

# **Cobalt Mining in the Democratic Republic of the Congo**

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**Nicholas Taylor Flora**

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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

Advisor

Karina Rider, Department of Engineering and Society

## Introduction

Technology, from phones to computers, dominate modern life. Everyday needs are dependent on these items. This gave me a fascination with technology, leading to me choosing my major. In college, I have learned the theories behind circuitry, software languages, and other concepts to assemble and run technologies. Only recently, I began to further dive into where the essential pieces of technologies originate. Specifically, I wanted to study the cobalt supply, which is one of the rarer minerals for modern technologies. What I found throughout my research was shocking. I uncovered a massive ethical dilemma that exists within the cobalt mining industry, specifically the Democratic Republic of the Congo (DRC).

My research focus is asking if there are alternative methods to artisanal mining and finding more sustainable practices that empower local communities whilst being realistic with the demand of cobalt for the global supply chain. Artisanal mining is nonindustrial mining, with little modern equipment and scarce safety measures. In the background section, it can be seen there are extensive health consequences for this form of mining, along with it making the whole industry unstable and leading to long term concerns. I conducted a literature review on three different aspects of this situation: alternatives to cobalt, the impact on the community, and government reform. The first part was what alternative methods could be for the DRC, or anyway to introduce these methods to the country. The second part is when these alternative methods are introduced, it empowers local communities and does not abandon them. Finally, being realistic with the demand of cobalt for the global supply chain, by researching if current efforts are being made for modern technologies to be less reliant on this cobalt industry in the DRC.

## **Background and context**

The Cobalt mining industry in the DRC is one full of ethical dilemmas. A lot of the research done into just how extensive this issue is can be found in my prospectus. To summarize the findings, a lot of the issues within the industry stem from corporate outsourcing, and a widespread history of corruption within the country itself. My findings highlighted widespread health issues within the mining community, and the abuse they face each day.

For example, in the article “When subterranean slavery supports sustainability transitions? Power, patriarchy and child labor in artisanal Congolese cobalt mining”, there was numerous interviews in the field from experts, who found a disturbing relationship between the government, traders, and miners (Savacool, 2020). They found child labor that was reinforced by community structures, and essentially modern slavery with extensive sexual abuse and prostitution for woman and girl miners. These community structures are deeply rooted in the DRC, and in their current form continue this ethical dilemma cycle. In addition, in the article “Sustainability of artisanal mining of cobalt in DR Congo”, Nkulu and other authors studied the health impact of Cobalt miners in the Kolwezi region in the DRC (Nkulu, et al., 2018). They found this by performing health assessments against a control group. They found higher cobalt levels in residents that were located near mining areas versus the control group. In addition, they found exposure-related oxidative DNA damage in children. This shows the short- and long-term health costs for the artisanal mining communities.

Beyond the individuals affected, there has been extensive reform in the past that has not worked for the area. For example, corporations have been outsourcing their responsibility through corporate formalization projects. This is seen in “Cobalt mining and the corporate

outsourcing of responsibility in the Democratic Republic of the Congo” (Calvao, et al., 2021). What they found in trying to integrate artisanal miners into these projects was that it simply expanded the brutal conditions on a more formal scale, and conditions were not improved but instead just amplified. This is due to corporations avoiding responsibility to take care of the workers, and instead they outsource this responsibility to local communities, that with current structures in place do not improve the conditions of the workers.

So with the health costs and failed reforms for corporations, this ties into the question of what historical conditions might’ve led to this. Well, for further background information, the article “Socio-Economic Collapse in the Congo: Causes and Solutions” highlights the historical implications of the Democratic Republic of the Congo (Rose, et al., 2009). This is important to understand the current state of the Congolese government, as reforms implemented through them might be moot because of their corruption. The article highlights the Congo’s long exploitation from Belgium colonialism, and near instant collapse after their 1960 independence when their first Prime Minister, Patrice Lumumba, was assassinated in 1961. They were ruled under a dictator Mobutu Sese Seko from 1965 to 1997, until Laurent Kabila overthrew him. Kabila was also assassinated in 2001, leading to his son Joseph taking power. Up until this point, The Congo was riddled with Civil Wars, corruption and economic mismanagement, even with the Sovereign National Conference in 1992 attempting reforms. To summarize, this article explains that alternatives to artisanal cobalt mining are roadblocked by the government. Its corruption, mismanagement, war and political instability deepen the problem to try and help the artisanal miners. Through this research, I can see that the first problem is the government itself, and nothing can be done for the artisanal miners if the government itself abuses them daily.

In addition, the article “Unintended consequences or ambivalent policy objectives? Conflict minerals and mining reform in the Democratic Republic of Congo” analyzes the reform process in the artisanal mining sector of the Democratic Republic of the Congo (Diemel, et al., 2019). This was initiated in the early 2000s to sever ties between mineral extraction and violent conflict. The past research assesses the impact of these reforms and has a study that takes a critical discourse analysis approach to the underlying goals of key policy documents between 2010 and 2012. The main goal was to have conflict-free sourcing and peace promotion, which did not always come into practice. The reforms realistically ensured minerals are sourced without funding conflict, instead of actively promoting peace. They were also implemented in conflict-free zones, limiting their true effectiveness. These showed an overreliance for reform on the Congolese government, which itself has many issues, and overlooked the well-being of the artisanal miners themselves. What the study ultimately found is that these past proposals that were analyzed had an underlying goal of giving international buyers more of a moral high ground by buying traceable, conflict free products. This gave them little incentive to focus on the well-being of the Congolese population. This suggests for a real alternative, a more holistic approach to the problem is necessary to get to the true hardships in the region.

Through this research, I found underlying health and ethical issues facing the people of the DRC. I also found a history of past reform that hasn’t seemed to work, either through historical conflicts, government corruption, or no incentive for corporations to change and instead outsourcing their responsibly. This context is key in understanding my research focus and the conclusions that I found.

## **Methods & theoretical framework**

To collect the data, as stated earlier, I broke the research focus into three key parts. I first researched if there was any ongoing effort to reduce the cobalt demand within the supply chain. What I found was that there was ongoing research into cobalt-free cathodes, which would significantly reduce cobalt demand as the technology boom grew the industry to its current scale present day. I then researched what alternative methods were available for cobalt mining. What I found was that the DRC has an infrastructure problem, and that any other industry that would want to come in to complement or replace the cobalt mining industry could not operate effectively within the country. Therefore, my research for this part stopped there, as I decided that before this step was completed any other step could not be attempted. Finally, given the background and context of the cobalt mining crisis, I wanted to research any projects that worked on government reform, with the government effectively, or any future reforms that could be given to the government as advice. I found two specific projects that worked on government reform, or in partnership with the current government, in addition to environmental guidelines should the industry remain in place. I researched this through valid scientific sources, given that I could not do on the ground research. I found all of my articles through google scholar, and What I found gave me an answer to my research focus, as seen in the next section.

## **Findings & analysis**

### **Technological Alternatives to Cobalt**

This Findings & analysis section is broken into three subsections. The first is Technological Alternatives to Cobalt. The article “A Perspective on the Sustainability of Cathode Materials used in Lithium-Ion Batteries” goes into detail on Lithium-Ion batteries, which are a

huge pusher for demands for Cobalt in the region (Murdock, et al., 2021). The push for sustainability globally and the development of EV technologies has sparked the need for more Lithium-Ion batteries. However, this technology never addressed the extreme ethical violations in harvesting the resources for it, which in itself are unsustainable. The article highlights the development of lithium-ion cathode development, making them less reliant on Cobalt, or not at all. This is definitely a realistic approach to address artisanal Cobalt mining. If the demand for Cobalt in the global market decreases, the need for dark ethical practices to spur production is also decreased. It essentially highlights the current hypocrisy in the current initiatives to increase EV production and CO2 emissions are increasing unethical Cobalt mining, which in itself is leading to resource depletion, ethical issues, and expansive impacts on the environment. If the main technology, lithium-ion batteries, which has spiked production in this industry, is less reliant or not at all on Cobalt, it will certainly alleviate this issue that has grown in this century.

The article “Advancing Cobalt-Free Lithium-Ion Batteries through Electrochemical Model Refinement and Experimental Parametrization of LNMO|Gr Cells with Gel Polymer Electrolytes” discusses two different lithium-ion battery configurations (Daems, et al., 2024). One is using liquid electrolytes, and the other using gel polymer electrolytes (GPE). Both of these battery configurations are Cobalt free and contain cheaper cathode materials. The model used experimental data, including various techniques like impedance spectroscopy and microscopy, for accurate parameterization. Accurate parameterization is the process of tuning a model’s parameters to improve predictions. What this study basically found was that the liquid electrolytes were more optimal than GPEs. The model can also be scaled up to larger cells which makes it a useful tool for evaluating battery performance in larger configurations. This article is

good insight on a specific experiment in looking into Cobalt-free lithium ion batteries. It shows that there is current ongoing extensive experiments into this alternative.

The article “Breaking Free from Cobalt Reliance in Lithium-Ion Batteries” further highlights the importance of cobalt-free lithium-ion batteries (Gourley, et al., 2020). It addresses the growing demand for electric vehicles (EVs) and the need for low-cost, high-performance lithium-ion batteries. This EV demand is one of many factors that has caused the need for Cobalt. It also highlights that Cobalt itself is expensive and scarce, leading to the harsh conditions in the Congo to save money on global production. This is why this article explores cobalt-free alternatives, to not only save money but also the ethical concerns with its gathering. It explores the feasibility of developing and commercializing cobalt-free cathode materials for lithium-ion batteries. In summary, the article highlights key research areas that could help reduce reliance on cobalt, while also maintaining the batteries performance and explore the feasibility of commercializing cobalt-free cathode materials for lithium-ion batteries, which could help lower the overall cost for current cobalt-dependent technologies.

The article “An overview of various critical aspects of low-cobalt/cobalt-free Li-ion battery cathodes” highlights specifically the importance of sustainable production of lithium-ion battery cathodes to reduce environmental impact, lower costs, and improve energy performance (Mallick, et al., 2024). The article emphasizes the role of battery chemistry in determining cell performance, battery pack costs, and the greenhouse gas emissions. It covers the need for spent-battery recycling for maintaining a circular economy for materials such as cobalt in cathode production. If this were to be instituted, then at the very least more Cobalt will be preserved and will stay within the supply chain, reducing the need to overmine the material and ultimately helping reduce the demand within the DRC, helping conditions. Its main points that help with the



DRC is it covers strategies for developing low-cobalt cathodes and improving recycling processes to reduce waste and the demand of cobalt, and improving the environment overall with lithium-ion battery cathode production.

Reading these four articles, it is clear there is an ongoing effort to research cobalt free alternatives to cathodes, specifically in lithium-ion batteries. It highlights that these alternatives are not only sustainable, but provide higher energy performance at a lower cost. It also provides current efforts to at least implement spent-battery recycling to not waste current cobalt that has been harvested by the DRC. The need for no cobalt, or recycled cobalt, also reduces its environmental impact, and decreases the high demand for cobalt, especially in the DRC. With this, the cobalt industry would be waned out of the DRC, and cheaper, more ethical approaches to this industry can be implemented, as the urgency for cobalt is reduced. This would ultimately encourage the DRC government to seek other industries to not lose a huge part of their trade, increasing incentive for a shift away from the cobalt mining industry. However, this potential abandonment of local communities would not empower them, and alternative industries are needed. This ties into the second part of the answer.

### **Infrastructure Needs**

The second subsection is Infrastructure Needs. The report “The Democratic Republic of Congo’s Infrastructure: A Continental Perspective” is from the Africa Infrastructure Country Diagnostic (AICD) (Foster, et al., 2010). This report discusses the significance infrastructure challenges faced by the Democratic Republic of Congo from years of historical conflict, as highlighted in the background section such as colonialism, civil war, and dictatorships. It estimates that roughly half of existing infrastructure assets require assistance, and that the country’s size, specific geography and low population density make developing infrastructure

difficult. The report does note that since peace was restored in 2003, there has been some infrastructure progress. There has been a privately funded expansion of the Global System for Mobile Communications (GSM) telephone network, growing domestic air transport, and road improvements. It suggests that the Congo has vast potential for energy generation. This is particularly highlighted by its massive hydropower resources, and the need for infrastructure in order to meet the countries' domestic energy needs and reduce costs. This development of road, rail and power infrastructure can go hand in hand with reliable, low-cost power.

To get more specific in this report, it estimates that to meet these infrastructure and power demands, the Congo needs to invest \$53 billion over the next decade (Foster, et al., 2010). For context, that is about 75% of the country's 2006 GDP, which means it needs outside help. Right now, the government spends \$700 million annually, and as highlighted in the background section it is no surprise to learn that most of this is lost to inefficiencies, which one can assume includes corruption. The report concludes that this spending must increase, which in my view is either through outside help or internal reform to lead to better efficiency. If this is not addressed, the current rate would take more than a century to fix the Congo's infrastructure. This is obviously not on pace, and there is a huge need to speed it up to give the country greater access to wealth and turn away from artisanal cobalt mining.

Clearly, based on this research, while infrastructure development and energy development would significantly help the DRC and bring in new industries, therefore empowering local communities, a lot of work is still needed. Looking at the background section, history is not kind to the DRC when it comes to outside assistance. This can be due in part to the government, which through the history stated has not been stable for the Congolese people. In addition, this instability has deterred outside investors into the country, as the anticipated

corruption gives less confidence that projects will achieve their original goal. However, through research, there are two examples of projects from outside assistance that have worked with the government, and helped put it in check, and also research into conservation initiatives that would at least make the current cobalt mining industry more sustainable and stable and reduce the community's health issues.

### **Corporate Social Responsibility and Policy with Government Reform**

The final subsection is Corporate Social Responsibility and Policy with Government Reform. The article “How New Business Models Can Address Human Rights Risks in the Cobalt Supply Chain” further explains the need for cobalt from the Democratic Republic of the Congo, and new business models produced to address the ethical rights concerns (Baumann-Pauly, et al., 2020). It highlights that companies have a high need to address these issues, and how to formalize artisanal mining and human rights protections within the supply chains. It focuses on the Trafigura pilot project at the Mutoshi mine, which aims to create a model for regulating artisanal mining and lessening human rights risks. To summarize this project, it found that the method used for extraction that was developed increased productivity, which in turn increased the income of each miner, while ensuring certain safety controls were in place. This was further compared to corporate efforts to reduce artisanal mining risks. The article further dives into the role of multi-stakeholder initiatives that would help establish industry-wide frameworks for ethical practices. This is certainly an example of a project that focuses on sustainability and ends up creating stability and wealth for everyone involved.

The article “The Democratic Republic of the Congo (DRC)’s response to artisanal cobalt mining: The Entreprise Générale du Cobalt (EGC)” analyzes a new government agency created. It is called the Entreprise Générale du Cobalt (EGC) (Debert, 2021). It was established by the

government in 2018 to address artisanal mining concerns and controls 15-30 percent of the country's output. This agency is very unique, however, as it is in partnership with a Swiss trader, which can put a check on the government itself to limit corruption. The article highlights the challenges the EGC faces, and the EGC role in the ever-growing Cobalt market for new technologies. This is promising research as it shows that there is at least an effort to assist the government and give ethical and stable guidance for the artisanal mining industry.

Finally, the report "Assessment of the Mining Sector and Infrastructure Development in the Congo Basin Region" highlights the need to have strict conservation initiatives and an enforcement system to limit the expansion of the mining industry in the Democratic Republic of the Congo into environmentally vulnerable areas (Reed, et al., 2007). This would help prevent massive environmental harm to the area. It would also force the mining industry to focus on the areas they already control, increasing their sustainability and addressing ethical concerns instead of focusing on simple expansion and profit. Using environmental protections is a tool to address ethical concerns with artisanal miners in the Democratic Republic of the Congo. It can also help address health concerns, as making the industry more environmentally conscious will reduce cobalt-related health deficiencies, such as. This is another reform that can be used for the Congolese government to better help their citizens.

The final three articles tie everything together, and address the ongoing effort and potential future solutions that can be implemented socially and economically within the Congolese government. It also highlights that when outside assistance does trust the government, and is not there to simply exploit, that real progress is made, and the industry is made better for everyone involved. The need for democratic elections, economic reforms, anti-corruption measures, and social welfare improvements through collaboration among government and

international organizations will be necessary to improve the government for the people and make proposed policy changes to improve artisanal mining more realistic. In addition, if cobalt demand is reduced through cobalt free cathodes, the government would have incentive to appeal to outside investors for things like infrastructure in order to not have the countries trade significantly reduced, potentially causing the government to root out its own corruption. From research into cobalt free cathodes, to calculated infrastructure development, to outside assistance projects and guidance highlighting government reform, I am confident that there is an answer to “are there alternative methods to artisanal mining and finding more sustainable practices that empower local communities whilst being realistic with the demand of Cobalt for the global supply chain?”

## **Conclusion**

Through extensive research, I had found background into an ethical dilemma within the DRC. With its history, it provides more context into why this issue exists in the current day. That led me to asking “are there alternative methods to artisanal mining and finding more sustainable practices that empower local communities whilst being realistic with the demand of Cobalt for the global supply chain?” With this question, I broke my answer into three parts, which through researching each part I found my answer.

I would say that there are alternative methods to artisanal mining within the DRC. I found that the DRC is heavily underdeveloped in its infrastructure. With this development, it could attract completely new industries into the DRC and give the local communities new jobs along with a source of untapped hydropower the country has within its borders. This can go in parallel with the ongoing research into cobalt-free cathodes, which would decrease the demand for

cobalt, decrease the demand for the artisanal mining industry, which in turn would increase demand for new industry leading to an increased demand for infrastructure development. Maybe this in turn would lead to government reform so the country looks more stable to outside investors, and the government avoiding a huge trade loss. This leads to the third part. There is already evidence suggesting that when projects are focused on sustainability, the environment, and worker conditions, everyone benefits. This is especially seen in the Trafigura pilot project. In addition, government agencies like The Entreprise Générale du Cobalt (EGC) that partner with outside entities show that government reform is not only possible, it is happening, and has shown positive results for everyone involved.

While the artisanal cobalt mining industry in the DRC gives technology to the world, the miners in this industry suffer. Any industry that leads to these inhumane conditions is not only unethical, but they are also unsustainable, and it is only a matter of time before it collapses on itself. If the answer I provided is not implemented in the future, I fear it could have further catastrophic consequences for the Congolese artisanal miners, and future catastrophic consequences for global technology. However, the answer provided concludes that there is an ongoing effort to solve this, and future work is being laid out to solve the DRC's cobalt mining crisis.

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