

The Human Cost of Electrification

Varga

Advanced Writing in the

Disciplines

Northeastern University

Boston, USA

varga.n@northeastern.edu

Abstract—Mining for critical minerals such as lithium and cobalt is set to increase as the need for low-carbon power storage increases, but mining often has localized negative effects on communities. The specific issues in the Democratic Republic of the Congo, Argentina, and Mexico are studied and compared. The commonality of the military-industrial-academic complex links these three locations and can be used to explain the degree of exploitation that occurs.

I. INTRODUCTION

The Fourth Industrial Revolution, coined by Klaus Schwab [1], is heralded by the climate crisis and the Age of Information. In part, it is marked by the need for large-scale electrification of systems previously dependent on fossil fuels, including energy production, distribution, and propulsion systems. Given current energy storage technology, the Fourth Industrial Revolution is encouraging the rapid expansion and development of mineral mines to fabricate the components necessary to build this change. This paper focuses on the human cost of the extraction and acquisition of crucial minerals and its connection to the military-industrial-academic complex. Currently, mining companies exploit the communities that surround mineral deposits with the permission or encouragement of the state; three cases of exploitation will be studied in this paper. In the Democratic Republic of the Congo, home to most of the world's cobalt resources, community members face danger and human rights violations due to mining [2]. In the South American Lithium Triangle, made up of Argentina, Bolivia, and Chile, mining companies violate Indigenous tribes' sacred water and land rights in areas of low rainfall. Finally, in Mexico, cartels are enlisted by mining companies to protect and expand mining territory at the cost of those living near the mines, which is perpetuated by the Mexican military. In each case, the global military-industrial-academic complex has either enabled or benefited from the marginalization of the communities surrounding mineral resources.

II. FOURTH INDUSTRIAL REVOLUTION

Cobalt and lithium, the primary minerals present in the Congo and the Lithium Triangle, are essential to building lithium-ion batteries. Currently, lithium-ion batteries are the commercially preferred solution for storing power in electric cars, electric bicycles, and large-scale battery solutions. They strike the best balance between cost-efficiency and energy density. As the need for low-carbon energy sources and transportation grows, so too does the demand for the components of lithium-ion batteries. The popularity of cobalt and lithium has surged over the past 20 years as lithium-ion technologies have grown more popular across sectors and commercially feasible in electric transport. The need for cobalt is estimated to nearly triple between 2017 and 2025, and lithium demand is expected to potentially increase 42 times from 2020 to 2040 [2], [3]. Over half of the world's cobalt is extracted in the Democratic Republic of the Congo, and a growing amount of lithium is mined from the "Lithium Triangle" in South America. Recently, one of the world's largest lithium reserves was discovered in Mexico.

While these countries have not seen direct intervention from global powers in over 30 years, international mining companies and intense demand for resources have still shaped the physical and social landscapes of these resource-rich countries.

III. DEMOCRATIC REPUBLIC OF THE CONGO

A. Current Conditions

The Democratic Republic of the Congo has been the center of global cobalt production for years, due to the high quality of the cobalt produced there. Cobalt is typically mined in cooperatives of "artisanal" miners under contract to a larger mining company. Cooperatives set the price for cobalt for their members; if a miner is not part of a cooperative, they can sell cobalt illegally on the open market. Cooperatives also generally do not advocate for better mining conditions [4]. Thus, members of cooperatives do not see much benefit from their membership. In the DRC, property rights are determined customarily at the community level, so if a miner finds cobalt on someone's property, the property owner can be displaced without remedy. Miners or cooperatives often create fake property titles or bribe local leaders to claim both money for a property and the land it sits on. This can lead to mines being established in the center of a village, creating a rift in the local community. These factors lead to local disdain for "foreign" miners who are not part of a village. In fact, researchers have reported that "violence is common and adversely impacts the living conditions in Lualaba

[a dominant mining region in the DRC]. [Participants] reported conflicts between different ethnic groups, especially between migrant miners and local village residents,” [4, page 6].

Miners describe their working conditions as dangerous and harmful to their health. Workers often do not use PPE, mine with hand tools, and are directly exposed to cobalt, which can lead to cobalt toxicity [4]. One miner stated, “most of us suffer from coughing, muscle aches, our body hurts all over. We work without protection so we breathe in the dust, it gives me a permanent flu,” [5, pages 9-10]. 9-10

Another major issue with cobalt mining in DRC is child labor. Since mining is a dominant economic activity in the Congo, children in poverty see mining as a way to make money for their families. According to [4, page 7], “Child labor is common in mining communities. Individuals and cooperatives alike may falsify ages to secure employment.”

Miners, communities, and children are exploited by mining companies to maximize profits. The mining and labor laws that permit mining conditions to exist as they do today are written and enforced by the Congolese government.

B. Past US Involvement

The current lack of mining regulation and legal protection for communities can be connected to the United States’ involvement in the destabilization of government when Congo was decolonizing from Belgium’s rule in the 1960s. During that period, the Congolese leader Patrice Lumumba was the most popular choice for the newly established position of prime minister due to his nationalist appeal. Lumumba appealed to every source he could to rid his country of the Belgian colonizers, including the UN, United States, and even the USSR. Lumumba’s contact with the USSR did not please the CIA, who perceived Lumumba as a potential communist threat. However, as explained in [6], “[Lumumba] and his supporters had cut their political teeth in the struggle against colonialism, and they found any form of external domination anathema. They were far more interested in nonalignment, and the foreigners they identified with were other African independence leaders, not Khrushchev or Mao.”

Ultimately, Lumumba was imprisoned and assassinated by his rival, Joseph Mobutu. Mobutu was financed by the CIA, who continued to use Mobutu as a figurehead throughout his time in power. This precedent has had consequences on the capability of government in the DRC into today. [6] states that “Ever since the CIA’s intervention, Congo’s leaders have been distinguished by a unique combination of qualities: scant political legitimacy, little capacity for governing, and corruption so extensive that it devours institutions and norms.” The lack of political leadership in the DRC has led to weak human rights laws, working conditions laws, and child labor. This allows mining companies to exploit the people of the Congo for profit, which causes violence, displacement, and adverse health effects.

IV. LITHIUM MINING IN THE LITHIUM TRIANGLE

In the Lithium Triangle, Indigenous tribes have their land and water rights violated by international mining firms. Lithium in the Triangle is mined through a brine-based process, where mines pump a layer of brine from within the earth to evaporate

it and reach lithium deposits [7]. Accordingly, lithium mines restrict Indigenous access to large amounts of land and deplete non-renewable groundwater around them. The Indigenous groups living near mines depend on groundwater for many activities due to the low amount of rainfall in the Lithium Triangle. Their biological need for water, economic activities, and ways of life are threatened by the land and water requirements of lithium mining.

The Argentine government has a responsibility to consult Indigenous tribes before mining in their territory, according to the Argentine Constitution. However, due to rapid changes in mine ownership, Indigenous groups have seemingly no point of contact when mines are established, violating their right to consultation. In a 2012 Supreme Court case, 33 Indigenous communities voiced this, claiming that their provincial governments did not consult them before permitting and performing mining exploration. Part of the claim was that mining activities disrupted their economic activities around the mines, especially around salt flats where many mines are located. The claim was rejected, which leads to questions about the significance of the Constitutional article and if Indigenous people’s rights take precedence over the economic activity of mines [7].

In its current state, the mining of lithium leads to exploitation of local Indigenous tribes in Argentina. Argentina’s provincial governments have disregarded their legal responsibility to protect Indigenous people so they can reap the economic benefits of mining activity.

V. MINING IN MEXICO

In Mexico, exploitation occurring around mines in the Guerrero province indicates the future for communities close to the recently discovered Sonora lithium deposit.

The Guerrero province is home to both mining companies and cartels, who have somewhat of a symbiotic relationship. In [8], Ximena Santaolalla describes how mining companies rely on cartels for many aspects of their business; cartels are enlisted to protect mines and their resources in a so-called “payment of dues” arrangement. Mining companies also use cartels to secure occupied land by force if it is determined to be suitable for mining. [8] characterizes the actions cartels have taken to force displacement: “Some hitmen allegedly cut out the heart of a child (alive as it happened), in front of the community to make it leave, clearly showing what they were capable of.”

In instances such as the disappearance of 43 students from Guerrero in September 2014, the military has collaborated with cartels. Students took buses to Mexico City yearly to protest previous repression of students, but in 2014 the military and the Guerreros Unidos cartel shot at the buses, leading to the disappearance of all 43 students. The incident occurred under the camera view of the State Guard Center of Command, Communication, and Computing (C4). [8] One 22-year-old student was found dead and faceless near C4 shortly after. According to scholars and journalists, “the crime was about sending a message: Do not mess with us, do not mess with our

business—human trafficking, extortion, kidnapping, drugs, weapons—and especially do not mess with the mining business.” [8] There have been nearly 4,000 people reported as missing in Guerrero over the last 5 years, a fact that is well known by the Mexican military. The military perpetuates the cycle of mining and displacement, and violence. The link between mining, the state, and the violence cartels enact on communities in Guerrero is inextricable. While the state looks the other way to further their profit interests, people living in Guerrero suffer from poverty, missing family members, and the constant threat of violence to their communities. In fact, “Guerrero is still one of the poorest states in the country and the sixth largest gold-producing territory in the world,” [8].

The way mining is conducted in Guerrero is especially worrying when applied to the future Sonora lithium project in the northeast of Mexico. The Sonora project encompasses one of the largest lithium deposits in the world, covering 243.9 hectares. Given that there are two cartels active in the region, communities surrounding the Sonora project have a high chance of facing the violence and exploitation occurring in Guerrero on a larger scale without strong government intervention [3].

VI. POSSIBLE SOLUTIONS

A. *Social Life Cycle Analysis*

One way to start solving the problems in mineral extraction today is to document the social effects of mining through Social Life Cycle Analysis, or S-LCA. Mentioned and built upon in [4], S-LCA is a developing analysis technique. It is modeled after the better-known Environmental Life Cycle Analysis to consider and enumerate the human costs of producing minerals. The technique combines various factors in the analysis, including lived experiences of community members and localized, relevant data sources in key areas such as housing stability, health and safety, and child labor. This practice offers a socially equitable way to understand and correct the effects of resource mining for the Fourth Industrial Revolution.

B. *Advancing Manufacturing*

Another possible solution is to encourage a more advanced manufacturing industry localized in mining areas, so that more mineral wealth can be generated locally. The model for resource extraction in the Congo, Mexico, and Argentina currently relies on export of raw materials to other countries, where the materials are refined. Most of the value of the materials is created through refining the materials in other countries with more developed manufacturing industries. Development of local industrial advancement can keep more mineral wealth in the communities that surround mines and encourage local deployment of innovations that use lithium and cobalt.

C. *Nationalizing Mining*

Finally, a third solution is to nationalize mining and industrial operations and center the needs of communities over the profit motive of international mining corporations. Bolivia has already taken steps in this direction by reestablishing a

national mining corporation which is owned and operated by the government [3]. With nationalized mining, the goals of extraction can acknowledge the history and importance of mining land and encourage cooperation with those most impacted by mining.

VII. THE ROLE OF THE MILITARY-INDUSTRIAL-ACADEMIC COMPLEX

Given the solutions that have been proposed, why hasn't there been a change in the way these minerals are mined? A primary reason is the military-industrial-academic (MIA) complex. The MIA is an agglomeration of corporations, governments, and militaries that perpetuates the mode of extraction that exists today [9].

The MIA complex can be specifically linked to the DRC, the Lithium Triangle, and Mexico. First, the CIA played a prominent role in establishing the current government of the DRC, which regulates the conditions of mining to exist as they do; second, Mexico's military is complicit in allowing mining companies to enact violence on communities through cartels; third, Argentina's provincial governments encourage mining companies to appropriate Indigenous lands with no regard to the circumstances of Indigenous groups. In each case, the success and profitability of mining is directly correlated with a lack of regulation and accountability from states. The military component ensures the security of raw materials for the use of advancing technology by industry and academia.

The military, industry, and academia have been tied together since the post-WWII period. During this time, industry looked to validate the use of science for profit by attracting scholarly researchers and the military looked to use the talents of researchers for their own purposes. With outcomes such as the nearly decade-long Project MICHIGAN and the lucrative research funding garnered by Stanford and MIT, the military solidified its connection with academia [9]. In 2021, the Department of Defense supplied \$7.4 billion dollars of research dollars to universities, making it the second largest federal funding source to university research and development [10]. The campaign of industry was also fruitful, resulting in groundbreaking research discoveries such as the transistor that continue to shape our world today [11].

Through the symbiotic relationships of industry and academia, military and industry, and military and academia, the MIA complex can be thought of as a single interconnected group of entities that benefit from mining operations occurring today. While this is not congruent with the formal definition of the MIA complex, it is an important way to explain issues that will continue to arise with the Fourth Industrial Revolution and mass electrification.

VIII. CONCLUSION

The close ties between military, state, industry, and academia ensure that without an absolute reversal in the way mining is administered and conducted, exploitation of communities surrounding minerals will continue unabated. Localized exploitation around mines can be found around the

globe in the Democratic Republic of the Congo, Argentina, and Mexico.

The role of communities in determining outcomes of the mineral wealth on their land is ignored by international mining firms. While the minerals being mined are a necessity for mitigating climate change and transitioning to low-carbon systems, communities deserve to benefit from their land. The mineral wealth these communities sit on top of should be used to mitigate the drawbacks of mining and the economy surrounding it.

REFERENCES

- [1] K. Schwab, "The Fourth Industrial Revolution: what it means, how to respond," World Economic Forum. Accessed: May 20, 2024. [Online]. Available: <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>
- [2] European Commission. Joint Research Centre., *Cobalt: demand supply balances in the transition to electric mobility*. LU: Publications Office, 2018. Accessed: May 28, 2024. [Online]. Available: <https://data.europa.eu/doi/10.2760/97710>
- [3] V. Vivoda, M. D. Bazilian, A. Khadim, N. Ralph, and G. Krame, "Lithium nexus: Energy, geopolitics, and socio-environmental impacts in Mexico's Sonora project," *Energy Research & Social Science*, vol. 108, p. 103393, Feb. 2024, doi: 10.1016/j.erss.2023.103393.
- [4] G. Bamana, J. Miller, S. Young, and J. Dunn, "Addressing the social life cycle inventory analysis data gap: Insights from a case study of cobalt mining in the Democratic Republic of the Congo," *One Earth*, vol. 4, no. 12, p. 11, Dec. 2021.
- [5] B. K. Sovacool, B. Turnheim, A. Hook, A. Brock, and M. Martiskainen, "Dispossessed by decarbonisation: Reducing vulnerability, injustice, and inequality in the lived experience of low-carbon pathways," *World Development*, vol. 137, p. 105116, Jan. 2021, doi: 10.1016/j.worlddev.2020.105116.
- [6] S. R. Weissman, "What Really Happened in Congo: The CIA, the Murder of Lumumba, and the Rise of Mobutu," *Foreign Affairs*, vol. 93, no. 4, pp. 14–24, 2014.
- [7] F. M. Dorn and F. Ruiz Peyré, "Lithium as a Strategic Resource: Geopolitics, Industrialization, and Mining in Argentina," *Journal of Latin American Geography*, vol. 19, no. 4, pp. 68–90, 2020, doi: 10.1353/lag.2020.0101.
- [8] X. Santaolalla, "State Crime, Extraction and Cartels," Harvard University, Jul. 2023. [Online]. Available: <https://revista.drclas.harvard.edu/state-crime-extraction-and-cartels-the-meaning-of-mining-in-guerrero-mexico/>
- [9] Salem Elzway, "2017 Graduate Student Essay Prize Winner: Pentagon Midwest: Making the Military-Industrial-Academic Complex (and Its Discontents) at the University of Michigan," *Michigan Historical Review*, vol. 44, no. 1, pp. 23–66, 2018.
- [10] M. Gibbons, "Universities Report Largest Growth in Federally Funded R&D Expenditures since FY 2011," National Center for Science and Engineering Statistics. [Online]. Available: <https://ncses.nsf.gov/pubs/nsf23303>
- [11] L. A. Mozingo, *Pastoral capitalism: a history of suburban corporate landscapes*. Cambridge: The MIT Press, 2014.