Shortcomings of Artisanal Mining:
A SCOT analysis of corporate-led mining projects in the DRC

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Abstract

Artisanal and small-scale mining (ASM) is a sector of the mining industry consisting of individuals or small groups mining without the support of industrial mining. In the Democratic Republic of the Congo (DRC), ASM represents a large portion of the cobalt mining industry, which is a vital supplier to international electronics and battery electric vehicle supply chains. "Formalization schemes" are attempts at engaging with the ASM sector legally while ensuring that unsafe mining practices and child labor can't be linked to these international supply chains. Through a Social Construction of Technology (SCOT) analysis of several formalization schemes, this paper uncovers the importance of these schemes to corporations as examples of their due diligence to keep a good public image with consumers, the potential for schemes to stress the financial situation of ASM communities worsening the factors driving child labor in the first place and to present opportunities for financial exploitation of miners, and the importance of mining cooperatives and collective bargaining in protecting miners and ASM communities from exploitation.

Introduction

In 2018, 35,000 children in the Democratic Republic of the Congo (DRC), some as young as six years old, labored to provide metals needed in your smartphone, laptop, and battery electric vehicle (BEV) (Kara, 2018). Cobalt is a metal critical to the chemistry of today's Lithium-ion batteries, with a new BEV requiring more than 13 kg of Cobalt. In 2019, 69% of the extracted Cobalt in the world came out of the DRC, of which 10-20% is sourced from artisanal and small-scale mining (ASM). The demand for Cobalt is expected to grow between 6- and 30-fold between now and 2040 (IEA, 2021). Artisanal Miners (AMs) are not employed by any mining corporation, nor do they earn a wage. Instead, AMs dig Cobalt ore from the ground without the help of machinery and sell it to traders and buying houses to earn a living. This informal system does little to prevent child labor and provides no regulations over the health and safety of AMs. For decades, the government of the DRC has sought to provide legal pathways for AMs to engage with the international market and the last few years have seen a number of corporate-led "formalization schemes" which seek to utilize ASM labor while ensuring that the Cobalt mined has no connection to unsafe or illegal labor practices.

In this paper I seek to better understand these formalization schemes through the lens of the social construction of technology (SCOT). Pinch and Bijker (1984) put forth their concepts of SCOT and the ways in which their theory may be used to understand all technologies as social constructs. Every technology is fundamentally formed through the views and needs of its stakeholders. These stakeholders are the social groups who interact with the technology and its success may be judged based on whether it has fulfilled all stakeholders' needs. Formalization schemes are the technology which this analysis sets its sights on. These schemes have several directly engaged stakeholders, hereafter referred to as direct stakeholders: the artisanal miners, the local mining officials, and of course the mining corporations and traders buying the ore.

There are, of course, other stakeholders less directly engaging with formalization schemes, hereafter referred to as indirect stakeholders, such as electronics companies and automakers and the final consumers of the products containing the cobalt. Appeasing the needs of as many of these stakeholders as possible is the goal of formalization schemes. Pinch and Bijker consider a technology to be closed when all stakeholders agree on the form of a technology. A closed technology can be reopened in the future as interpretations from the stakeholder groups change, but a closed technology has reached a sort of equilibrium where stakeholder needs no longer require alterations to the technology.

I analyze below the successes and shortcomings of the trial formalization projects currently deployed in the DRC and ask how future projects might move closer to a closed technology. I will begin by looking at the indirect stakeholders mentioned above, who are responsible for the skyrocketing demand for Cobalt. Next, I will discuss AMs and the ways they have engaged with the international market in the past, revealing the needs of the direct stakeholders. Finally, I will examine the structure of formalization projects which have begun in the past few years, and how they seek to cater to all stakeholders.

Indirect Stakeholders

The switch from internal combustion engine vehicles (ICEVs) to BEVs is an important step in the transition to a carbon neutral future. The International Energy Agency puts the lifecycle greenhouse gas emissions of a BEV at about half that of an ICEV (IEA, 2021). The threat of climate change alone is a strong driving force for consumers seeking out BEV and on top of that policy changes such as vehicle CO_2 regulations in Europe and fuel economy regulations in China are pushing consumers towards BEVs. Government policy hoping to curb climate change and public interest in being eco-friendly is quickly growing the sales of BEVs.

3.1 million passenger BEVs were sold in 2020 and that number is expected to have risen to 14 million in 2025 according to BloombergNEF's 2021 Electric Vehicle Outlook. BloombergNEF (BNEF) posits that to achieve a net-zero carbon global vehicle fleet by 2050, BEVs will need to be 60% of new vehicle sales by 2030, and ICEV sales will need to completely phase out just after 2035. Even without the policy changes necessary to reach net-zero by 2050, driven only by market forces, BNEF predicts BEV sales to outnumber ICEV sales by the early 2030s. This increasing demand represents the most important need from the indirect stakeholders in this analysis.

Developed nations are at the foot of a precipice of ever-growing demand for more Cobalt. As stated above, depending on advancements in battery chemistry and policy changes, the IEA (2021) predicts the demand for cobalt will at a minimum increase 6-fold by 2050 and could grow as much as 30-fold compared to 2020 demand. Another important factor for indirect stakeholders is the presence of child labor. Automakers and electronics firms have strong incentive to ensure that no headline will link their product directly to the suffering of children. That sort of connection could lead to boycotts from their consumer base. One such headline was the December 18, 2019 article from CNN Business, "Apple, Google, Microsoft, Dell and Tesla are sued over alleged child labor in Congo" (Toh, 2019). The article describes the class action lawsuit spearheaded by an advocacy group called International Rights Advocates (IRA) accusing the tech firms and automaker of "knowingly benefiting from" and "aiding and abetting" child labor in the DRC. The plaintiffs represent the families of 14 children killed or maimed in mining accidents such as cave ins (IRA, 2021). As a direct result of this lawsuit, Huayou Cobalt suspended the buying of Cobalt from AMs as of May, 2020 (Calvao, et al., 2021). Swiss mining firm, Glencore, who according to the IEA handled 24% of all the cobalt coming from the DRC in

2019, issued a statement in response to the lawsuit claiming that they have no dealing with ASM. Several of the tech firms accused issued statements reaffirming their commitment to "responsible sourcing" of the materials used in their devices (CNN, 2019). This sort of bad publicity is a strong incentive for tech firms in the formation of these formalization schemes. The consumer base for electric vehicles are already making decisions based on the impact that their purchases will have on the world around them and would certainly be dissuaded by connections to child labor. Companies such as tech firms and automakers seeking to keep a clean corporate image push the need for a verifiably responsible supply chain all the way back upstream to the mining corporations like Glencore and Shelina resources, which is the next largest source of cobalt coming out of the DRC amounting to 10% of the total output in 2019 and whose subsidiary, Chemaf, will feature prominently in one of the pilot projects featured below (IEA, 2019). The two major needs of indirect stakeholders from the technology of the mining system within the DRC are an ever-growing need for cobalt and the removal of any accusations of irresponsible sourcing. Any formalization scheme which will conform to these demands would be a successful technology from the perspective of the consumers, tech firms, and automakers.

Direct Stakeholders

AMs are driven to ASM due to poverty. The average monthly income per capita, adjusted for local buying power, in the mining region known as the "copper belt" of the DRC is just 35 USD, with two-thirds of households worrying about getting enough to eat. 60% of households in these mining communities have relied on mining as a source of household income at some point. Children working outside of the home can be an important source of income for the poorest members of these communities. Nearly one in four households belonging to the poorest 20% have at least one child working outside of the home, in contrast to less than 1 in 10 for the richest

20%. There is very little employment opportunity in the mining industry; only 10% of those earning a living from mining are employed, the rest are AMs (Faber, et al., 2017). These AMs are highly flexible and may change where they mine or the mineral they are mining for at any time. Often the state of international markets affecting the price that they will be paid for ore is the driving force behind these changes.

The first ever attempt at creating a legal route for AMs to engage with the international market came in 1982, when the DRC passed a law allowing for the free circulation of minerals with the hopes of growing the mining sector and economy. This essentially created a free-for-all system, where there was no regulation over AMs. The next major change came in 2002, when a law backed by the IMF and World Bank created the concept of a *zone d'exploitation artisanale* (ZEA), a mining concession set aside explicitly for ASM. For an AM to operate legally after 2002, they would need to register with the government to receive an ID card and could only mine within ZEAs. ZEAs were established in less favorable areas than industrial mining concessions, creating an incentive for AMs to illegally mine on property set aside for industrial mining companies. Private military and security forces occasionally guarded industrial concessions to prevent incursion, leading to harassment and exploitation of AMs. Today, AMs need to be affiliated with a mining cooperative which has been given permission to operate within specific ZEAs in order to mine legally (Calvao, et al., 2021). The existence of a legal pathway, however, has done little to prevent illegal mining. 65% of ASM sites in the copper belt are operating without a cooperative (Faber, et al., 2017). Only 14% of AMs in one survey were even aware of the existence of ZEAs.

On and off ZEAs, AMs are vulnerable to exploitation. Police, military, and officials from the government agency in charge of ASM, SAEMAPE, often harass and extort AMs. Rather than

prevent AMs from mining illegally, authorities often extort payments in cash or ore from AMs. Refusal to pay could result in retaliation in the form of seizure of tools or even beatings (de Silva, et al., 2017). Children are forced to pay bribes to officials, to have a blind eye turned to the illegal child labor taking place, putting the most vulnerable into an even worse position (Kara, 2018). Once AMs have finished mining and washing the ore, it must be taken to a trader. AMs are often paid less than half and sometimes as low as 6% of the price which these intermediary handlers receive when selling to the ore processors (Faber, et al., 2017). When selling ore, it is weighed and tested for purity. In a survey of 81 AMs, only 2 reported trusting these measures, but with little protection in place, there is no course of action but to accept the buying house's valuation of the ore (Calvao, et al., 2021). Corporations buying this cobalt often have little incentive to truly try and prevent ASM from occurring on their industrial mining concessions. The law is after all being broken by the AMs, not the corporation, and the presence of ASM increases the supply of cobalt flowing out of the area, fueling the industry. The pressure coming from indirect stakeholders, however, is pushing mining companies to attempt to distance themselves from illegal mining.

Any structuring of the mining system in which AMs are exploited can quite clearly be seen as a failure, even if it may be favorable for stakeholders such as the police or mining corporations. This exploitation is happening to an extremely vulnerable group of people, who until recently, have had little recourse to change the system. With the attention of the journalists and consumers discussed above, who are necessarily opposed to propping up an industry built on exploitation, the needs of AMs are finally being considered. Often considered as a solution to the issues of child labor and AM exploitation is complete disengagement with ASM. While this solution might clear the conscience of the purchaser of a new BEV, it is not a favorable solution

to several other stakeholders. First, mining corporations would be losing a large pool of cheap labor, and more importantly, tens of thousands of AMs would lose an important source of household income. This move might paradoxically even raise the amount of child labor occurring, as families in poverty are made more desperate. Avoiding engagement clears the supply chain of any connection directly to child labor, but really only sidesteps the problem and would worsen the conditions for those in poverty turning to ASM.

Formalization

Kasulo

The Kasulo ASM site came to be, according to local lore, when in 2014 a local resident dug a hole for a new septic tank. After discovering cobalt, the crowded neighborhood rapidly transitioned into a series of mining pits as residents began to dig. Under mounting pressure as the situation developed, local authorities along with a Congo Dongfang Mining (CDM) first attempted to ban ASM, but after these attempts were met with little success, decided to formalize the makeshift ASM site. 600 families were paid by CDM to leave the neighborhood so it could be fully converted into a mining concession. In return for administering this transition, CDM was given monopolistic control over the cobalt sourced from the new ASM site.

Figure 1. The Kasulo neighborhood before mining began. May 16, 2016. (Source: Kelly, 2019)

Figure 2. The Kasulo neighborhood after mining began. May 20, 2019. (Source: Kelly, 2019)

CDM reached an agreement with a local mining cooperative, CMKK, and built a perimeter wall to keep unregistered AMs out and the cobalt in. The side of the deal beneficial to CMKK and the AMs was the mechanized stripping of several meters of topsoil and gravel to expose the ore rich earth beneath. This stripping makes ASM a far less dangerous task, as deep

underground tunneling is not necessary to reach ore veins. In this system, CDM invested the initial costs of the perimeter wall and top-layer stripping, and continues to pay for checks to ensure no unregistered AMs may access the site, but they avoid the long-term planning and investment required to institute full industrial mining. Additionally, the risk of price fluctuation for cobalt is shouldered by the AMs rather than CDM, as they owe no wages and only pay for the cobalt mined. If prices dip low, AMs simply do not show up to mine. The site has seen anywhere from 500 to 14,000 AMs depending on the cobalt market. To avoid accusations of price manipulation, CDM invites several buying houses deemed in line with their due diligence policies to participate in a small closed market within the site. While these buyers must compete with one another, CDM is the ultimate buyer of all the cobalt and thus still retains a strong economic control over the buying of cobalt (Calvao, et al., 2021).

The ASM site at Kasulo depicts how, when offered the opportunity, those living in poverty will mine for cobalt, regardless of the legality of the action. The semi-mechanized system introduced, where machinery is used for an initial removal of worthless soil, presents a successful interaction between CDM and CMKK. CDM invests initially, but removes the risk of AMs being injured on their mining concession and CMKK receives a mining environment much less prone to cave ins and underground work.

Kamilombe

The ASM site at Kamilombe has failed to implement the successful strategies seen at Kasulo. Attempts to strip the top soil were met by violence from the local miners. Machinery and industrial infrastructure were burned. AMs using the site resisted the introduction of safety measures, perhaps out of fear of losing access to the ability to mine. Additionally, AMs showed a preference for having access to free markets, where price fixing is less possible and higher

earnings for cobalt can be found. An NGO representative with the Cobalt for Development Initiative voiced their skepticism of formalization projects, saying, “Model mine is just a name at the end of the day, all minerals are bought, irrespective of origin” (Calvao, et al., 2021). The situation at Kamilombe highlights the problems with formalization schemes such as that at Kasulo, in which one company is the sole buyer of cobalt from a cooperative. Economic exploitation is likely to occur in such a monopolistic system. Additionally, the benefits to safety may not outweigh the needs of the local community. Kamilombe remains unstructured and unregulated, enabling the presence of child labor and unsafe labor practices which ultimately yield higher earnings for the community. The miners around Kamilombe have decided that formalization would introduce too many restrictions and ultimately harm their community. Whereas at the Kasulo site, the children intending to partake in the mining sector are turned away, Kamilombe forgoes these restrictions, seeing them as beneficial only to the mining corporations. These communities are likely not all that different in their needs, but the Kasulo site in a crowded neighborhood created worse optics for the government and corporations, leading to a stronger push to formalize. Any real solution to all problems in establishing a well-functioning mining solution must be economically advantageous to the local community, otherwise illegal mining will persist and the cobalt will find its way into the international supply chain.

Mutoshi

The Mutoshi model mine is the most robust attempt at a formalized ASM system to date. In 2017 international commodity trader Trafigura, Chemaf, a subsidiary of the international Shalina Resources, American NGO Pact to Launch, and local mining cooperative COMIAKOL entered into a joint venture to develop a formalized mining system at Mutoshi. Similar to Kasulo

project, AMs entering the site need to present ID to ensure they are at least 18 years old and members of COMIAKOL. AMs are also subject to random drug and alcohol testing (Calvao, et al., 2021). Pact to Launch performs weekly compliance checks and quarterly checks are conducted by a third-party company. Chemaf is the sole buyer of cobalt from the site and provides trucks for transporting ore and excavators for removal of waste. Chemaf also provided safety equipment, onsite toilets, and health clinics (de Silva, et al. 2019). Mutoshi represented an opportunity for Trafigura and Chemaf to get ahead of the curve with respect to a responsible cobalt supply chain. The project is in a way a sort of marketing gimmick, and was intended as a pilot program for other formalization schemes to model. In 2018, when the price of cobalt fell drastically, Chemaf dialed back many of the promises made. Payments to COMIAKOL came less frequently and surface soil was not stripped for AMs. Chemaf also halted the replacement of worn or lost safety equipment (Calvao, et al., 2021).

Mutoshi represents the most ambitious attempt at a formalization scheme to date. It however is not impervious. Price differences between nearby markets and the price paid by Chemaf has led to occasional strife with COMIAKOL, in which cobalt has been withheld. Additionally, the street into the mining concession is lined either side with AMs of all ages partaking in illegal ASM just outside the border of the model mine (Calvao, et al., 2021). All of these projects attempt to address the various needs of the AMs and corporations while providing the international battery supply chain with ethically sourced cobalt. The major driver behind child labor and unsafe practices is poverty, and these projects rightfully choose to engage with the ASM sector. Without this engagement, there is no chance to solve the needs of the AMs.

Conclusion

A pessimistic view of the information in this paper is that a mining system addressing the needs of all stakeholders is simply impossible. With the driving force of poverty, illegal ASM will persist, regardless of legal alternatives, and this illegal cobalt will make its way into the supply chain. The existence of model mines implementing formalization schemes are in this view largely symbolic. An illusion of sustainable sourcing to shirk responsibility. They are, however, real steps towards a better system. The best possible form of formalization scheme would provide AMs with better health and safety protections, provide corporations and consumers with cobalt sure to have been mined safely, and take steps towards alleviating the need for child labor in the first place. The analysis of the Kamilombe site shows that ASM communities can be strongly opposed to formalization, as it can financially harm them. Collective labor bargaining seen with cooperatives is a critical part of improving the situation. Cooperatives represent the best chance of making the needs of AMs heard in the discussion over formalization.

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