

**"Uncovering the Dark Side of Technology: Exploring the Connection of Conflict Minerals,
Child Labor, and the Global Supply Chain in the Electronics Industry"**

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Abstract:

A topic that has recently come to light over the past few years is the conflicts with the electronics supply chain. With the increasing amount of technology, people are wanting more and more electronic devices that satisfy all their needs and make their lives easier. With this increase in demand for these devices, minerals such as tantalum, tin, tungsten, and gold are being sourced at a rapid rate. This leads to conflicts within the supply chain as the minerals are being sourced from countries like the Democratic Republic of the Congo where minerals are being mined by children and women in very poor working conditions. This is where the term “conflict minerals” stemmed from. Laws and regulations have been put in place to try and reduce the amount of conflict minerals being sourced. A good example is the Dodd-Frank Act that was created in 2010, more specifically section 1502 which addresses the topic of conflict minerals. The goal of section 1502 is to increase the traceability among companies that are part of the stock exchange to ensure they are not sourcing their minerals from conflicted countries. Progress is being made; however, there are still thousands of companies that have no idea where the source of their raw material comes from.

Keywords: Conflict Minerals, Electronics Industry, Dodd-Frank Act, Global Supply Chain, Child Labor, Technology

"Uncovering the Dark Side of Technology: Exploring the Connection of Conflict Minerals, Child Labor, and the Global Supply Chain in the Electronics Industry"

Background

In today's day and age, everything is processed using electronics and different technological devices. We rely heavily on technology to complete daily tasks and to travel from point A to point B whether it be by car, airplane, train, etc. It seems as though we are dependent on our phones and laptops to communicate with others and live our everyday lives. Without the ability to use our phones and other electronic devices, people would think the world is going to come to an end and there would be various problems spread worldwide. The part that the majority of the population do not think about is, how are these electronic devices created? Where are they created? Who is creating them? These are all important questions that go seemingly unnoticed. In this study, the supply chain behind the electronics industry and how it is connected with conflict minerals and child labor will be talked about.

The electronics industry is one of the fastest growing industries in the business field and that is for good reason. Businesses are becoming more productive than ever before, they are saving millions of dollars, and they are able to communicate with people of interest all around the world in the matter of seconds. In an article by E.J. Roberts, he mentions, "The industry is constantly changing as a result of evolving scientific knowledge and increasing demand. The manufacture of goods is evermore automated. There is heightened productivity. Cheap labor costs elsewhere means that the UK workforce is now more involved with product design and innovation" (Roberts, 2019). This quote explains how the electronic industry continues to expand as more scientific knowledge is gained and there are improvements in technology. A more recent topic of discussion involving this industry is sustainability and reducing fossil fuels.

One of the said solutions to this is creating electric vehicles which run off lithium-ion batteries among a variety of other types of batteries. Many of the larger car manufacturers are beginning to switch their focus to creating these electric vehicles to abide by the regulations in place and to remain competitive in the automobile market. The same goes for smartphone manufacturers as there is a new phone that comes out every year and they are trying to keep their customers satisfied. There are consistently new advancements being made to the newest smartphones which in turn require more material to create. Between phones, electric cars, laptops, and other electronic devices, there has been a demand surge for the minerals and materials required to make them. The majority of these minerals come from the Democratic Republic of Congo where there has been a 20-year war between armed groups and the state. This is where the term “conflict minerals” originated from.

The Democratic Republic of Congo is one of the largest countries in Africa and is a gold mine for minerals required in the production of the electronics we use on a daily basis. This has led to huge conflicts between the state and armed groups of individuals who illegally harvest these minerals with the use of child labor and unsafe working conditions. The main minerals that are being harvested consist of tantalum, tin, tungsten, and gold. Also known as 3TG. These groups harvest the minerals and sell them around the world making huge profits from them. According to Earthworks, a national organization focused on preventing the destructive impacts of oil, gas, and minerals, “Conflict minerals are usually talked about in the context of the Democratic Republic of Congo (DRC), where a 20-year conflict between armed groups and the state has to mass murder, rape, and other human rights violations. More than 3 million people have been killed in the conflict. More complex than a war, the fractious violence is often financed by the extraction and sale of conflict minerals, including tin, tantalum, tungsten, and

gold. These often end up in our phones and electronic devices” (Earthworks, 2024). This quote is a good example of the horrors and effects that come from these valuable minerals. There have been laws and regulations set in place as result of this topic such as the Dodd-Frank Act and others to try and reduce the amount of violence behind these minerals.

This is an important topic to address and talk about as many people do not realize the behind the scenes of the electronics we use on a daily basis. The impact of 3TG has not been very relevant in other countries besides the DRC; however, there are still children dying everyday in the mines and people being killed as a result of the value of the minerals. By addressing these issues through recognition of the topic and laws being placed, a more efficient and ethical way to create electronics can be found.

Information that is Unknown

While studies have been performed and there is information about the sourcing of conflict minerals, there is still uncertainty of whether or not companies are purchasing these minerals from ethical suppliers and if they are following the regulations in place. A big part of this involves section 1502 of the Dodd-Frank Act. Russel Han mentions that “Section 1502 of the Dodd-Frank Act requires SEC-registered issuers to conduct supply chain due diligence and submit conflict minerals disclosures (CMDs) that indicate whether their products contain tantalum, tin, tungsten, or gold (3TG) sourced from the Democratic Republic of the Congo (DRC) or its neighboring countries (“covered countries”)” (Han, 2021). This act was put in place in 2010 to improve transparency for sourcing of products. With this law being created, many companies have shifted their focus to researching the suppliers they buy from and how they create and gather their resources. The issue is that there are still companies who do not abide by

the regulations as they want cheaper materials which leads to the purchasing of their required materials from unethical suppliers.

Another unknown aspect is whether or not the minerals required in today's electronics can be replaced with other resources. We are always looking for the best solutions to problems and trying to produce products that perform well. As of right now the 3TG minerals are the most effective along with cobalt which is becoming more popular. Research still needs to be done to find more efficient ways of mining these minerals. Jeremy DaSilva, a publisher from John Hopkins University, states "The labeling of cobalt as a conflict mineral suggests that it is directly used by armed groups to fund violence, and this legal definition would mean inclusion under supply chain transparency programs like Dodd-Frank. Furthermore, calling cobalt a conflict mineral leads many companies to treat it as such, despite the legal classification. Current data shows, however, that there is little evidence of armed groups vying for control of cobalt mines, utilizing the existing labor force in these mines, or selling cobalt for profit like is evident in Eastern Congo with other conflict minerals" (DaSilva, 2022). As mentioned in this quote, there is not enough evidence about cobalt being considered a conflict mineral as it is becoming more popular as of late because of its importance in creating electronic vehicles.

Purpose of Research

The complexities of child labor and conflict minerals in international supply chains continue to be poorly understood by millions of companies and people around the world. There are efforts being made and a great deal of attention has been brought about this topic. This remains true especially with the electronics industry involving supply chains. While the Dodd-Frank Act has been created, there are still millions of children and families suffering every day because of the demand for 3TG and Cobalt. The purpose of this research paper is to address the

problems related to conflict minerals, child labor, and the global supply chain for the electronics industry. Through research the following questions will be address:

1. What are the main reasons and contributing elements that keep child labor alive in areas where conflict minerals are mined, and how do these relate to the aspects of international supply chains?
2. What are the current laws in place to prevent unethical sourcing from mines that allow child labor and slavery?

Summary

Technological advancements for smartphones, electric vehicles, and other electronics have led to an increasing need for minerals to produce electronics because of a surge in demand for new technology. As a result of this, conflict minerals are being used more and child labor and death have increased in third-world countries where the minerals are being harvested. There have been acts created to increase transparency in supply chains around the world; however, little is still known about the harmful effects and events taking place as a result of 3TG and Cobalt.

Method of Research

For this research, data will be used from past articles, findings, and statistics to present information about this particular area of study. It will be collected data from academic and industry specific databases to ensure all of it is relevant and factual. This will allow me a wide range of information and different perspectives on the nexus of conflict minerals and child labor within the global supply chain. There is both quantitative and qualitative data available regarding conflict minerals and their correlation to increased violence in the DRC. For quantitative data, different visuals will be presented that will show trends and patterns over the year to help provide evidence and answer the different research questions. Quantitative data will be gathered

from the United States Government Accountability Office and other sources to present graphs representing fatalities caused by conflict minerals from recent years. For qualitative data, case studies and surveys will be examined to help understand why these events are still taking place and what exactly these events are. This data will also be used to answer the research questions.

Discussion

By analyzing past and current research about the electronics supply chain and all it entails, people will become more educated on the topic of conflict minerals and where their electronics stem. This is a fairly new topic that has come to light in the last 15 years which means there are not the most efficient solutions in place as research is still to be done. It will take a larger amount of time than 15 years to solve this problem as the electronics industry is trying to deal with a wide web of problems at once. The consumers are increasingly demanding as expectations are extraordinarily high when it comes to what people want with the products they are purchasing. There are actions taking place; however, it is difficult to monitor and enforce the laws that are being created as there is little research on the millions of companies that are purchasing these conflict minerals. The research presented here will aim to make everyday consumers familiar with the topic of conflict minerals in the electronic industry and how we can work together to reduce the amount of child labor and death in the Democratic Republic of the Congo.

Research Question 1 – What are the main reasons and contributing elements that keep child labor alive in areas where conflict minerals are mined, and how do these relate to the aspects of international supply chains?

The primary areas where child labor is prevalent include countries in Africa and Asia that are underdeveloped and rely heavily on outsourcing their products to make money. The reason for this is because the land where they are living contains valuable minerals which are needed to produce a lot of the products that are used by billions of people around the world. In an article from *Skilling Mining Review*, it is mentioned “The use of child labor in mining is prevalent in many developing countries, particularly in Africa and Asia. In these countries, children are often forced to work in mines to help support their families financially. They are often made to work long hours for little pay and are exposed to dangerous conditions such as toxic fumes, heavy machinery, and underground tunnels” (2023). One of the major areas where child labor is a common thing, is the Democratic Republic of the Congo. There are a few distinct reasons why child labor is kept alive in this area. They are mining companies inside the country, government regulations, supply chain companies outside of the country, and consumers.

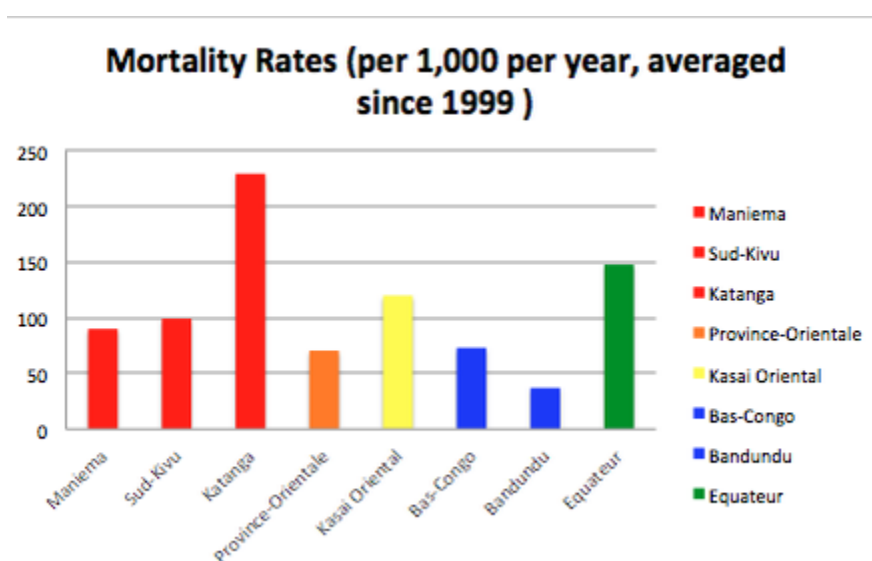
When it comes to mining companies that are inside the Democratic Republic of the Congo and other underdeveloped countries, the mining industry is their main source of income and provides a level of stability to their economy. Josep F. Maria SJ, a writer for the *African Journal of Economic and Management Studies*, explains “Artisanal miners – individuals who “extract and concentrate mineral substances using non industrial tools, methods and proceedings” (RDC, 2002, art. 1, no. 21) – constitute “the largest segment of the Democratic Republic of the Congo (DRC) mining sector” (The World Bank, 2008, p. 56). The estimated number of artisanal miners in the DRC ranges from 500,000 to two million. With an average of four to five dependents for each artisan, the total number of people whose livelihood depends on this activity could be between eight and ten million (14-16 per cent of the total DRC population)

(The World Bank, 2008, p. 56)” (Maria SJ, 2012). This quote gives a fitting example of why child labor is kept alive and how it relates to the global supply chain because the DRC is expected to produce millions of minerals and sell them to other countries. The mining companies allow child labor because it is much cheaper, and they do not have to worry as much about them since health is not of their main concerns. Since mining is such a large industry in the DRC, government regulations have been placed within the country to try and reduce child labor and violence.

In 2009, the Organization for Economic Co-operation and Development (OECD) gathered a working group to establish guidelines for companies that were operating and/or sourcing minerals from conflict-affected areas. This set of guidelines is called the OECD Guidance. One of the requirements they established is, “Local minerals exporters are, for instance, required to gather and disclose information on all taxes and other payments made along the supply-chain to government, security forces and armed groups; on the ownership and corporate structure of the exporter; on the mine of mineral origin; on the identity of all intermediaries; on the locations where minerals are traded and processed; and on transportation routes. The Guidance further recommends that this information is regularly checked on the ground by an assessment team, who are tasked to provide recommendations for risk mitigation.” By following this, companies that are a part of the global electronic supply chain can increase their visibility and ensure that they are sourcing from ethical suppliers; however, this does not mean that every company will abide by these rules.

Outside of Africa and the Dominican Republic of the Congo is where most of the electronic and supply chain companies operate. They would have more transparency and visibility on the issues taking place if they were to build inside of the DRC but that would come with a cost as there are different laws and regulations. One of the reasons electronic companies are one of the reasons child labor is kept alive in that area is because they rely heavily on the minerals that are being mined there, specifically the 3TG and Cobalt. As mentioned before, these minerals are used to make products like smartphones, laptops, electric vehicles, and many more electronic devices. It is much cheaper to buy from unethical suppliers as the children mining the minerals and putting their lives on the line are being paid almost nothing to work several hours a day in terrible working conditions.

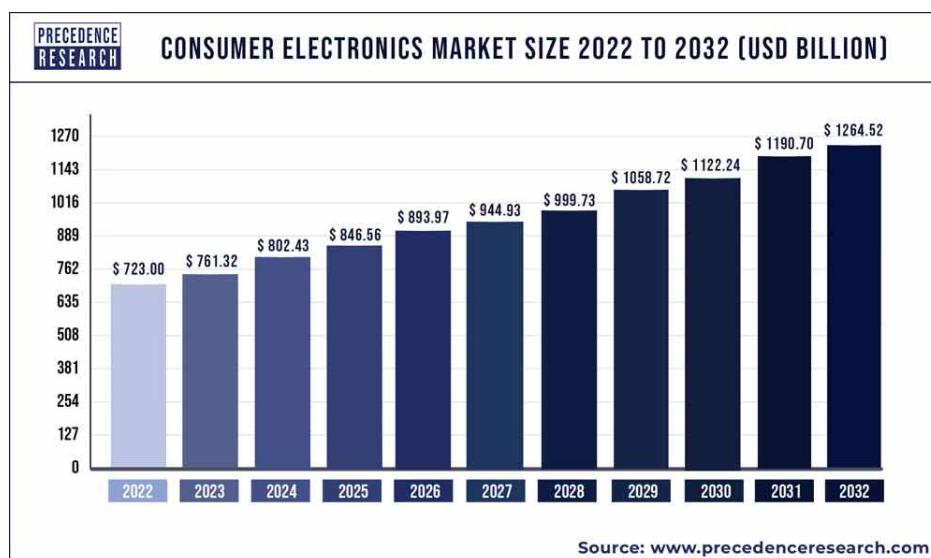
Figure 1. Mortality Rates of Men, Women, and Children since 1999



Note. The red graphs display the regions in the East (where the coltan mining takes place). The Katanga region has the highest mortality rate with Maniema and Sud-Kivu in the middle range of the data.

Consumers are another reason while child labor is still happening in the DRC. Similar to the electronic companies, there has been an increase in demand for electronic devices over the years as technology continues to improve. If you look at it from your own point of view, think about what devices you are using on a daily basis to communicate with others, for your own personal entertainment, and to complete the tasks you have for work. The majority of the devices you use are created from the minerals that children are mining every day. We all take part and are somewhat responsible for the events taking place in the DRC we just do not realize it.

Figure 2. Consumer Electronics Market Size 2022 to 2032 (USD Billion)



Note. “North America was the dominating market in 2022. The high disposable income of the consumers, huge demand for the luxury and premium products, high standard of living, higher adoption of the latest technologies, and the presence of the top players in the region are some of the prominent factors that has driven the North America consumer electronics market.”

Between mining companies, government regulations, supply chain and electronics companies, and consumers, child labor has increased and been kept alive in the DRC. There is no sign of the demand for electronic devices slowing down which means child labor will remain a key factor in supplying these devices.

Research Question 2 – What are the current laws in place to prevent unethical sourcing from mines that allow child labor and slavery and how are they being enforced?

When it comes to creating laws and regulations, they are usually based off events that have happened in the past and led to some unfair advantage, people being harmed, or just an overall unethical issue, etc. It can be a difficult and prolonging task to create laws, but it can be even harder to establish them and ensure that they are followed. This can become even more of a challenge when laws that are created in the United States or another country are to be enforced in a country thousands of miles away. A great example of this is Section 1502 of the Dodd-Frank Act.

In 2010, President Barack Obama signed the Dodd-Frank Act as a response to the economic crisis of 2008. This act was created to, “was aimed at promoting “the financial stability of the United States by improving accountability and transparency in the financial system, to end “too big to fail”, to protect the American taxpayer by ending bailouts, to protect consumers from abusive financial services practices, and for other purposes” (Manhard, 2013, pg. 30). While this was the overall goal of creating this act, there was one section that was devoted to conflict minerals. This was Section 1502 and it dealt specifically with conflict minerals coming from the DRC. “Section 1502 on conflict minerals specifically deals with the exploitation and trade of minerals originating in the Democratic Republic of the Congo that is “helping to finance conflict

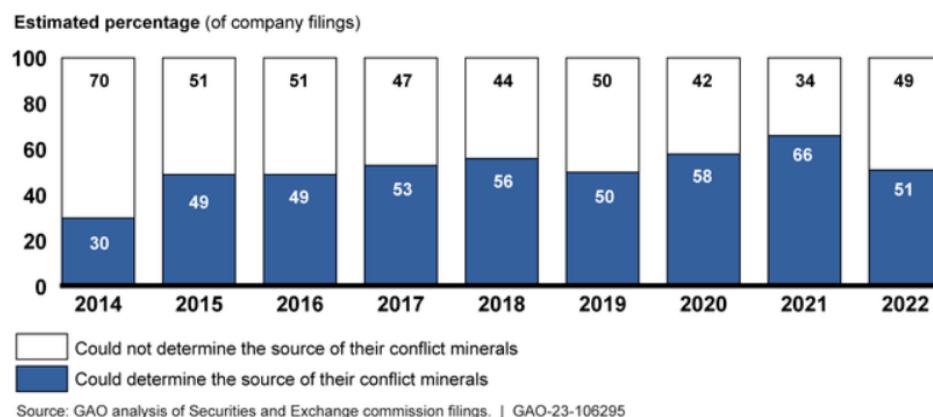
characterized by extreme level of violence in the eastern Democratic Republic of the Congo, particularly sexual- and gender-based violence, and contributing to an emergency humanitarian situation therein”. In particular, Section 1502 requires all companies traded and listed on the US American stock exchange market to disclose information on the use of conflict minerals, which are necessary to the functionality or production of a product” (Manhart, 2013, pg. 31). This quote explains how Section 1502 is devoted to ensuring that any company who uses these minerals must be able to explain where they come from and who they are purchasing them from. The companies held accountable to this law were given three years to collect all the information available on where they source their raw materials from and be able to present it by 2014.

A stunning result from this study came to light after the three years was over. “Only about 1% of the companies were able to declare that their products were conflict-free beyond a reasonable doubt. Of the rest, 19% declared that they had no reason to believe their products contained DRC conflict minerals. The remaining 80% admitted that they were unable to determine their raw materials’ country of origin” (Kim, 2017). This means that only 20% of companies on the stock exchange are able to determine where they source their minerals from showing that the Dodd-Frank Act did not prove to be very efficient. The reason tracing these minerals is difficult is because the companies are thousands of miles away and do not have easy access to visiting the suppliers.

To this day, companies are focusing more on visibility within their supply chain as a result of the Dodd-Frank Act. They have increasingly improved the traceability of raw materials and are going to continue to get better. With more advancements of technology and finding different suppliers, the conflict minerals are becoming less and less. This does not mean they are completely gone as there will most likely be a presence of violence and child labor that comes

with mining these minerals for quite a while. The Securities Exchange Commission has been enforcing this act upon thousands of companies the last 14 years and has no plans of slowing down until all sourcing follows ethical standards.

Figure 3. Source of Conflict Minerals in Products as Preliminarily Determined by Companies' Reasonable Country-of-Origin Inquiries, Reporting Years 2014–2022



Note: Estimates have a margin of error of no more than plus or minus 10 percentage points.

Conclusion

The electronics industry is one of the largest growing industries in the world as technology continues to improve. Everyday, people are using electronic devices to communicate with each other, complete tasks, travel to different locations, etc. We are very reliant on the electronic devices we purchase and most of the time would not know what to do without them. This is a good and bad thing as work is becoming more efficient and we are able to talk to family and friends around the world as well as continue to improve research on our health and finding solutions to major problems around the world. Just like most good things in this world, there is always another side of the picture. In this case, as a result of the surge in technology and the electronics industry, is child labor and violence in other parts of the world. A more specific part of the world being in Africa in the Democratic Republic of the Congo where thousands of

children are mining minerals that are critical in the production of electronic devices we use every day. Once this research came to light, an Act was created, and more awareness gathered around the horrors that were taking place across the world. This research focused specifically on the why child labor is still alive in different regions and what actions have taken place to prevent the violence in those areas.

There are multiple reasons why child labor is still happening in the Democratic Republic of the Congo. As I mentioned previously, they consist of companies that are built around mining these resources within Africa, the different government regulations that are in place outside of Africa, supply chain companies outside of the country, and consumers. After doing research on these different reasons, all of them proved to be a strong correlation on why child labor is still alive. They all play a part with the main one being consumers from around the world. For example, think about Apple, Samsung, Google, and all the other smart phone manufacturers. They are working around the clock to remain competitive in their market so that they can satisfy consumers' needs and provide products we find suitable for our needs. All these improvements in technology lead to more demand for conflict minerals which in turn leads to more mining being done. While there has been a decrease in child labor and violence in the DRC, it is still a relevant topic that needs to continue to be addressed. A great, but slow start to addressing this topic is the Dodd-Frank Act in 2010. More specifically, section 1502 required companies in the US stock exchange to provide documents on where they source their raw materials from. Companies are continuously improving the traceability behind their supply chains which is leading to less and less child labor taking place that we know about.

Overall, this paper emphasizes the need for continued research and collaboration to address the complex issue of sourcing conflict minerals. It advocates for increased awareness

from consumers, more responsibility to be taken place from companies in the electronics industry, and cooperation from companies globally to reduce the amount of child labor taking place around the world. By working towards a more ethical electronics supply chain, there can be a vast improvement of global sourcing for the materials needed to create electronic devices that will continue to improve and be manufactured.

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Appendix A

Figure 1. Mortality Rates of Men, Women, and Children since 1999

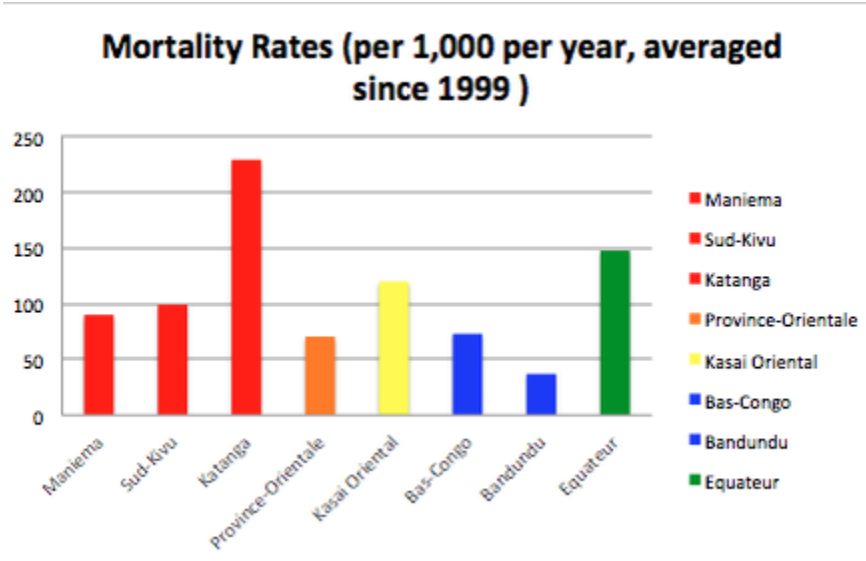


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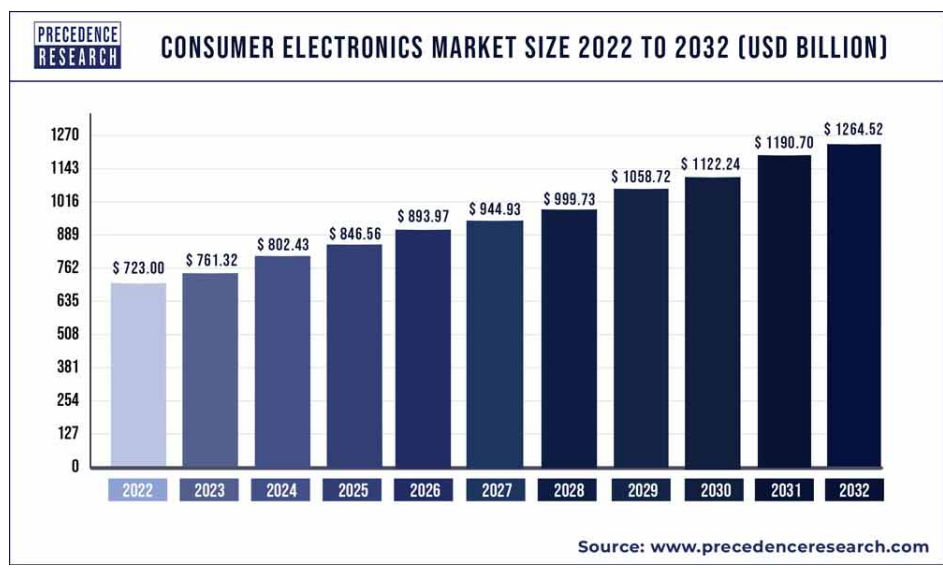
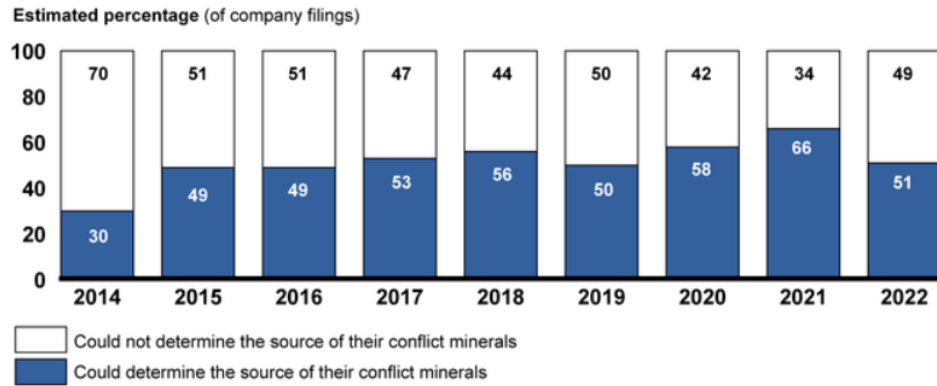


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Source: GAO analysis of Securities and Exchange commission filings. | GAO-23-106295

Note: Estimates have a margin of error of no more than plus or minus 10 percentage points.