund 2008; Van Donge 2009). The transition also marked a shift of the interventionist role of the state to that of a facilitator of capital. In both regions' copper-mining regions, where the state corporate mining companies dominated, this shift entailed a move from corporate welfarism towards minimally applied corporate social responsibility (Straube 2021; Rubbers 2021). Alongside increased mineral exploration in both countries (Lydallm & Auchterlonie 2011), are contestations arising from mineral rents and the environmental impact of mining itself. These have coalesced around the benefits of mining to communities and environmental concerns (Mulenga 2019; Kolala & Bwalya-Umar 2019). The opacity of mining contracts has exacerbated these issues, with calls for increased transparency in the mining sector of DRC and Zambia (Oxford Analytica 2021; Okenda & Malasi 2021).

The struggles that both DRC and Zambia have faced in governing their mining sectors have driven popular narratives for resource nationalism. This is partly fueled by the contrast between the mining sector's funding during the period of state corporate welfarism and its subsequent decline (see Dibwe Dia Mwembu 2001; Mususa 2021; Rubbers 2021; Straube 2021). Although Zambia has maintained political stability since its independence in 1964, the trends that led to nationalization of the mining sector in the late 1960s and its reprivatization in the 1990s are like those of the DRC. Prior to 1990, in the aftermath of independence, in both countries, the state corporations dominated mining, with the Zambian state holding shares up to 60% and the Congolese state having 100% ownership (Manley & Wake 2015). In view of lessons both countries learnt from the challenges of managing state mining corporates (see Manley & Wake 2015), DRC and Zambia's plans to promote value addition to its minerals will be influenced by state policies and the role that private mining corporations, that now dominate play in mobilizing support and partnerships for an African green industrialization agenda.

Chapter 2. **Mining in the Central African Copperbelt**

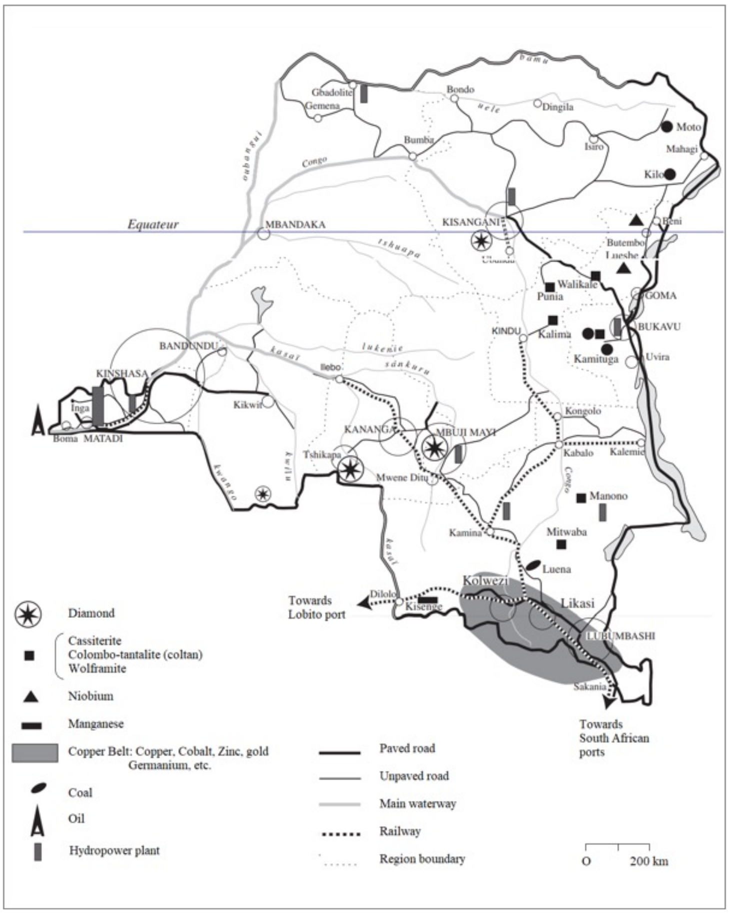
2.1. The minerals mined in DRC and Zambia

Copper dominates mineral production in the DRC and Zambia. However, both countries are mineral-rich in other resources. According to estimates by several scholars (Rusembuka 2015; Kalindo & Ingonde 2021; Kitobo 2022), the DRC is endowed with more than 1,100 different mineral substances (Otamonga & Poté 2020), justifying its worldwide recognition as a 'geological scandal' (Figure 1). Despite the country's mineral diversity, the full-scale of its mineral wealth is only partially known due to fragmentary nature of the state and incomplete data on the country's reserves. (Mufungizi 2024). Included in this mineral wealth are deposits of copper and its allied metals, gold, diamonds, tin, and uranium, some of which are mined industrially and artisanally (Kitobo 2022).

Though Zambia is endowed with a variety of mineral resources (Nyambe & Phiri 2010) mined in both large and small-scale operations (Tychsen et al., 2018), large-scale copper and cobalt production dominate the country's mining focus and production (USGS 2022). This is largely due to the fact its Copperbelt and North-western provinces host some of the world's highest-grade copper and cobalt deposits (KPMG International 2013). Additionally, Zambia has the world's highest-grade zinc and lead deposits, mined at Kabwe (Nyambe & Phiri 2010), leaving a toxic legacy. Zambia is also one of the largest global miners of emeralds, contributing nearly 20% to global supply (Nyambe & Phiri 2010; Tychsen et al. 2018).

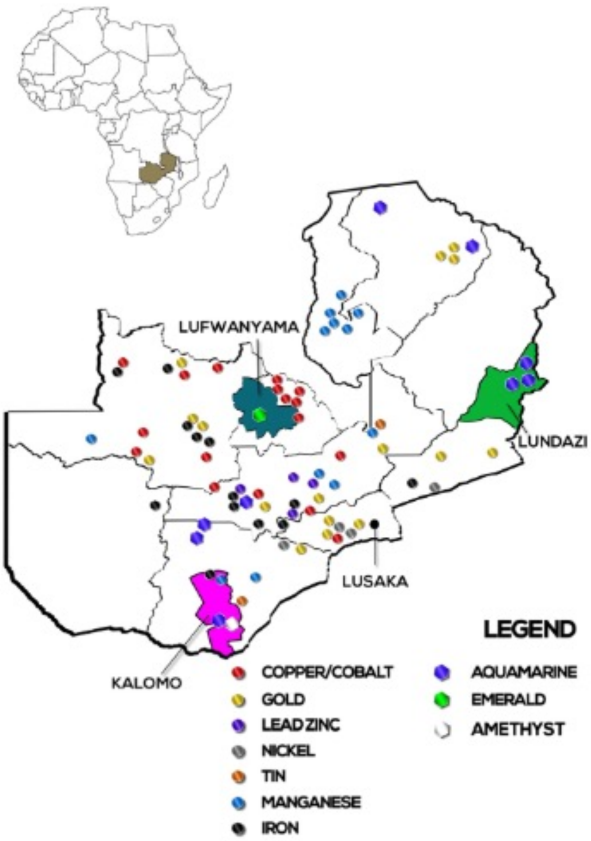
In plans to diversify its mining portfolio, the country has seen increased exploration and mining of other minerals relevant to the energy sector (Banda 2022). This includes the mining and stockpiling of uranium in the Southern and North-Western provinces (Haakonde et.al. 2020; Katebe et.al. 2017). Manganese mining has also seen a mini boom, particularly in smaller operations, in districts like Serenje (Kandulu 2021). Zambia has also seen a growth in nickel exploration, with plans for mining and prospective exploration of rare earth mineral deposits in the Eastern region of Zambia (Johnson et.al. 2007).

Figure 1: **DRC's main mineral resources**



Source: Malzalto (2009)

Figure 2: **Distribution of mined gemstones and minerals in Zambia**



Source: Nyambe & Phiri (2010)

2.2. Industrial mining on the Central African Copperbelt

Industrial mining in the DRC and Zambia in the early 20th century was established by corporations, the "Union Minière du Haut Katanga" (UMHK), and the Anglo-American Corporation (AAC), and Rhodesian Selection Trust (RST) that were tied to the colonial and imperial interests of Belgium and Britain, respectively. Following the DRC's (then, Zaïre) independence from Belgium colonial rule in 1960, the aftermath of this event was tumultuous, largely because of economic and geopolitical interests' centered on the country's mining industry. This saw the country's first post-independence leader assassinated in 1965 (see Nzongola-Ntajala 2014; Williams 2014). This was then followed by a secessionist movement in the rich mining Katanga region, led by Moise Tshombe, who briefly became premier after Lumumba's death (Boehme 2005, Kennes & Larmer 2016). Some sense of stability was established after Mobutu Sese Seko ascended to power on the back of a coup in 1965.

In 1967, Mobutu set about nationalizing the UMHK (Radmann 1978), of which assets were used to create the large state-owned corporate the Gécamines. Mobutu Sese Seko, had a long run in leadership, and whose power, despite domestic criticism, was maintained by aligning it to USA interests at the height of the Cold War (Afoaku 1997). Zambia, which gained its independence in 1964, started the nationalization of the AAC and RST in 1969 (Annan 1972; Lungu 2008a) to eventually create what became the state-owned corporation Zambia Consolidated Copper Mines. Thus, from the late 1960s to 1990s the DRC and Zambia had strategic control over their mining sectors. However, both countries' state mining corporates came under financial distress, leading the countries from the late 1990s onwards to recapitalize them through a process of re-privatization. This also came on the back of IMF/World Bank-supported policies to liberalize their economies.

2.3. Vying for Control and managing interests, the private and state mining enterprises in DRC

In the 1990's, the DRC was faced with the collapse of the mining output of copper and cobalt due to the bankruptcy that threatened the Gécamines, the large state-owned mining company. This led to a discussion in the early 1990s during the country's National Sovereign Conferences on the privatization of the Gécamines. This was also just as Mobutu Sese Seko was open to political pluralism. At stake in the discussions was how private investment to ailing state industries might revitalize them to ensure jobs for Congolese (Rubbers 2020). A weak economy, worsened by the war[4] that led to the overthrow of Mobutu Sese Seko's government in 1996 and its replacement by Laurent Kabila in 1997 (who was himself assassinated in 2001), meant that mining reforms only came after 2001 when Joseph Kabila assumed leadership.

Subsequently, between his time in office from 2001 and 2019 (with two re-elections), Joseph Kabila's government oversaw a period of significant mining reform. Amongst these was the 2002 Mining Code aimed at attracting foreign direct investment in the mining sector (Matundu & Kandolo 2016). This saw the beginning of restructuring of the state mining sector from 2003, which saw the state-owned mines sell its majority stake in most of its mining holdings to private investors. This resulted in the creation of joint ventures between the state and private sector for the mining of copper and cobalt deposits (Rubber 2020). The resulting dominance of private investment, and the minority stake of the state in mining in the DRC arguably makes the country a largely privatized mining landscape.

Thus, since the early 2000s, the DRC has undertaken various legislative reforms aimed at improving both the governance and increasing the attractiveness of the mining sector towards foreign direct investments (Kamba-Kibatshi 2016; Shengo & Kime 2022). The wide range of reforms to the DRC's mining code, as well as other regulatory reforms were intended to revive the country's mining sector5.Additionally, a platform of civil society organizations involved in the mining sector has pushed for reforms to improve governance and transparency in the DRC's extractive sector (Kabongo & Cihunda 2017; POM 2017). This has resulted in strides over the last two decades to implement the 2002 mining code; joined the Extractive Industries Transparency Initiative (EITI) in 2007; revised the country's mining contracts in 2008; and signed a statutory decree for the publication of contracts on natural resources in 2011 by the Prime Minister. It also saw the implementation of an "economic governance-matrix program" aimed at improving natural resources governance in 2011. Besides, a more participatory process in mineral governance has ensued, such as in the revision of the mining code since 2012 and the institutionalization of an annual conference on governance and transparency in the mining sector. Ferdinand Rusembuka (2013) and Willy Kitobo (2022) provide a detailed background to the shifts in mining regulation in the DRC.

State corporates in the DRC

Until the end of the 1990s, mining was exclusively the responsibility of the Congolese state. In the southeast of the country, in the provinces of Haut-Katanga and Lualaba, two state-owned mining companies, Gécamines and Sodimico, held titles on concessions of which mineral deposits were mined to produce copper and cobalt together with allied metals including zinc, cadmium and lead, etc. In the center of the country, the state-owned company "La Minière de Bakwanga" (MIBA) produced diamonds, whereas in the northern of the former Katanga province, the state-owned mining company "Congo-Etain" was producing tin. In the eastern part of the country, gold was produced by OKIMO and SOMINKI (Kitobo 2022). All these mining corporations involved in copper extraction and its allied metals had been subsumed by the Congolese state in the late 1960s following independence from Belgium colonial rule (Verlinden & Cuypers 1956; Shengo & Kime 2022). They were reprivatized by the early 2000s, with the Congolese government maintaining a stake, to avoid bankruptcy. Benjamin Rubbers (2020) argues that the privatization of the state-owned mines effectively allowed the Congolese state to continue to be active in the sector.

However, reprivatization did not have the support of a large part of the country's political

4 The war was carried out against the DRC (Then Zaïre) by the Allied Democratic Forces for Liberation (AFDL), backed by Rwandan and Ugandan military troops.

5 The current legislation for mining activities in the DRC is based on Law no. 18/001 of 09 March 2018 amending and supplementing Law no. 007/2002 of 11 July 2002 or the ancient Mining Code (Journal of Officiel de la DRC 2018a). Additionally, by Decree N° 18/024 of 08 June 2018 (Journal of Officiel de la DRC 2018b), which sets out the implementation of the Mining Code as well as other legal and regulatory texts that contain provisions relating to the governance of the mining sector (Kabongo & Cihunda 2017).

class at the time, who, arguing in the national interest, saw it as a mistake (Groupe d'intellectuels de Kolwezi 1996). Rather than a sell-off, they argued that they did not see why the state did not enact an internal restructuring of state-owned corporations that would have seen mobilization of internal financing, especially given that many still had viable operations and infrastructure. The real concern for this group was the diminished and weakened role of the state in the management of strategic economic sectors. It was also seen as a loss of economic sovereignty over the country's mineral resources.

Threatened by bankruptcy, the Gécamines was the first of the state-owned mining corporations to be restructured (Rubbers 2020). An initial opening to private investment was through the creation of a partnership with Malta Forrest for the mining of cobalt at the Kasombo deposit in a joint venture, with the state maintaining a 60% share (Groupe d'Intellectuels de Kolwezi 1996). Similar partnerships were later established with other private investors. Details on different types of partnership deals signed by the DRC and private investors to mine mineral resources are described in a report released by POM (2017). Table 1, below, provides an overview of the joint ventures created over time by the Gécamines in partnership with private investors.

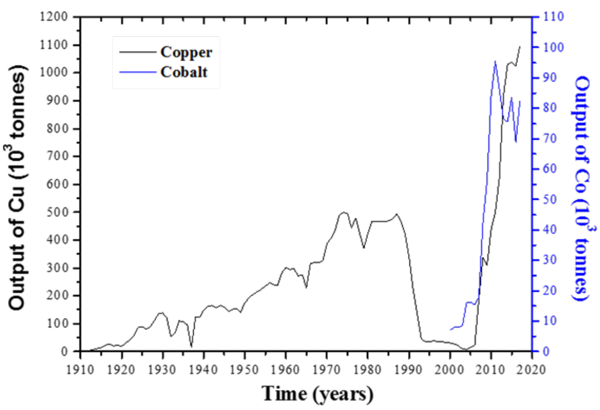
Over time, since the initial offering of the sale of state-owned mining corporation, its stake has been significantly diminishing. This has seen the emergence of a political critique that views the state as being expropriated under the cover of a privatization policy. In both the DRC and internationally, this has been described as a plunder of the mineral wealth (Geenen & Claessens 2013; Akilimali 2021) of the DRC or colloquially "the Katanga raid".

The introduction of a new mining code in 2002 revitalized what had been a distressed mining sector. It saw the reopening of dormant and abandoned mines as the state-owned mines entered partnerships with private investors. This saw the recommissioning of mines and building of plants (Shengo & Kime 2022). The result was a dramatic increase in mining output (See Figure 3), for example, 1,094,637.63 and 82,461.39 tonnes, respectively, for copper and cobalt (Shengo & Kime 2022).

DRC's output of copper and cobalt in 2023 was estimated at 2,500,000 tonnes and 170,000 respectively. This was a significant rise from 2021 when the country produced around 1,790,800 tonnes of copper and about 93,000 tonnes of cobalt (Kitobo 2022). With new mining ventures such as the Kamoa-Kakula project, owned by Ivanhoe Mines (39.6%), in a joint venture with Zijin Mining Group (39.6%), Crystal River Global Limited (0.8%) and the Gécamines (20%), which included the commissioning of minerals processing plants in 2021 (Golder Associates Africa Pty Ltd. 2017; Kitobo 2022), the country's copper output is expected to rise further.

However, despite the DRC seeing a dramatic rise in output, the country has not seen a transformative redistribution of resource rents. This is what led to the revision of the mining code in 2018. Indeed, some of the arguments made by DRC's legislators to support the revision of the mining code in 2018 were that the 2002 mining code, considered at the time the most attractive in the world for foreign direct investment for mineral exploitation, had failed to support a socio-economic transformation of the country (Kabongo & Cihunda 2017). On the contrary, it was seen that its implementation has resulted in the Gécamines losing control over its richest copper and cobalt mining concessions. Thus, the mining code of 2002 is implicated in the DRC's loss of what is seen as its mining heritage. The lapse in the mineral rights of the

Figure 3: **Trends in the evolution of the DRC Cu and Co outputs of over 110 years**



Source: Shengo & Kime (2022)

Table 1: **Joint ventures created over time by the Gécamines in partnership with private investors**

N°	Partnership or created joint-venture	Agreement signing	Shares (%)	
			GÉCAMINES	Partner
01	Cimenterie Matériaux du Katanga (CIMENKAT Sprl)	01/12/1979	49.73	50.27
02	Tenke Fungurume Mining (TFM Sarl)	30/11/1996 28/09/2005	20	80
03	Groupement pour le Traitement de terril de Lubumbashi (GTL Sarl)	24/06/1997	20	80
04	Société d'Exploitation de Kipoï (SEK Sprl)	12/09/2000	40 and 5 (state)	60
05	RUASHI MINING (RM Sprl)	09/06/2000	25	75
06	Minière de Kalumbwe Myunga (MKM Sprl)	20/07/2001	17.5	82.5
07	Mutanda Mining (MUMI Sprl)	16/05/2001	20	80
08	Société pour l'Exploitation des Gisements de Kalukundi (SWANMINES Sprl)	03/03/2001	25	75
09	Société Minière de Kolwezi (SMK Sprl)	31/01/2001	30	70
10	Congolaise des Mines et de Développement (COMIDE Sprl)	07/03/2002	25	75
11	KasontaLupotoMines (KALUMINES Sprl)	06/05/2003	40	60
12	Kamoa-Kakula project	2003	20	80
13	Compagnie Minière du Sud Katanga (CMSK Sprl)	14/05/2004	40	60
14	AMCK MINING Sprl	08/12/2005	lease	
15	Compagnie Minière de Tondo (CMT Sprl)	08/12/2005	30	70
16	Compagnie Minière de Musonoï (COMMUS Sprl)	08/12/2005	27	73
17	Compagnie Minière de Kasombo (MIKAS Sprl)	08/12/2005	25	75
18	Compagnie Minière de Luisha (COMILU Sprl)	07/04/2006	28	72
19	Kipushi Corporation (KICO Sarl)	2007	32	68
20	Société Minière de Deziwa et Ecaille C (SOMIDEC Sprl)	25/08/2008	32	68
21	Sino -Congolaise des Mines (SICOMINES Sarl)	22/04/2008	32	68
22	Compagnie Minière de Kambove (COMIKA Sprl)	12/09/2008	30	70
23	BOSS MINING Plc	03/02/2009	30	70
24	Kamoto Copper Company (KCC Sarl)	25/07/2009	25	75
25	Kisanfu Mining (KIMIN Sprl)	16/07/2009	30	70
26	CHEMAF Sprl for mining on PE 2350 et 529	08/09/2010	lease	
27	Société d'Exploitation de CHABARA Sprl	13/02/2010	30	70
28	Grande Cimenterie du Katanga (GCK Sprl)	02/08/2010	35	65
29	KANSUKI Sprl	6/07/2010	25	75
30	Compagnie de Traitement des rejets de Kingamyambo (METALKOL Sarl)	07/01/2010	25 and 5 (state)	70
31	Société d'Exploitation de la Cassitérite au Katanga (SECAKAT Sprl)	13/02/2010	30	70
32	Société Immobilière du Congo (SIMCO Sprl)	26/02/2010	99	1

Source: Gécamines List of partnerships (Sept 2011) : accessible via https://congomines.org/reports/483-liste-des-partenariats-en-cours-sept-2011

Gécamines has resulted in the state-owned corporate remaining with only about 1.500 km2 of mining concessions, translating to about one-tenth of the half of the total area of its 1906 mineral concessions6.For example, in the copper and cobalt mining sector, Gécamines, on behalf of the Congolese state had been engaged since 2006 in 29 joint ventures, but holding only an average stake of about 28% in these new companies.

Several scholars (Mazalto 2009; Kitobo 2022) have made the case that the diminished stake of the Congolese state in its industrial mines has been to the detriment of the country's population, who have seen little benefit since. This has been driving policy for the review and revision of various mining contracts that have been contested as bringing little socio-economic benefit to the country's population (Cobalt Institute 2022; POM 2017). The argument is that these contracts were entered into at a time when the DRC was undergoing a period of economic and political instability; and that a country emerging from war was not in an advantageous position to negotiate them (POM 2017). In the aftermath of the war and confronted with the urgency of mobilizing financial resources for the country's reconstruction, policymakers failed in their bid to had garner the resources from those contracts as they expected to. Additionally, most investors who acquired the rights to the country's mineral resources were uninterested to give them added value, such as through refining. Instead, viewing the greater Katanga region as the new "el dorado", they opted for exporting mineral resources in their raw form and making quick profits.

A report7 prepared by a Special Commission and submitted to the National Assembly to examine the validity of the financial arrangements entered in by the Congolese state on behalf of the Gécamines between the countries two wars (1996-1997 and 1998) established that all these mineral contracts were unfair (Assemblée Nationale de la DRC 2006; POM 2017). The real value of the Gécamines' mineral resources, and their projected profitability were highly underestimated, leading to calls for reassessment of their value and revisiting the mineral contracts (Budimbwa 2006; Maiotti & Katz 2019). Unfortunately, the DRC's review of its mineral contracts has not yielded the expected results, primarily due to agreements that swap mineral resources for infrastructure entered in 2008 with Chinese corporations, which has been viewed as unfair and are under review (AFREWATCH, 2021; Kabemba, 2016). The unfairness of these agreements is reflected in an unequal distribution of benefits between the contracting parties (Kabemba 2016; Mazalto 2009).

The Sino-Congolese of Mines (Sicomines) is an illustration of one of these agreements for mega mining projects. The agreement stipulates that the profits made during the first phase of the mining project would reimburse the mining investments made by the Chinese side to develop the mining project and to pay the related interest (Landry 2018). Additionally, 66% of the profits made in the second phase of the mining project would enable the repayment of the investments made for the construction of the infrastructure, including the payment of the associated annual interest (Landry 2018). Furthermore, the remaining 34% of profits would remunerate shareholders in proportion to the shares they hold. Several scholars (Marysse and Geenen2008; Kabemba 2016; Landry 2018) who analyzed who benefits in this agreement expressed concerns about who bears the risks. Also drawing on economic projections, they noted that it is uncertain who wins prior to the expiry of the agreements (Landry 2018). Part of this uncertainty was highlighted to be related to the variable value of metal prices on the global market. Additionally, the value of the infrastructure that would be built the Chinese companies would vary in value according to how well built and maintained they are (Landy 2018).

A key reason for the re-evaluation of the DRC's mining contracts is that the real value of the mineral resources granted to private investors has been

6 Essor du Congo, Album édité à l'occasion de l'Exposition International d'Elisabethville organisée au mois de Mai 1931. Accessible via https://search.library.wisc.edu/catalog/999695150702121.

7 Rapport Lutundula (2006): Assemblée Nationale, Commission spéciale chargée de l'examen de la validité des conventions à caractère économique et financier conclues pendant les guerres de 1996-1997 et de 1998, République Démocratique du Congo. Accessible via https://congomines.org/system/attachments/assets/000/000/209/original/Lutundula-2006-ReportComplet.pdf?1430928066.

highly underestimated (Budimbwa 2006). This is compounded by the fact that the Congolese did not have verified data on their mineral reserves when they entered into various joint ventures, particularly for the mining of their copper and cobalt deposits. Thus, although the DRC is acknowledged as being the world's leading producer of cobalt and Africa's leading producer of copper, it is also one of the world's poorest countries, where most of the population lives on less than one dollar per day (Hesselbein 2007; Weijs et al. 2012). Establishing the scale and value of mineral resources is thus key to the DRC's mineral policies. Although significant strides have been made regarding the identification and quantification of mineral resources, more needs to be done (Kitobo 2022) to avoid what has been characterized as a resource curse (Addison & Roe 2018; Davis & Tilton 2005; Mathobela-Nhlapo 2018). For example, when the global price of copper from 2002 to 2006 and 2007 neared $10,000 per tonne, the DRC lost out because its policymakers had ceded the mines to private investors in agreements dating back to between 1996 and 2004 (Global Witness Publishing Inc. 2006). Similarly, the country did not benefit from the increase in cobalt price during the mining boom of late 2016 until mid-2018, when its price increased from about $30,000 to $90,000 per ton (BGR 2019).

Today, the DRC's population is concerned that they are not being able to derive more profits and benefits from cobalt mining, despite its current economic and strategic importance. There is also concern that the country might not learn from past mistakes and are calling for better review and negotiation of mining contracts for the extraction of other critical minerals available in the country, such as lithium. Both lithium and cobalt, of which the DRC is endowed with, are among the keys to the global green transition's success (Bouchene et al. 2021). Investing in building knowledge on reserves, fair mineral agreements, adding value to minerals through refining and processing, as well as stemming illicit financial flows, are seen as key to addressing the DRC's development agenda.

2.4. Mining in Zambia: Attracting Investment and pushing for redistribution of mining rents

Zambia, shortly after the reintroduction of multi-party electoral politics in the mid 1990's, started the process of reprivatizing its mining sector. In 1970, it had been nationalized, when the state had bought majority shares in the two large copper mining corporations then, the Rhodesian Selection Trust Mines and the Anglo-American Corporation, which then became the Roan Copper Mines (RCM) and Nchanga Consolidated Copper Mines (NCCM). In 1982, these two mines were merged to form the Zambia Consolidated Copper Mines (ZCCM), a large parastatal that oversaw mainly copper and cobalt mining operations and other allied industries mainly concentrated in several towns in its Copperbelt province.

ZCCM operated a corporate welfare system (that had started in the mid-1950s by the RST and AAC mines) that was in line with the country's developmental state welfare approach, adopted and expanded after the country's independence from colonial rule in 1964. The redistribution of mineral resource rents that started in the 1950s was on the back of a trade union movement that consolidated in the 1940s (see Larmer 2007), which remains politically relevant today (see Musonda 2023a). This meant that mining communities in Zambia had access to a comprehensive range of public services and infrastructure that was co-managed by the company and local municipalities. The range of services and facilities that the state corporate ZCCM provided allowed the emergence of a substantial middle class on the Zambian Copperbelt.

The privatization of the mines in the 1990s brought this to an end, as the restructuring that ensued saw most of the labor force laid off, amid also a wider contraction of state services in the context of structural adjustment austerity policies. In 1995, a new mining code and investment act was introduced that allowed the state to enter into development agreements with private mining corporations. This is what allowed the sale of significant stakes in the state corporate. John Lungu (2008b) describes how this led the Zambian state between 1997 and 2000 to enter into agreements with mining multinationals on terms that were highly favorable for them, such as long tax breaks and significant reductions in mineral royalties and corporation tax. Much of these agreements were kept secret from the Zambian public, ostensibly because the large concessions made by the state to corporations would have been hard to justify given the unprecedented scale of cuts to social spending, widespread labor retrenchments and increased poverty in the country, and in the mineral-rich region. The privatization process of ZCCM was thus mired in allegations of corruption (Van Donge 2009).

When ZCCM was privatized, it was not sold as a whole, but was unbundled and sold as separate operations, with a new state investment arm, ZCCM-IH maintaining a stake in the unbundled corporations. Its sale attracted capital investment from several countries, including Canada, Australia, the United Kingdom, India and China. Since the commodity boom from around 2004, new mining projects in greenfield sites have brought in significant investment to the North-Western region of Zambia, that also abuts the DRC copper mining regions. In this region are the Lumwana copper mine owned by Barrick Gold (Australia/Canada), and the Canadian-registered First Quantum Minerals (FQM) mines that include Kalumbila mine and the profitable Kansanshi copper mines. By some estimates, the Canadian registered FQM Kanshanshi accounts for Zambia's largest copper output, making Canada the largest investor in Zambia's mining industry.

While China has a long diplomatic and economic engagement with Zambia since the country's independence in 1964 (Kodo 2022; Musiitwa (2021), its most well-known role in investment and development corporation was with the building of the Tanzania-Zambia (TAZARA) rail line in the 1970s. The TAZARA provided a lifeline for Zambia's copper exports when the southern rail corridor down through Zimbabwe and on to South Africa was disrupted due to the political circumstances of Zimbabwe's liberation wars and apartheid in South Africa. Over the years, Chinese mining corporations and related investments, such as in metal refining have been growing in Zambia (Mukete 2016) also as its demand for commodities such as copper and cobalt has grown (Kodo 2022). Most notable among Chinese-related investment are the China Non-Ferrous Metals ownership of Luanshya copper mine and its development of the Muliashi concession and the large-scale Chambishi Copper Smelter, located within the Zambia-China Economic and Trade Cooperation Zone, also on the Copperbelt province.

Overall, foreign mining operators own Zambia's mining corporations, either alone or in partnership with the Zambian state. Table 2 below provides a summary of private mining investment and the state involvement in Zambia, using compiled data from ZCCM-IH.

Zambia, which is part of the EITI, has since around 2006, following the commodity boom, been trying to garner more resources from its mining sector while also attracting investment. This has at times been contentious, reflecting diverging interests in the mining-dominated economy. The mining sector, whose most valuable mining assets are predominantly in the control of private corporations, shifted from a corporate welfare model to one of voluntary corporate social responsibility. The Zambian state, since the 1990s, has largely departed from a developmental state approach, focusing primarily on facilitating capital investment and protecting those interests. This has placed mining communities in Zambia, with a history of strong unions and active civil society, often at odds with the state and the mines. Under pressure from mining communities, who constitute a considerable voting bloc in Zambia, successive governments have succumbed to pressure, which has seen the country revise it mineral tax policies several times. Notably, in 2008, when the country introduced a windfall tax on the back of high copper prices. However, when President Levy Mwanawasa, from Movement for Multiparty Democracy (MMD) party who spearheaded that tax drive, died in office, his vice president, Rupiah Banda (MMD), who took office in 2009, chose to end what had been a widely supported tax measure. Later, when the MMD lost office in 2011, ushering

Table 2: **Some mines corporates and mining joint ventures in Zambia**

Sector	Company	Product	ZCCM-IH %	Partners %	
Mining Assets	Kabundi Resources Ltd	Mn	100.0		
	Kariba Minerals Ltd	Amethyst	100.0		
	Limestone Resources Limited	Lime	100.0		
	Konkola Copper Mines Plc	Cu, Co	20.6	Vedanta	79.4
	CNMC Luanshya Copper Mines Plc	Cu	20.0	China Non-ferrous Metals Company Limited (CNMC)	80.0
	Kansanshi Mining Plc	Cu, Co, Au	20.0	First Quantum Minerals Limited (FQM)	80.0
	Lubambe Copper Mines Plc	Cu	30.0	Jinchengxin Mining Management Company Ltd	70.0
	Copper Trees Minerals Ltd	Cu	15.58	Horizon Mining Ltd	84.42
	Mingomba Mining Ltd	Cu, Co	20	KoBold: (52 %); EMR Capital: (28%)	80
	Chibuluma Mines Plc	Cu	15.0	Jinchuan Group	85.0
	NFC Africa Mining Plc	Cu	15.0	CNMC	80.0
	Chambishi Metals Plc	Cu, Co	10.0	Eurasian Natural Resources Company (ENRC)	90.0
	Zambia Gold Company Ltd	Au	51	Ministry of Finance, Zambia	49
	Mopani Copper Mines Plc	Cu, Co	49	IHR	51
Energy Assets	Maamba Collieries Ltd	Coal, thermal energy	35.0	Nava Bharat Singapore Pte	65.0
	Copperbelt Energy Corporation Plc	Power supply and generation, biofuel	31.07	Aurora UK AcquistionCO PTE: (34.64%). Minority shareholders: (21.04%). Zambian Energy Corporation Ireland: (13.25%)	68.93
Other Assets - Technical & Environmental Consultancy Services	Misenge Environmental & Technical Services Ltd	Environmental, Analytical, Radiation and Engineering	100.0		
Other Assets - Financial Services	Investrust Bank Plc	Financial Services	71.4	Meanwood Venture Capital Ltd: (17.5%); Others: (11.1%)	28.6
Other Assets - Manufacturing	Central African Cement Ltd	Cement and Power energy	49.0	SINOCONST	51.0
Other Assets - Real Estate	Rembrandt Properties Ltd	Hotel accommodation and retail supermarket	49.0	SIMS Capital Ltd: (25.5%) Urban Brands Asset Management Ltd: (25.5%)	51.0

in the populist party the Patriotic Front, headed by Michael Sata, another review of the tax regime raised mineral royalties and corporate taxes, with protestations from the mining companies8. When Michael Sata too died in office in 2013, the new party leader, Edgar Lungu, went on again to review the tax regime, replacing the value-added tax (VAT) with a non-refundable sales tax that came into effect in 2019. The motivations for the Zambian government ending the VAT system were the large sums owed in refunds to mining corporations in a context where the government struggled to collect mining revenue from the mines due to systems of tax avoidance (Siwale 2019). The sales tax was criticized by the mining sector, which argued that it would increase the costs of production for what are capital-intensive economies (Zambia Chamber of Mines 2019). The Zambian state thus aimed to settle what it owed from unpaid refunds and start afresh, reportedly repaying around USD 400 million by 2021 (Obisie-Orlu 2022). Additionally, Edgar Lungu's PF administration, under significant political pressure from Copperbelt province mining communities, set about renationalizing two mines: Mopani Copper Mines (Glencore owned) and Konkola Copper Mines (owned by Vedanta Resources), which had since their reprivatization in the early 2000s attracted controversy.

Grievances around the Mopani and Konkola Copper Mines (KCM) centered on several factors. At the forefront were allegations of environmental mismanagement, with communities living around the mines making cases of environmental contamination and pollution9. Also, there were financial irregularities. For Mopani, allegations arose that its owner, Glencore, the Switzerland-based commodity trader, was avoiding paying taxes10 through loopholes such as transfer pricing. For KCM, there were allegations of not paying local suppliers and owing significant sums to the country's energy companies, while the Indian CEO of the UK-registered company had been filmed bragging about his extraordinary profits from the mine11.

These cases stoked popular resentment and a call to renationalize the mines, which were seen as having been mismanaged since reprivatization and brought little revenue to the country on the Copperbelt. The renationalization of Mopani and the liquidation of KCM have been dogged by irregularities. In the case of KCM, the way the liquidation was carried out embroiled the country in an international arbitration process. For Mopani, the cost and terms of the sale of the mine to the Zambian state have been viewed as disadvantageous to the country, even while they provided a useful popular political optics for the Patriotic Front that was contesting elections in 2021.

The PF lost, ushering in the mining investment friendly UPND, under the leadership of Hakainde Hichilema.

Keen to attract investment in the mining sector, given the increasing demand for copper and other mineral commodities for the green transition, and a highly ambitious plan to boost production of copper from about 830,000 in 2021 to 3 million metric tons by 2031 (Besa 2023). There has been some skepticism about whether Zambia can reach this production output within the target time line given the lengthy negotiated processes to bring large-scale mines to production. The UPND administration has been revisiting its mineral code to set a tone that it is creating a predictable and stable environment for investment in the mining sector. Additionally, keen not to be seen as promoting resource nationalism, it has sought new private investors for the Mopani Copper Mines, which was fully owned by ZCCM-IH. In 2024, Delta Mining Limited, a subsidiary of International

8 Chris Mfula, 'Zambia mine chamber: ops may scale down over royalty hike', Reuters, 14 November 2011. https://www.reuters.com/article/idUSL5E7ME1X3/

9 Zoe Loftus-Farren, 'A Zambian Activist's Win Against British Mining Firm Sets Legal Precedent', Earth Island Journal, 11 May 2023. https://www.earthisland.org/journal/index.php/articles/entry/zambian-activist-mining-vedanta-chilekwa-mumba-goldman-prize/ Rob Davies, 'Glencore court ruling in Zambia may trigger new pollution claims', The Guardian UK, 18 September 2016. https://www.theguardian.com/business/2016/sep/18/glencore-court-ruling-in-zambia-may-trigger-new-pollution-claims

10 'Zambia court ruling against copper mining company is a victory against abusive tax practices', African Tax Administration Forum, 1 June 2020. https://www.ataftax.org/zambia-court-ruling-against-copper-mining-company-is-a-victory-against-abusive-tax-practices

11 Gershom Ndhlovu, 'Mining Mogul Brags About the Unbelievable Deal He Scored for Zambia's Copper', Global Voices, 18 May 2014. https://globalvoices.org/2014/05/18/video-mine-owner-mocks-zambian-government-for-selling-price/

Resources Holdings (IRH), a UAE-based corporation, acquired a majority shareholding of 51% in Mopani Copper Mines. Protracted negotiations with Vedanta over KCM saw Vedanta resume running the mine in August 2024, with more stringent requirements for them to develop and recapitalize the mine and for better social and environmental management – and to settle their debts. Efforts to further liberalize the mining sector have served to attract renewed investment in mining, with First Quantum Minerals (FQM), a Canadian mining house, promising a USD 1.25 billion expansion of its productive Kansanshi Copper Mines and about USD 100 million for its nickel mining operations at its Enterprise Nickel Project (Kotze 2022). There has been also a push for copper/cobalt exploration from new actors such as U.S. tech billionaire-backed, KoBold Metals on the Copperbelt province, which in February 2024 announced a significant find of high-grade copper. Not only does the UPND administration under President Hichilema have to create an investor-attractive environment - given the push that comes from below for better mining revenue redistribution, but it also must deliver and demonstrate strides towards socio-economic transformation, particularly to mining communities in the country whose political activism sets the political weather of the country (Musonda 2023b).

Apart from recent policies to create a predictable mining tax policy, since 2013, Zambia's mining policies have been geared toward increasing mineral exploration, diversifying the portfolio of minerals mined, and creating policies that allow for local participation in the mining sector, such as local content policies. Like efforts being made in the DRC and other African countries keen to map and update their mineral resources, Zambia announced in 2023 plans to conduct aerial geological surveys. It has also been revisiting its mining licenses, cancelling those that are non-compliant or dormant in efforts to revitalize the sector. A number of these policies are laid out in a National Critical Minerals Strategy launched in August 2024 which runs to 2028. The strategy includes plans for mineral beneficiation and value addition; and to strengthen research and development in critical mineral value chains. The strategy also highlights how the Zambian government plans to engage with the private sector going forward, and how it aims to stimulate local participation in the critical mining sector. This includes plans for a production sharing mechanism of 30% for the state, and a 30% stake for a state in all new mining developments through a to be established state investment arm. Additionally, the strategy also outlines a minimum of 35% per year for local participation in mining procurement. While attracting criticism from large industry players12, these plans appear to address three concerns that have emerged as mining and mineral exploration have intensified in the region. These are the need for mineral feedstock that can be directed towards building a domestic and regional industrial economy that adds value to minerals. Increasing the state equity stake to address some of the challenges of collecting resource rents in contexts of global tax avoidance. Last, but not the least, to address demands for increased local participation in the mining sector and to create linkages from it to the wider economy.

Mining activity in Zambia is regulated by the Mines and Minerals Development Act No. 11 of 2015 of the Laws of Zambia and the Mines and Minerals Development (Amendment) Act No. 14 of 2016, as well as several other statutes that relate to health and safety, the environment, taxation, and land acquisition (Dokowe & Kolala 2016). Also, since 2017, Zambia has sought to tie mining to its industrialization agenda and introduced several policy frameworks aimed at diversifying of mining and adding value to its mineral sector. These are the National Export Strategy of 2017 and the National Industrial Policy of 201813. Zambia has also been innovating policies for artisanal mining, looking into how a cooperatives model might form the basis to simultaneously formalize, scale-up operations, and make the sector safer (Hilson 2020).

Globally, the trend toward mechanization and automation in mining is playing out in

12 "Zambia mines lobby calls on government to halt reforms". Bloomberg News, September 17, 2024. Accessed 18 September 2024. https://www.mining.com/web/zambia-mines-lobby-calls-on-government-to-halt-reforms/

13 William Banda (2022) provides a good summary of Zambia's mining, industrial and development policies.

Zambia and the DRC. At new industrial mines, fewer workers are needed, and as such, these mines, in contrast to the past, are becoming less dominant employers. In contrast, artisanal and small-scale mining has become an important sector. However, it has also led to concerns about safe labor practices, particularly the use of child labor, especially in the DRC. Efforts to address this have seen the enactment of ethical and due diligence frameworks in mineral supply chains (Galantich 2019; Global Witness Publishing Inc. 2006; Savio 2010; Tychsen et al. 2018). This has driven policy discussions on both how to regulate and support this sector, which provides jobs.

2.5. Artisanal mining in DRC and Zambia

Rising mineral commodity prices, liberalizing economies, and weaker regulatory systems amid economic precarity have seen a surge in artisanal copper mining in the DRC and Zambia (Furniss 2021; Mususa 2021). Artisanal mining is thus both an important source for local livelihoods and a contributor to global mineral supply chains. However, the use of child labor and poor working conditions have placed issues of ethical sourcing of commodities and the regulation of mining high on the national and international agendas. This has resulted in several global initiatives, such as the US Dodd-Frank Act on stemming the flow of commodities from conflict regions; OECD and EU guidelines on responsible sourcing, and the formulation of Environmental and Social Governance frameworks that guide investment and are to be encoded in the EU planned battery passport.

These frameworks, particularly in the DRC, have come under criticism14 for only further marginalizing artisanal and small-scale miners, focusing on alleviating the concerns of consumers, rather than working toward improving the welfare and conditions of miners and mining communities. Regionally, the national governments of the DRC and Zambia have been experimenting several frameworks, stemming from the Mosi-O-Tunya declaration, whose key recommendation was to raise the ethical standards of the artisanal and small-scale mining sector, while also recognizing it as key to livelihoods and local participation in mining.

Artisanal mining in DRC

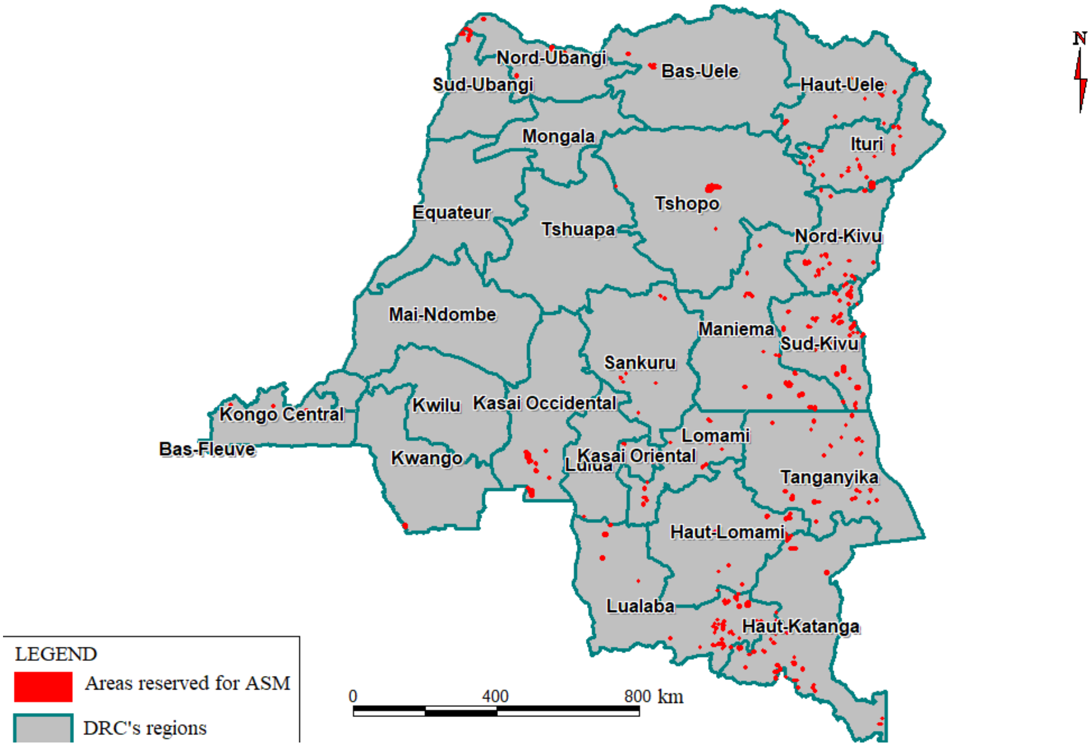
A significant amount of mineral production in the DRC is from artisanal mines, of which there are more than 484 legal sites (See **Figure 4**) (Baumann-Pauly 2020; Al Barazi et al., 2017; Kitobo 2022; Triest 2012). Artisanal mines, for instance, produce around 42% of stanniferous products and 90% of 3T minerals (tantalum, tin and tungsten), about 65% of diamonds and gold, of which statistics are not readily accessible because roughly 98% of their exports are fraudulent (Kitobo 2022; Karaki 2018).

The weak governance of artisanal mining in the DRC is a subject of several critical studies and reports (BGR 2019; Global Witness Publishing Inc. 2006; Hilson et al. 2017; International Group Crisis 2020; Maiotti & Katz 2019; Matundu & Kandolo 2016). However, artisanal mining is a significant contributor to the production of base and precious metals and critical minerals in the DRC (Baumann-Pauly 2020; Al Barazi et al., 2017; Triest 2012).

In the DRC, between 2019 and 2020, this sector contributed an estimated of 15-30% of global cobalt supply (Baumann-Pauly 2020; BGR 2019). Artisanal mining has also become the second largest employer in the DRC, and thus a key source of livelihood (Hilson et al. 2020; Karaki 2018). According to Kitobo (2022), artisanal mining provides employment to over 2,500,000 legal and illegal miners and over 7,500 traders. These, in turn, in addition to other economic activities conducted in and around artisanal mines, support around

14 An open letter signed by academics and researchers highlighted the flaws in initiatives such as the Dodd-Frank Act and OECD guidelines on responsible sourcing and offers some recommendations to address the ethical concerns in artisanal mining. https://suluhu.org/wp-content/uploads/2014/09/09092014-open-letter-final-and-list.pdf

Figure 4: **Areas dedicated to legally established artisanal mining in the DRC**



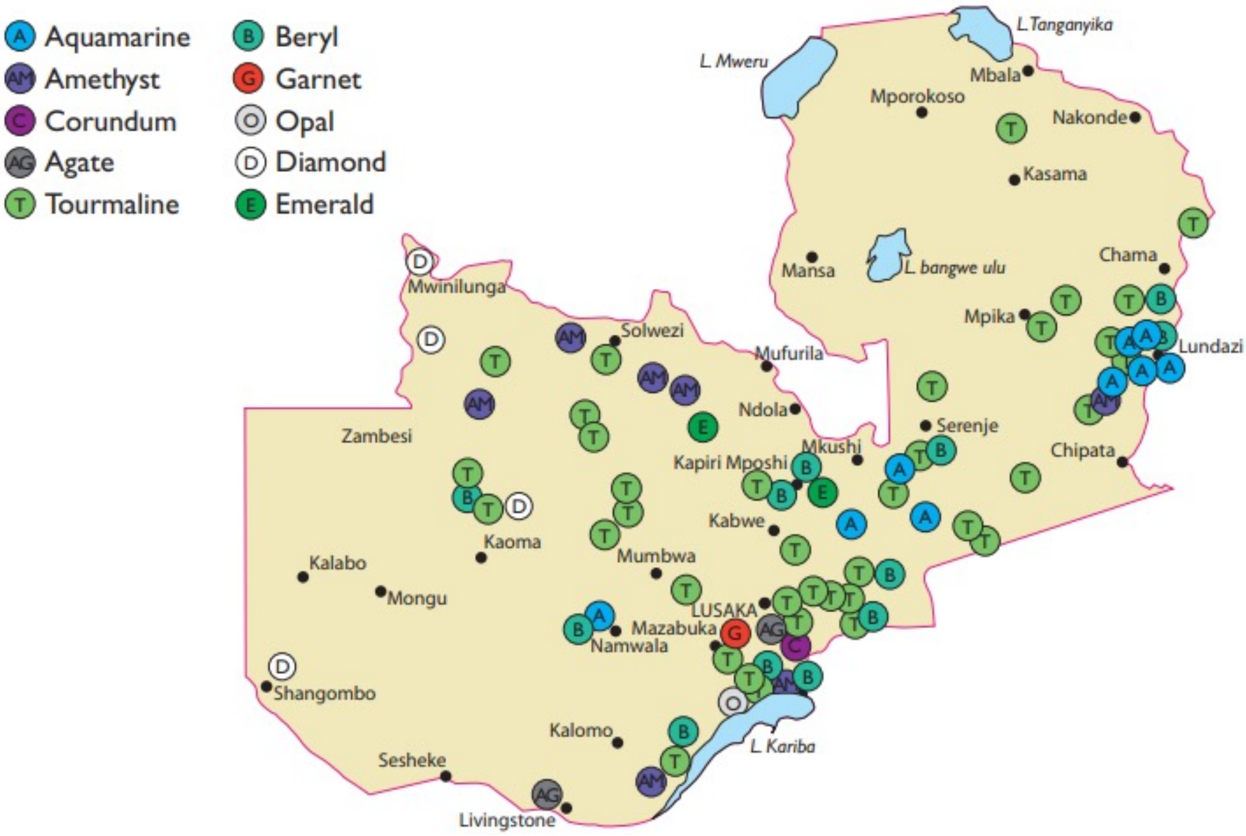
Source: DRC Mining Cadastre (2023)

15,000,000 dependents. The growth in artisanal mining occurred after the collapse of the country's industrial mines in the 1980s, following a decline in both demand for raw materials and investments in large-scale mining (Radley 2019). As commodity prices rose in the early 2000s, artisanal mining also came to be seen as well-paying. Despite its importance as an economic sector, it has largely remained informal and poorly regulated (Savio 2010; Galantich 2019). There is thus calls that more needs to be done to improve working conditions in artisanal mining in the DRC, which are carried out under dangerous conditions with low pay, and to regulate the sector to address fraud and smuggling of mineral products (Global Witness Publishing Inc. 2006). Of highest importance is to end child labor and exploitative practices (Baumann-Pauly 2020; Al Barazi et al., 2017; Global Witness Publishing Inc. 2006). In efforts to address this, the DRC is piloting several initiatives, such as the Mutoshi Pilot Project, an artisanal cobalt mining operation supported by Trafigura, the commodity trader, which seeks to mechanize the mining.

Artisanal mining Zambia

Zambia has historically been associated with large-scale industrial copper mining, which has played a key role in the country's development process (Kodo 2022; Tychsen et al. 2018). However, it also has an artisanal mining sector, mining gemstones such as amethyst, emeralds, tourmaline and aquamarine. Since the 1990s, artisanal mining of copper and reworkings of copper slag heaps emerged in line with the massive layoffs that occurred with the restructuring and reprivatization of the state mines (Mususa 2021). More recently, Zambia has seen a growth in artisanal gold and manganese mining in the Northern region of the country (Chilombo & van der Horst 2021). The direction in Zambia has been to formalize artisanal mining, including the reworking of copper slag dumps. This has seen, for example, the creation of large cooperatives of artisanal miners on the Copperbelt town of Kitwe, such as the Black Mountain Consortium. Gemstone mining in Zambia (see Figure 5) though carried out at small-scale, and in restricted zone under license, in aggregate accounts for an important

Figure 5: **Gemstones occurrences in Zambia**



Source: Modified from Tychsen et al (2018)

share of the Zambian mining industry (Siwale & Siwale 2017; Tychsen et al. 2018). Artisanal mining has become important to rural livelihoods in mining regions, providing not only start-up capital for other economic activities but also a supplementary income for agricultural communities.

Artisanal mining has spurred opportunities for innovation and the development of a local fabrication and manufacturing industry (Wematu 2022). For example, cooperatives and miners are converting minerals such as quartz, silica, river sand, and granulite into valuable goods for industrial and commercial use (Wematu 2022). However, from a governance perspective, although artisanal mining in Zambia is highly formalized, it still raises similar issues to those in the DRC regarding environmental and working conditions and ethical rules, such as the presence of child labor at mining sites (Tychsen et al. 2018).

Chapter 3. **Prospects to expand mineral processing and refining in the Central African Copperbelt**

DRC and Zambia have mining industries that are orientated towards minimal processing of their commodities regionally, with most being exported to be refined and turned into finished mining products abroad (Makgetla et.al. 2019). As a result, mined ores continue to be processed primarily to prepare commercial-grade commodities or semi-finished products such as copper blister, copper and cobalt concentrates, and their inorganic salts. It is not just copper that is minimally processed, the same applies to other commodities mined in the countries, such as gold, diamonds, emeralds and manganese. The practice of minimal processing at extraction sites and bulk transporting of battery minerals to Asia and Europe means countries such as DRC and Zambia losing out on the added value of their commodities. This translates to fewer decent jobs and little resources to grow and diversify their economies.

In the DRC, for example, during the colonial period, all mining commodities were sent to Belgium for further processing and refining (Verlinden & Cuypers 1956; Shengo & Kime 2022). Over time, however, particularly post-independence, the in-force metallurgical processes were upgraded at plants owned exclusively or in part by Gécamines (see Figure 6) to produce high-grade copper cathodes as well as electrolytic cobalt intended for export (Shengo et al.2020).

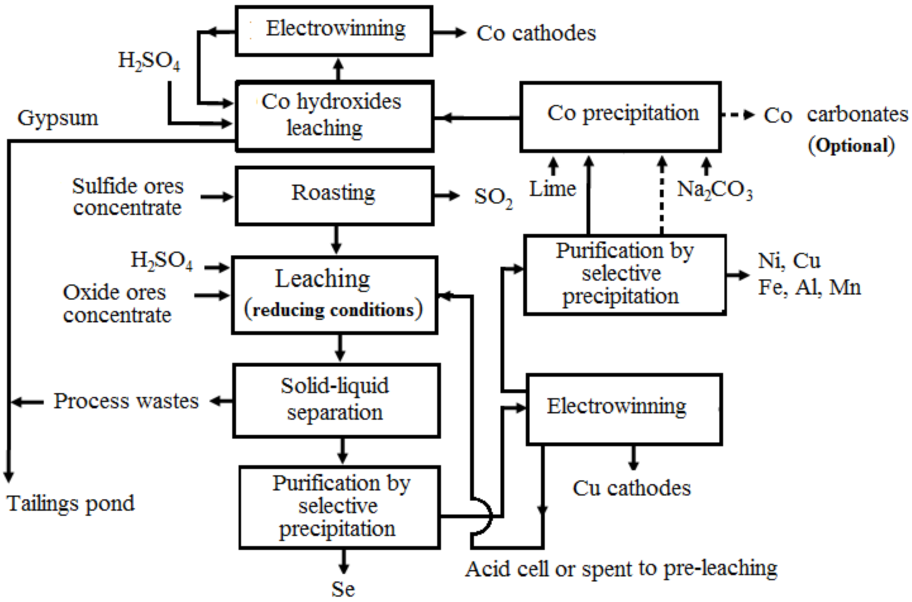
Since then,, cobalt produced at operational hydrometallurgical plants has been shipped to Finland as inorganic salts (hydroxides and carbonates) for further processing (See Figure 7). More recently, most of the DRC's cobalt is sent to smelters operated in China. China's key stake in the DRC's copper, cobalt mines, coupled with its refining capacity, has made it a dominant global producer of refined cobalt.

Although Zambia had made some strides in the processing of copper and cobalt in country as part of its post-independence industrialization strategy in the 1970s, these gains were reversed by the 1990s. A commodity downturn and significant national debt placed the countries industries, which were largely under state control, under economic stress. A major restructuring of the economy that saw reprivatization, decommissioning of manufacturing as it moved towards cheaper global markets, led to a process of deindustrialization in the country. At one point, Zambia was not only smelting its copper sulfide ore but was also producing a significant of copper wire from copper cathodes at the Metal Fabricators of Zambia Plc (ZAMEFA) located on the Copperbelt province. Operations at ZAMEFA have over time scaled down, even as the country has plans for increasing value addition.

A study conducted in the late 1980's to examine Zambia's potential to add value to its mineral commodities argued that inadequate transport infrastructure and a small regional market for finished copper products limited the country's plans for value addition (Meijer & Manen 1987). The landscape for both regional markets and transport infrastructure has significantly changed in the right direction for both DRC and Zambia. The integration of the region's markets, upward urbanization trends, and varied consumer trends in electronics and other manufactured indicate significant scope for mineral value addition, not just for a global market but for regional consumption.

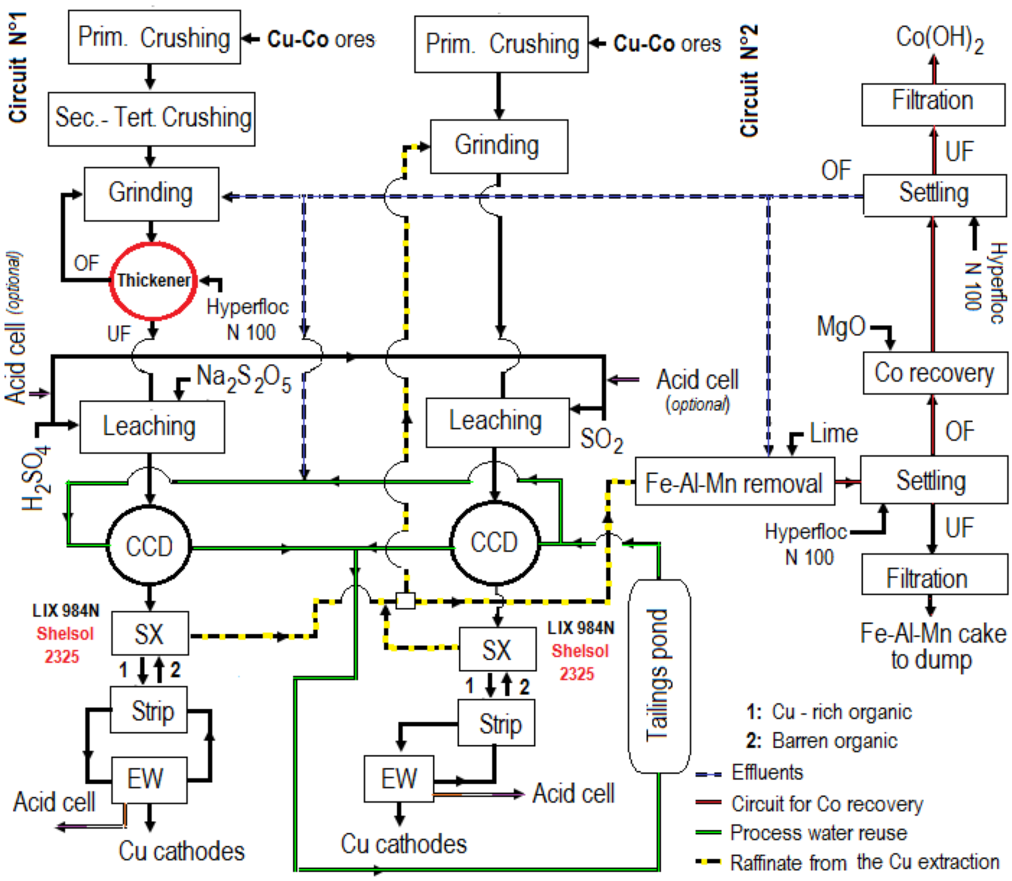
Today, one of the key reasons given for not adding value to mineral commodities at a local and regional level is the energy deficits that

Figure 6: **Flow sheet formerly implemented at Gécamines to produce electrolytic copper and cobalt**



Source: After Shengo et al.2020

Figure 7: **Flow sheet to produce copper cathodes and cobalt hydroxides**



Source: After Shengo et al.2020

both countries experience (World Bank 2020). This has focused attention for both countries on mobilizing investment for energy production (World Bank 2020). DRC and Zambia have particularly focused on growing their renewable energy sector, especially hydropower and solar power. This could in the future position them as world producers of battery minerals that are less reliant on fossil fuels. However, a significant energy crisis from 2023 has seen Zambia, which is more reliant on renewable energy embark on plans for a new 300-Megawatt coal power plant with Maamba Energy Limited in 2024.

To address its energy deficit, Zambia has been actively mobilizing investment towards the energy sector, and since 2024 with the support of a World Bank program15. The Copperbelt Energy Corporation, which targets energy supply to the mining sector, listed Zambia's first green bond on its stock exchange in January 2024 to mobilize financing for renewable energy projects, which it has been expanding. Mining corporations, whose operations have been curtailed by power cuts, have negotiated supply negotiated supply from the Southern African Power Poolvia Zambia's state energy utility, ZESCO. First Quantum Minerals in Zambia set to source energy from Mozambique and Namibia.

Notable energy projects in the DRC include the upgrade of turbine 5 at the existing Inga II hydropower facility and the building and refurbishment of other existing hydropower plants. These improvements are geared toward providing the Kamoa-Kakula mining project with priority access to 240 MW. Other projects include the building of the Busanga hydropower plant and the refurbishment of the Nseke and Mpiana Mwanga hydropower power plants. These projects aim to address the DRC's energy deficit for domestic supply and the mining sector and expand capacity for the sustainable mining of copper, cobalt and lithium (AFREWATCH 2017; AVZ Minerals 2020; World Bank 2020).

While several studies have detailed the state of DRC's energy sector and on what should be done to address its gaps and increase supply (World Bank 2020; Yu et al. 2019) there has not been enough political will to tackle the energy deficit. This is despite the knowledge that energy demand in the key mining provinces of Lualaba and Haut Katanga is growing and will continue to do so.

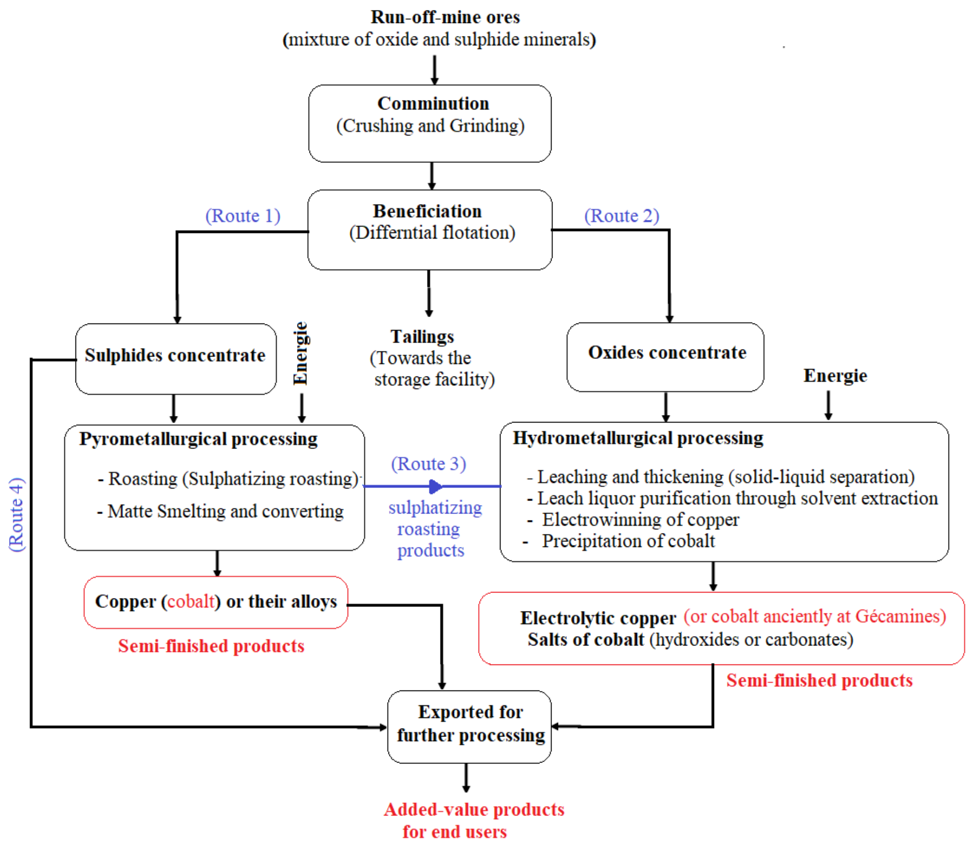
In the CAC, the kind of mineral ore mined has implications for the kind of refining process that may be best suited to extract copper and cobalt (See Mambwe et.al. 2022; Shengo & Banza 2013). The options taken, have different requirements for energy, and on their impacts on the environment. Thus, investments in energy infrastructure and the creation of a good regulatory environment, opens feasibility of expanding refining in the region. For instance, many active mines in the region have reached such depths that the mineralized zones of the deposits largely contain primary copper and cobalt sulfide minerals (Shengo et al.2020). These type of minerals (chalcopyrite and carrollite) do not easily lend themselves to hydrometallurgical processing (See route 2 at Figure 8) in situ because of their low solubility. Hydrometallurgy involves the leaching of metals from mineral ore usually in a light sulfuric acid solution. This type of processing results in acid-laced tailings that are responsible for significant negative environmental impacts (Shengo et al. 2020).

For such ores, the more viable processing option is to fully roast them (requiring significant energy) to obtain copper blister – a process called pyrometallurgy (See route 1 at Figure 8). Alternatively, partially roasted ore can be further refined through a hydrometallurgy (or leaching) process to extract a solution that is rich in copper and cobalt, that can be used as feed in a traditional extraction (See route 3 at Figure 8).

The increase in the proportion of sulfides in extracted ores has led some mining companies to opt to produce sulfide concentrates as per routes 2 and 4 (see Figure 8). This means that the ores are processed either by local smelters or abroad, including smelters in China (Shengo et al. 2020).

15 National Energy Advancement and Transformation Programme (NEAT). https://www.worldbank.org/en/news/press-release/2024/03/15/world-bank-boosts-support-for-the-financial-sustainability-reliability-and-resilience-of-afe-zambias-electricity-sector#:~:text=LUSAKA%2C%20March%2015%2C%202024%20—,its%20electricity%20sector%20by%202033.

Figure 8: **Routes used during the metallurgical processing mixed ores in DRC**



These processing routes are either implemented or under examination by large mining companies: Ivanhoe Mines, Katanga Copper Corporation, Minerals and Metals Mining, Congo Dongfang International, Chemical of Africa, Ruashi mining and Kinsenda Copper Company, among others.

A comprehensive plan for an industrial ecosystem in the CAC that addresses energy, environmental and social regulations, as well as innovation in metallurgical processes for mineral refining would be the step towards removing the barriers that have inhibited the further processing and refining of mined minerals – and a precursor to a regional battery industry.

Chapter 4. Cooperating to Create a Battery Industry

DRC and Zambia are incentivized by several factors to cooperate and build a battery mineral industry in the CAC region. First, their mineral endowment shapes this. The DRC and Zambia have well-established mining sectors and possess two key minerals for battery manufacturing: cobalt and lithium for the former, cobalt and nickel for the latter (USGS 2022). Additionally, they are in the Southern African Development Community (SADC), whose other countries are significant producers of minerals such as manganese in South Africa, lithium in Zimbabwe, and graphite in Mozambique.

The second factor driving the DRC and Zambia's cooperation and pursuit of a battery mineral industry in the CAC regions is an African agenda that is codified in the Africa Mining Vision (AMV) 2009 to have minerals make substantial contribution to the continent's development and create decent jobs. To achieve this, the African Union, as well as SADC (the regional economic bloc of which both DRC and Zambia belong), have prioritized industrialization. These regional policies link to a broader regional economic integration policy and more recently, their consolidation within the African Continental Free Trade Agreement (AfCFTA). It is in this context that the DRC/Zambia battery plans should be placed, coming on the back of sustained investment in regional interlinking physical and institutional infrastructure, such as in transport, energy, border infrastructure, and mobility of labor.

The third aspect is driven by broader global trends that may address Africa's own demand for energy and electrification. It is anticipated that some 23 million electric vehicles will be sold over the coming decade, according to a report from the United Nations Conference on Trade and Development (UNCTAD 2020). The report also highlighted that the market for rechargeable car batteries, estimated at $ 7 billion, might rise to $ 58 billion in 2024 and is projected to reach $ 120.4 billion by 2027.

4.1. Leveraging partnerships, and trying to loosen control

The favorable factors that incentivize DRC and Zambia to build a battery minerals industrial sector may hinge on their ability to leverage and navigate the complex geopolitical terrain that characterized by the economic contest between the USA and China. Both DRC and Zambia entered this fray when, in December 2022, they signed an MoU with the USA to facilitate the development of an integrated value chain for electric vehicle (EV) battery production in the CAC. The MoU with the USA, which came a year after DRC and Zambia's own cooperation agreement, was understood by several observers as an indication of the USA's interest to counter China in the region, and to secure a critical mineral value chain for their technology industries that is increasingly dominated by China (Foreign Policy 2019; Castillo and Purdy 2022; Cobalt Institute 2022). DRC and Zambia rank as Africa's largest copper producers and world leaders in cobalt production, with the DRC[16] alone contributing about 71% of the output (IEA 2022; USGS 2022) and being home to nearly 3.4% of global lithium resources (USGS 2022). In the DRC China's corporations' dominant role in the battery mineral value chain, risks weakening the basis for regional cooperation in a battery industry, therefore jeopardizing its implementation. It is estimated that nearly 80% of the DRC's copper and

16 Owing to the rapid development of its nickel-cobalt mines and high-pressure acid leach plants capacity, Indonesia succeeded joining the DRC in 2022 as a major driver of cobalt supply (Cobalt Institute 2022).

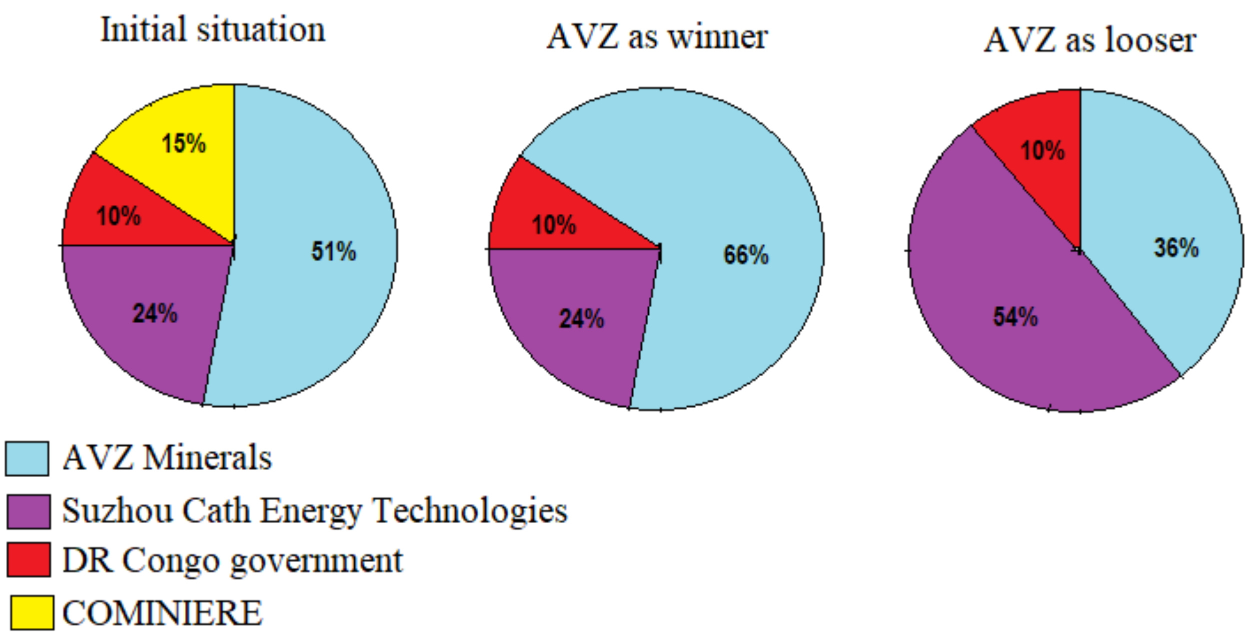
cobalt output is processed in China (Foreign Policy 2019; Rubbers 2020; Cobalt Institute 2022; Kitobo 2022; USGS 2022). Chinese corporations are also increasing their investments in lithium mining.

Suzhou Cath Energy Technologies, owned by China's battery giant CATL and Pei Zhenhua, holds a 24% stake in the Manono lithium and tin open-pit project (Castillo & Purdy 2022). It's partner AVZ (a company from Australia) has a controlling interest of 51% in the project. The other 25% is in the hands of the state-owned company "Cominière" (La Congolaise d'Exploitation Minière). At the time of writing, a shareholding battle for a 15% stake being sold in Cominière is underway, led by Zijin Mining Group Co against AVZ. If successful, this would increase the shareholding of Chinese companies' interests by 15% in (Figure 9) the Manono lithium and tin project17 (The Boatman Capital Research 2022).

Indeed, through large shares of capital held in various mining joint ventures created in partnership with the Gécamines (see Tables 1 and 3), Chinese corporations control the leading copper/cobalt producers in the DRC. These include China Molybdenum's (CMOC) Tenke-Fugurume Mining (BloombergNEF 2021) and Sicomines. Glencore, the Swiss-based commodity trader and miner with a history of corruption charges,18 remains the other dominant copper/cobalt producer. Glencore, which accounts for 31% of global cobalt capacity, has a large stake in two mines, the Kamoto and Mutanda mines, in partnership with Gécamines (BloombergNEF 2021; IEA 2022).

Exemplifying the extent of China's growing interest in the mining sector of the CAC, a recent report (Ntumba et al. 2015) indicated that two-thirds of the mining companies operating in the former province of Katanga have benefited from Chinese foreign direct investment. This poses a dilemma for the DRC and Zambia, as well as their cooperation with the USA, and its allies, who have banded together through the Mineral Security Partnership.

Figure 9: **Suggested scenarios for gaining control over the Manono lithium and tin**



17 The scenarios showing how the shares of AVZ Minerals and other stakeholders in the Manono lithium and tin mine can undergo changes so that this project falls under Chinese companies' control. Accessible via https://theboatmancapital.com/avz-minerals/avz-minerals-experiencing-a-chinese-burn/

18 Daniel Thomas, ' DRC: Miner Glencore pays USD180m in latest corruption case', BBC, 5 December 2022. https://www.bbc.com/news/business-63858295 . See also, "Glencore Entered Guilty Pleas to Foreign Bribery and Market Manipulation Schemes" Press release, Office of Public Affairs, US Department of Justice, May 24, 2022. Accessed 24 September 2024. https://www.justice.gov/opa/pr/glencore-entered-guilty-pleas-foreign-bribery-and-market-manipulation-schemes

Table 3: **List of mining companies with Chinese investments in the Katanga, DRC**

N°	Mining company name	Yearly Cu output
01	Africa One	
02	Congo Dong Fang International Mining (Lubumbashi)	C
03	Congo Dong Fang International Mining (Kolwezi)	
04	CGM	NF
05	Congo International Mining Corporation	C
06	Congo Jing Ju Cheng Mining Company	C
07	CNMC Huachin Mabende	B
08	Compagnie Minière de Kamoya	C
09	Compagnie Minière de Luisha	C
10	Congo Loyal	C
11	Cota Mining	NF
12	Dragon International Mining	C
13	Emmanuel Mining	NF
14	Feza Mining	C
15	Fu Yuan Mining	NF
16	Huachin Metal Leach	C
17	Huachin Mining	C
18	Huan Tong International	NF
19	Jia Xing Mining Industry	NF
20	JMT	C
21	Kinsenda Company Corporation	B
22	Kai Peng Mining	C
23	Mabende Mining	C
24	Magma Mining	C
25	Metal Mining	NF
26	Minière de Kasombo	B
27	MJM	C
28	Minière de Kalumbwe-Myunga	C
29	New Mineral Investments	C
30	Rong Chang	NF
31	Ruashi Mining	B
32	Sino-Congolaise des Mines	A
33	Shituru Mining Corporation	C
34	Song Hua	NF
35	South China Mining	NF
36	Tong Xing Congo Sarl	NF
37	Yinping Commerce Sarl	NF
38	Zhong – Hong	NF

A: ≥100,000 tonnes Cu/year; B: between 20,000 and 100,000 tonnes Cu/year; C: <20,000 tonnes Co/year; NF: Not found

With China's upper hand in the copper, cobalt and lithium mines and mineral value chains of the region (Foreign Policy 2019), how will DRC and Zambia mobilize these partnerships to regain control over the supply chain of critical metals (Cu, Co, Mn, Li, etc.)? How will they freely engage with the USA in an agreement to develop an integrated value chain to produce electric vehicle batteries without prejudicing the extensive investments from China in the mining and other sectors? How will both DRC and Zambia, whose governments' roles have shifted since the 2000s to be less interventionist and more facilitators19 in deals for the mining of mineral resources, including the mining of critical metals, mobilize the substantial capital needed to build a battery industry, fund energy projects, support skills development, and fund research and innovation when they struggle to mobilize resource rents?

A complex picture emerges on the ground. While there are moves by both DRC and Zambia to increase state participation in the mining sector (through for example joint ventures), the current trends in both countries, under the administrations President Felix Tshisekedi, and President Hichilema are not inclined towards majority state ownership. In other words, a nationalized extractive industry, such as in Chile, Norway and Saudi Arabia – or that which characterized both DRC and Zambia a period after their independence from colonial rule until restructuring in late 1990's to 2000s is not likely. For example, in the most significant of recent copper mining agreements in both countries the state's share falls just below 50%. Notable in the DRC is the Deziwa Mining Joint Venture between the state corporate Gecamines and China Non-Ferrous Metal Mining Company where the state share is a significantly higher 49%. In Zambia, in the new National Critical Minerals Strategy, the goal is for the state to have a stake in greenfield projects, and a production sharing mechanism from the mines output that is set at 30%. At the same time, both countries (some would argue due to financial constraints) are auctioning off their potential interests, as indicated in the recent mineral deals, in the DRC, the Manono Lithium and Tin project, and in Zambia, the Mopani Copper Mines bought by the IRH.

DRC and Zambia must make do with dividends (when they are shared out) from the various partnership contracts signed with foreign investors for mining copper and cobalt. They also accrue corporate taxes and mineral royalties, when they can have oversight to ensure tax compliance. The hard reality is that DRC and Zambia have progressively lost control over industrial mines of copper and cobalt since the 2000s. Previously dominated by former colonial powers and their allies (with a brief period of state ownership post-independence in both countries), these mineral supply and value chains have now ceded to China.

Other global regions and countries – such as the EU, USA and Japan are seeking to shore up and secure the mineral supply chain and diversify from China. DRC and Zambia, under pressure from communities who question the value of the mining sector when it does not substantially change the quality of their lives are compelled to renegotiate the terms of mining.

The increased competition for mining interests in the CAC has opened a window for DRC and Zambia to reset the terms of mining agreements. To this end, they cooperate with the USA. But they do not seek to choose sides. The challenge for the DRC and Zambia in their cooperation with the USA and the EU, who are pursuing protectionist policies at home – the USA through the inflation reduction act that aims to onshore a battery industry and the EU through regulating the standard of batteries to curtail China - will be on the terms their partners may place to further their interests.

DRC and Zambia will need to invest in significant diplomat efforts to navigate and, in some areas, reconcile the interests of the world's biggest economic powers that are playing out in their region. Also, those of middle and emerging powers, such as Saudi Arabia and the UAE, which are cash-rich and are buying some of the largest

19 Referring to the reform of the mining sector and its difficult implementation, Malzalto (2008) stated: "The development of mineral resources is now entrusted to private investors who benefit from financial incentives and a commitment from the State and donors to secure investments"

mining assets in both DRC and Zambia. Saudi Arabia and the UAE, both long term allies of the USA, but also forging closer ties with China (UAE, being part of BRICS+), will be a significant factor in the region's mining landscape.

To navigate these multiple interests in the region, DRC and Zambia would have to strengthen their own bilateral cooperation. They should also seek to expand these cooperative efforts to encompass the wider SADC region. This may afford them some leverage to counter potential negative externalities arising for their competition. This is what the EU has done in its own efforts to advance its critical minerals agenda, even though within the CAC, the EU instead went on to sign individual agreements with both countries that mirrored each other – a divisive strategy to secure a raw minerals supply and value chain, according to some Africa policy makers.

Mostly importantly, as DRC and Zambia renegotiate mining terms and with a multiple of actors and interests, civil society in both countries must push for transparency and accountability. Not only in the scrutiny of mining agreements and how they address issues of social and environmental governance. But crucially, call for greater accountability in the way that the state mining investment holdings in both DRC and Zambia are run; and on the returns that accrue to the country. This would entail the governments of both countries strengthening the capacity for regulation and revenue collection in the mining sector.

Chapter 5. **Going forward towards a battery industry**

The foundation to the CAC developing a battery industry is advancing the refining of minerals to battery-grade quality. DRC and Zambia will need to refine their minerals locally to produce battery components. Zambia has already succeeded in advancing its manufacturing sector, rendering it capable of producing non-electric car batteries. This strengthens a regional cooperative partnership with the DRC to boost their respective mining and manufacturing sectors. DRC and Zambia aim to take advantage of the global demand for cobalt and lithium-ion batteries[20] and establish a supply and minerals value chain closer to the production sites. This would lead to the emergence of an industrial ecosystem in the CAC that covers mining, refining, and battery-making plants. A 2021 Bloomberg NEF study report highlighted that it would be significantly cheaper[21] to produce battery precursors in the DRC compared to the USA, China, and Poland.

A joint effort to produce battery-grade minerals would harness DRC and Zambia's complementary mining industries. This would require the two countries to create varying platforms and institutions for the ongoing collaboration that this would entail. Among the areas that the two countries would need to prioritize is the upgrading and building of new infrastructure for transportation and logistics. Processing and refining of minerals are an energy-intensive process, requiring concerted efforts by both countries and within the broader region (both countries are part of the Southern African Power Pool) to expand energy production and supply.

The processing of minerals in the region would need to expand beyond copper and cobalt, on which DRC and Zambia's mining industries have focused. It would need to develop and build capacity for the processing of other battery minerals, such as manganese22, and connect its production plants to the copper and cobalt industrial complexes. The manufacture of batteries requires the additional development of production chains for lithium, nickel and bauxite (to produce aluminum). A lithium production industry connected to the Manono Lithium and Tin Project is being developed (AVZ Mineral Limited 2020, 2022; Kitobo 2022). Significantly, the DRC has three of the key battery minerals: cobalt, lithium, and manganese, not to mention that copper is the essential component for battery electrodes manufacturing (USGS 2022). Zambia, on the other hand, also a copper producer, has an industry producing nickel and cobalt as its main recoverable co-product. It also has exploitable reserves of other critical minerals, such as rich deposits of manganese, iron, lithium, graphite, nickel, phosphorous and aluminum (Nyambe & Phiri 2010). However, the DRC, Zambia has not established an industrial ecosystem for the processing of the entire range of these minerals. This may, or may not be feasible within the CAC, and an entire regional (SADC) approach should be explored to see what is economically viable. Most importantly and related to the implementation of the AFTCA for an integrated African economy - exploration of the

20 A recent forecast projects that 900 million EVs will be built between now and 2050 and this is likely to drive cobalt production for battery manufacture to significantly soar (IRENA 2023). According to 2022 cobalt market report, the EV sector has become its largest consumer accounting for 40% of its total demand (Cobalt Institute 2022).

21 With cost of a 10,000 metric tonnes precursor costing USD 39 million to set up in the DRC, compared with USD 65 million in Poland, and USD 112 in China, with the USA being over USD 120 million. See 'The Cost of Producing Battery Precursors in the DRC', Bloomberg NEF, November 2021.

22 Which is not only found in both DRC and Zambia, but of which South Africa has the world's largest reserves.

financial feasibility of an African battery industry should go beyond electric vehicles, to look at the continents urbanization trends and the related demands for energy storage and electrification. This would be in line with African Union Agenda 2063, and its long-term plans for green growth. Under consideration is also the question on how Africa secures an industrial production base in the context of growing global insecurity and a trend towards geoeconomic fragmentation. Disruptions to global supply chains as happened during the COVID-19 pandemic - and which deeply impacted African countries may no longer be outside the norm .

Crucially, both countries and the region will need to substantially increase their investments in education, research and innovation. However, given the fiscal constraints both countries, particularly Zambia, face, DRC and Zambia have been pooling resources toward knowledge clusters to support the sector. The University of Lubumbashi is being positioned as a regional center for battery research. In Zambia, the Copperbelt University is already established as the SADC center of mining excellence.

A key aim of these regional knowledge collaborations, as per the mission of the Congolese Battery Council (CBC), is to create an infrastructure that also support intra-African trade and innovation. To speed up battery industry development, DRC and Zambia are exploring strategic partnerships with automakers, particularly manufacturers, highlighting the prospects of long-term access to an African market as the continents moves towards opening intra-African trade.

To further plans for cooperation to develop a battery industry in the CAC, DRC and Zambia have created the Zambia-DRC Battery Council, initially aimed at seeing battery precursors produced within the region. A special economic zone, located in the CAC, has been identified by both countries for the setting up of a battery precursor plant. Additionally, in December 2022, the DRC established the CBC, whose mission includes identifying partnerships to attract investment and promote research and innovation to support the country's efforts to move up the battery minerals value chain. Key to its mandate is also ensuring local supply of battery minerals and other inputs for domestic/regional production of battery precursors. Part of the CBC's mandate is also to propose regulatory guidelines and standards for the emergent battery industry sector, as well as trade policies. This would entail examining how to ensure that potentially restrictive trade batteries, such as the regulatory frameworks of the EU battery passport and the USA Inflation Reduction Act, do not close the possibility for the DRC and Zambia to trade not only with the EU and the USA but also with other regions, not aligned with their policies. It also examines scope for international cooperation, for example opportunities within the framework of the USA Inflation Reduction Act and Mineral Security Partnership, such as for the setting up of midstream facilities in Africa and Latin America (Church et.al.2023). In the CAC this opens the potential for investment to produce battery grade ready minerals. However, the complexities emerging around protectionist trade policies, including the subsidies being thrown to the electric vehicle battery sector by China, the USA, and Europe, mean that DRC and Zambia also need to invest in international trade expertise to further the region's own interests.

Apart from trade expertise, given the increased global demand for battery minerals that will likely drive the expansion of new mines in their region – and sharpen societal demands for better redistribution of mineral rent – the countries and region need to grow their ability to mobilize resources from the sector through taxation and other measures. DRC and Zambia, as other African countries have struggled since the liberalization of the mining sectors to leverage better mining agreements and to ensure tax compliance23 from international firms in mining - much needed if they are to ensure that mining contributes to their development agendas.

23 This reflects the broader concerns from developing and emerging economies on the international tax system. "UN General Assembly Member States have voted with a majority of 125 in favor of adopting a Convention on International Tax Cooperation" November 22, 2023, African Union. https://au.int/en/pressreleases/20231122/un-general-assembly-member-states-have-voted-majority-125-favor-adopting

They may have to consider alternatives, where they pool their collective weight in bargaining new agreements. A collective regional weight is also what they will need to mobilize to help them navigate the geopolitical currents of big power trade competition in an insecure world.

5.1. Recommendations

DRC and Zambia, should consider the following recommendations, as they are in the early stages of establishing a battery minerals industry in the region:

- To achieve their objective, both countries must first work to regain control over the production chain of these minerals. This means to renegotiating, balancing or even increasing their shares in different joint ventures already created thanks to foreign direct investments for mining key battery minerals (Co, Li, Ni, Mn, etc.). They will need to do this to ensure that a nascent battery industry is not starved of raw materials.

- They need improve knowledge of their mineral resources through in-depth geological surveys and fieldworks to identify and locate their deposits, assess available resources and certify their reserves. This will allow them to properly assess the value of their mineral assets.

- As mining and mineral exploration expands in their countries, DRC and Zambia should explore collective bargaining approaches with other strategic mineral-producing countries in the region to negotiate better mineral agreements that do not create a 'raid' on their mineral wealth.

- They will they need to raise the ethical rules, human rights, transparency and good practices in the mining industry. Importantly, they need to ensure that mineral resource rents support human capital development through social spending on education and health. How they mobilize and use resource rents will be key to this.

- They will need to actively mobilize finance to support investments that address the energy deficit. Additionally, for transport and logistics infrastructure, not doing so will hamper plans for a battery industry.

- To establish cooperation frameworks with universities, research centers, electric automakers and countries with proven skills the technology of manufacturing batteries and their components, DRC and Zambia need to be deploy diplomacy at both regional and global scales to build a battery minerals network and promote the training of a skilled workforce and the transfer of technology for manufacturing battery components.

- Both DRC and Zambia are pursuing a pluralistic approach to attracting investment and capital to build a battery industry in the region, aiming to catalyze a socio-economic transformation. They will need to build trade and foreign diplomacy capacity to navigate the geopolitical terrain and pursue their own mineral development agenda.

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