Does Society Run on Slavery? Ethical Sourcing of Materials in the U.S. Aerospace Industry

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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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Introduction

You might think that slavery in the US ended during the Civil War after the issuing of the Emancipation Proclamation. You might also believe that today's society is much more advanced than society in the 1800s, with substantial improvements in medicine, transportation, communication, and technology in general since the Civil War in addition to the formal abolition of slavery. However, what if I told you that the United States might still take part in slavery today, and that technological infrastructure crucial to modern society relies on this slavery to function? Unfortunately, this is a very real possibility, and if it turns out to be true, society may have in essence failed to advance as much as we thought it has. While formal slavery has been abolished in much of the world a new form called modern slavery has emerged which includes offenses such as forced labor, indentured servitude, human trafficking, and more arising from abuse of power, violence, coercion, manipulation, or deception (Anderson and Harris, 2023). Unfortunately, this modern form of slavery exists in mines in the Democratic Republic of Congo (DRC), which extract cobalt, gold, tin, tantalum, and tungsten. The infrastructure mentioned before, which is created and maintained by the aerospace industry, is responsible for much of communication, navigation, weather tracking, and more, all of which are crucial in many peoples' daily lives (What are satellites used for, n.d.). *In this paper, I will investigate whether the U.S. aerospace industry uses materials, particularly cobalt, mined through modern slavery in the DRC and if so, what changes would have to occur to stop this from happening.*

Background and Context

Whether they be man-made satellites, astronauts heading to the moon, or a rover on its way to Mars, the space industry has wide-reaching implications. Satellites' impacts pervade

throughout society; as mentioned in the introduction, they affect wireless communication, navigation, weather tracking, and more, and that excludes any of the other types of objects we put into space (What are satellites used for, n.d.). In the aerospace industry gold, cobalt, and tungsten are used in some rockets and satellites. More specifically, gold is useful in electronics because of its low electrical resistance and for satellite plating because of its high corrosion resistance, cobalt alloys are utilized in rocket engines, and tungsten finds use in nozzles of solid propellant rockets (Halchak, 2001, Rocket Nozzles, n.d., Sims, 2023). Additionally, some technology sent into space uses lithium-ion batteries which contain cobalt (Nobel-winning lithium, 2019). While gold and tungsten are both potential candidates for unethical sourcing of materials in the aerospace industry, from here on out I will focus primarily on cobalt. Unfortunately, much of the world's supply (around 88%) of cobalt originates from the DRC in mines that are home to poor working conditions (Gross, 2023, van den Brink et al., 2020).

The cobalt mines in the DRC are home to a host of issues regarding workers' safety and just compensation; in fact, these mines are home to modern slavery. Workers in the mines in the DRC mines are subjected to around four times the fatality rate of mining workers in the United States; cobalt toxicity, which leads to pulmonary and dermatologic problems, has been reported as well (Fehring and Secrist, 2023). Furthermore, the mines are home to vast amounts of child labor and abuse; at least 40,000 children work in these mines and many report payments equivalent to one to two U.S. dollars per day, and UNICEF claims that children mining or living there are exposed to physical and drug abuse as well as sexual exploitation and violence (Fehring and Secrist, 2023). Thus, it is very clear that the DRC's cobalt mines are home to severe wage theft / forced working conditions, violent and sexual crimes, and hazardous working conditions: all of which are unacceptable. It is ironic that much of the technologies that use cobalt (such as

electric vehicles, smartphones, etc.) are created to solve problems or help people yet the cobalt that makes these technologies work comes from such abhorrent conditions.

Literature and Laws

In the U.S., there is policy regarding conflict minerals: the Dodd-Frank Act from 2010 has specific contents regarding conflict minerals and mentions the DRC and tin, tantalum, tungsten, and gold, though it doesn't include cobalt (Dodd-Frank, 2023). This policy mainly mandates disclosure of conflict materials originating from the DRC or neighboring countries (Dodd-Frank, 2023). This policy is based on company transparency. It does not directly mandate that companies are forbidden from acquiring conflict materials, just that companies that acquire conflict materials must admit to using them. This policy effectiveness relies on a company both telling the truth about their supply chain and that a company's stakeholders or customers will care enough to seek change if the company discloses use of conflict materials. There are a few similar policies in place in other locations including Australia, the U.K., and California that address modern slavery in supply chains (Harris and Nolan, 2022). Similar to the U.S., Australia's policy is based on transparency and free market pressure: it requires businesses larger than a certain threshold to self-report the risk of modern slavery in their operations or supply chains and anything they do to prevent it, and these reports are published for the public to access freely (Harris and Nolan, 2022). However, as Harris and Nolan go on to argue, this doesn't directly stop the problem, it relies on consumers or investors to read these reports and then protest the companies to change, which presents several problems (Harris and Nolan, 2022). First, consumers or investors have to care about the problems in the first place, they'd then have to spend time and energy working for a change in company policy, and the company would then

have to listen and adopt this change. All of this is also dependent on the company being truthful in its report, and it all unfortunately goes against financial incentives as modern slavery would logically allow the acquisition of goods and services at a much cheaper rate than if they were acquired ethically. This system leaves enforcement unguaranteed by delegating it to external sources, thus decreasing the chance that anything gets done to prevent modern slavery (Harris and Nolan, 2022). Therefore, this sort of system is not good enough and needs further assistance to become effective (Harris and Nolan, 2022). The laws in the U.K. and California are also similarly based on mandatory transparency, and as such are ineffective in the same ways (Hess, 2021).

There are a few ideas in the literature already on how to effectively solve this issue including repurposing other laws and policy, a victim centered approach, and an upgraded version of company transparency. Starting with the repurposing approach, one idea is to use existing anticorruption laws. Duquene acknowledges outright that current US laws can't hold businesses accountable for modern slavery committed in other countries (Duquene, 2021). However, Duquene argues that anti-corruption is taken extremely seriously in the U.S. and abroad, and that modern slavery classifies as a kind of corruption; therefore the U.S. should simply apply the rules and regulations that are made for anti-corruption to modern slavery issues, and they will disable companies from being able to utilize modern slavery in their supply chains (Duequene, 2021). This approach has two important benefits: first, it uses laws and rules already in place in multiple countries, thus removing the need to introduce and pass new policy or legislation. Second, these laws that are already in place are taken seriously; they will be legitimately enforced and followed, which will prevent any non-compliance from companies. However, this practice would require that the countries with these laws decide to use them in this

manner. This outcome has an unclear path to success as these laws were not written with the intent to curb modern slavery, and thus this option could be hard to implement.

The second idea is the victim centered method. Regarding the human trafficking form of modern slavery present in Albania, Nurkić-Kačapor proposed this type of approach to solve the issue (Nurkić-Kačapor, 2011). While it is important to focus attention and care on the victims of modern slavery, this type of approach could end up ineffective if enacted in a country that is foreign to the victims; in this case the foreign country is the U.S., and the victims are the mining workers in the DRC. This is because the people being enslaved live in the DRC's jurisdiction and the U.S. tends to prioritize the wellbeing of its own citizens over that of people outside the U.S. Thus, this idea would likely find trouble in gaining traction in the United States and its legislature.

Finally, the upgraded company transparency approach. In a work that talks more directly about the U.S., Hess advocates for the abandonment of transparency-based policy and the adoption of what he calls "mandatory human rights due diligence" to help address modern slavery (Hess, 2021). This approach seems promising; it acknowledges the weaknesses of company self-reporting and transparency-based policies and attempts to address them by requiring more of companies. With mandatory human rights due diligence companies must create, put into place, and publish a plan that identifies potential human rights violations in their supply chain and create a system to both prevent those violations and monitor company cooperation with the policy. This idea goes on to state that if the company fails to do any of this any person negatively affected by the failure of the company to prevent human rights violations is allowed to sue the company. This idea is more logically sound than the preceding ideas and could be an effective method to decrease the use of modern slavery in U.S. supply chains,

however there are still some issues with this plan. It ultimately requires those being harmed to directly sue the companies that violate this policy, which goes back to the victim centered approach idea and likely wouldn't work well. If workers are subjected to harm through modern slavery, then due to that modern slavery and exploitation they are unlikely to have the resources to sue a company far removed from their situation. Additionally, it's unclear how people exploited by mining companies in the DRC would know or care much about the end users or companies that buy the metals they mine; it makes more sense for them to pursue action directly against the mining companies that exploit them.

While these three approaches might do more than the basic company transparency policies that are currently enacted in the world, all three come short of a robust solution and serious concerns regarding these methods arise following simple logical counterarguments. I would like to propose an amended version of mandatory human rights due diligence by replacing the potential for litigation with a yearly audit completed by a U.S. government agency created to determine any wrongdoing. This agency could then assign heavy fines and penalties to companies convicted of said wrongdoing. This would be difficult to set up as it would require new laws and a new enforcement agency, but positive change often comes at a necessary cost and disruption to the status quo.

Methods

To determine whether the aerospace industry is engaged in collecting unethically extracted materials, I will collect evidence by attempting to find the connection between US aerospace entities and the unethical mining of cobalt in the DRC. This includes primarily any proof that any US aerospace entity has collected cobalt from unethical sources and any official

policies (or lack thereof) regarding ethical supply chains published by US aerospace entities. Thus, the types of evidence I will search for include news stories (e.g. a story exposing a company for unethical practices), aerospace company policies written in documents or on their company websites, online published lists of aerospace company's suppliers or supply chain, and any studies or other scholarly work regarding the unethical extraction of cobalt from the DRC. I will collect sources from the internet through google searches and through academic databases (primarily the Academic Search Complete database). I will conduct my analysis by considering whether the evidence suggests that U.S. aerospace companies are collecting materials unethically and by determining how well each entity's policies prevent the unethical collection of resources in general. I acknowledge that some of this evidence could be flawed; as publicly admitting the purchase of cobalt from places that commit human rights violations could cause tremendous damage to an entity's public image and enacting policies that prevent unethical sourcing of materials would cost said entity extra effort and money, aerospace entities have clear incentives to hide any unethical sourcing of materials. Therefore, information regarding this matter published by the U.S. aerospace industry could be internationally faulty or hidden in order to serve that industry's financial interests. Thus, I will gather evidence and analyze it accordingly.

Results and Analysis

One of the most well-known aerospace entities in the United States is NASA, the National Aeronautics and Space Administration. It is a government entity responsible for first getting humans on the moon in 1969 through the Apollo program. In 1981, NASA itself published an article called "Cobalt, a Vital Element in the Aircraft Engine Industry," where it acknowledged that the U.S. imported more than 90% of its cobalt with 58% coming from what is

now the DRC (Stephens, 1981). The same report goes so far as to mention that "This…situation places the United States in an extremely vulnerable position if [cobalt] supplies are cutoff for any length of time" (Stephens, 1981). Additionally, it appears that the current NASA Supply Chain Risk Management policy has no direct mention of ethics, child labor, working conditions, or human rights (Office of Safety, 2021). While supply chain risk management generally focuses on things that would stop the flow of goods or supplies and doesn't always consider ethics, here it is largely still relevant as systems where people are being exploited are inherently fickle and unreliable. NASA should also care about the ethics of the situation and discuss it in their supply chain risk management strategies just because of how important it is in order to make sure that everyone involved is being treated humanely; however, even ignoring that point unethical acquisition of resources will lead to poor health outcomes for workers and high discontent from workers and maybe even the public. Both of these could incentivize the mistreated workers and/or the public to revolt or dismantle the unethical resource extraction systems that exploit the workers. All of this is to say that there is a strong link between ethical resource collection and supply chain risk management for multiple reasons, yet NASA doesn't seem to connect the two at all. Thus, NASA has openly admitted the United States' heavy reliance on cobalt from the DRC yet has no mention of ethical working conditions in their current policy on Supply Chain Risk Management. While it is true that the condition of US cobalt acquisition hasn't necessarily stayed the same since the publishing of the NASA report in 1981, other data suggests that it has remained consistent by showing that around 88% of the current world supply still comes from the DRC (van der Brink et al., 2020). This suggests that the US is still heavily reliant on the DRC for cobalt, and the lack of mention of ethical working conditions or material procurement in NASA policy suggests that NASA does nothing to prevent the acquisition of unethically sourced

materials. In other words, it seems likely that NASA does not ethically source cobalt, or at the very least that NASA does nothing to prevent the unethical sourcing of cobalt.

Another famous United States-based aerospace entity is SpaceX. They are well-known for engineering reusable rockets that can be launched and then landed safely as opposed to a typical rocket that is discarded after a single use; as such and with their overall success SpaceX is becoming more relevant over time as one of the most successful private spaceflight entities. Regarding its ethical practices, SpaceX has a form for potential suppliers online that specifically mentions that suppliers should conform to laws and regulations regarding human trafficking and slavery (SpaceX Code of Ethics, 2016). While it's better than not including this at all, it seems that all SpaceX does to prevent unethical sourcing of materials in its supply chain is hope that its suppliers follow laws and regulations. This is similar to the transparency-based solution defined above and leaves all the burden to the suppliers. This means that there is essentially no enforcement from SpaceX on this policy, and if a supplier decided to ignore this then nothing would stop them from sourcing materials unethically. Thus this is a very weak and ineffective system to prevent unethical sourcing of materials. Relatedly, SpaceX was founded by Elon Musk, who is currently CEO of an electric car company, Tesla. Tesla has come under scrutiny for its sourcing of materials in 2023 with its purchasing of materials from Glencore, a large mining entity with dozens of human rights allegations against it (Calma, 2023). Since Elon Musk has influence over both companies, it seems likely that if Tesla has bought materials from mining companies like Glencore, then SpaceX has too. While SpaceX does have some mention of preventing unethical supplying of materials in their supplier code of ethics, it is ultimately a very weak overall defense to poorly sourced materials and hence it seems like a suboptimal policy similar to NASA's relevant (lack of) policy.

Lockheed Martin is a U.S. engineering firm infamous for its business regarding defense and weaponry. It is common knowledge that the U.S. has an ambiguously ethical use of weapons at best, so to say Lockheed Martin is an ethical company to begin with is not necessarily true. Subsequently one might expect that Lockheed Martin has dubious morals when it comes to their supply chain. Ironically, out of the three companies I've investigated, Lockheed Martin has far and away the most mention and best policy of preventing unethical sourcing of materials. On their company website page for Sustainable Supply Chain Management, Lockheed Martin contains a specific section on conflict materials, and while it doesn't specifically mention cobalt, it does mention the DRC and conflict materials in general and its commitment to following the U.S. code on disclosing use of conflict materials (Sustainable Supply Chain Management, n.d.). Thus, while Lockheed Martin may not conduct the most ethical business practices, its supply chain is the most progressive and ethical so far. While this U.S. based policy is probably not completely effective and needs to be updated, Lockheed Martin seems to be holding themselves much more accountable than both NASA and SpaceX.

While it is useful to note the differences between the three entities discussed already, it is important to emphasize that the most effective entity-level policy seen so far is essentially company transparency, which, as stated before, is overall a weak and generally ineffective policy. In order to truly deter entities from acquiring materials unethically the final policy described in the Literature and Laws section above should be enacted in the United States.

Conclusion

With the increasingly widespread adoption of technology (and thus, lithium-ion batteries) and societal reliance on the aerospace industry, the use of cobalt and other conflict materials will

only become more and more commonplace. With the deplorable cobalt mining in the DRC consisting of human rights violations, forced labor, forced evictions, violence, sexual crimes, and more, and with the DRC being the world's largest supply of cobalt, industries must be cautious of acquiring cobalt lest they enable these human rights violations and thus in essence cancel out the benefits of the technology they're creating using said cobalt. According to the literature, the existing global policies, mainly based on transparency and market pressure, are inadequate to effectively prevent unethical sourcing of materials, specifically cobalt, from the DRC in the aerospace industry and in general. A better approach would include government enforced accountability and supply chain audits conducted frequently. After looking at three U.S. based aerospace entities - NASA, SpaceX, and Lockheed Martin - it can be concluded that none of them have airtight prevention of unethical sourcing of material, and unethical sourcing of materials could continue under their current company policies and U.S. laws. However, ranking their policies yields Lockheed Martin, then SpaceX, then NASA in order of best to worst policy and cognizance of unethical sourcing issues. More work needs to be done to audit the supply chains of all U.S. aerospace entities in order to effectively identify and disrupt any unethical sourcing of materials. Furthermore, lots of work needs to be done by governments around the world to abolish all forms of slavery.

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