PRIORITIZING PEOPLE AND THE ATACAMA DESERT IN THE SUPPLY CHAIN FOR ELECTRONICS

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Abstract

Global supply chains are the commodity chains that allow global capitalism to function. They facilitate an interconnected world while also maintaining obscurity around the details of the labor conditions, environmental standards, and other harm occurring in supply chains. Governments largely do not regulate these supply chains, reflecting a neoliberal governmentality that takes responsibility away from governments. Free-market policies, associated with neoliberalism, have been imposed on the Global South, prioritizing profit for corporations over societal well-being. The Atacama Desert and people indigenous to the desert are experiencing a loss of water, and consequently, a loss of livelihood as a result of lithium mining. Despite this, consumers of electronics feel that they cannot change their consumption because electronics are a necessity, and all electronics are currently made with lithium. To prioritize human and nonhuman well-being, the supply chain for electronics requires an alternative to lithium, and other supply chains may require the development of alternatives as well. Greater transparency in supply chains does not necessarily alter consumer behavior, as knowledge of injustice alone does not remove other barriers consumers face when changing their consumption. Finding an alternative to lithium will likely be a challenge, as the most viable alternative at the moment is sodium, research of which is still in the developmental stage. Along with research and development of less harmful alternatives, regulation of global supply chains is necessary to take responsibility away from consumers in the prioritization of well-being.

How might global supply chains prioritize human and nonhuman well-being?

Background

Global supply chains consist of the commodity chains that facilitate the extraction, production, distribution, consumption, and disposal of goods around the world. It is nearly impossible to exist in the world without being a link in a global supply chain.

Supply chains are designed to prioritize efficiency. Tim Maughan and Miriam Posner describe how the infrastructure of supply chains and the programming that powers them are designed for efficiency at the expense of humans and the environment (Maughan 2016 and Posner 2018). Shipping containers are an example of the standardization and anonymity that characterizes the infrastructure of supply chains (Posner 2018).

Global supply chains are the backbone of global capitalism. In *Capital in the 21st Century,* Thomas Piketty explains how global capitalism, left unregulated, has led to and will continue to cause growing global wealth inequality, arguing that this trend is a threat to democracy and social justice (Piketty 2014). It is important to locate supply chains in this trend because global capitalism depends on supply chains to function.

Brown (2003) describes how the political ideology of neoliberalism is jeopardizing democracy globally, as it takes responsibility away from the state and places it in the hands of individuals. Perreault (2018) describes how this neoliberal ideology has led many Latin American countries to become heavily dependent on extractive economies, which has led to widespread inequality and environmental degradation.

What are the controversies surrounding this topic?

During the COVID-19 pandemic, there have been major supply chain disruptions that have led people to feel as though we can't afford a reduction in efficiency (Free and Hecimovic 2020). Global supply chains are designed to prioritize profit and efficiency, which is only possible due to the lack of transparency surrounding environmental and human harm in supply chains (Posner 2018).

It is difficult to pin down a concise definition of neoliberalism. Brown (2003) defines neoliberalism as both a form of economics as well as a form of governmentality. Neoliberalism consists of "liberal" economics, including deregulation and free-market economics, as well as a mode of governing that derives its legitimacy from market success (Brown 2003). Stiglitz (2002) defines neoliberalism in conjunction with the structural adjustments that the International Monetary Fund (IMF) and the World Bank imposed on the global south. These structural adjustments are a specific set of economic policies, including a reduction in government spending on social safety net programs, deregulation of the economy, and privatization (Stiglitz 2002).

Neoliberalism is a term that is often used with a negative connotation. One of the most famous supporters of neoliberalism is Ronald Reagan, who did not refer to his policies as neoliberal. Reagan believed that high tax rates were the cause of the "bad economy" his presidency inherited, which faced high inflation and unemployment (Steger and Roy 2010). In his efforts to combat this high inflation, Reagan cut taxes, particularly taxes for higher-income earners, under the rationale that lower tax rates would encourage economic growth (Steger and Roy 2010). These policies were implemented in the early 80s and resulted in high income inequality as well as reduced government revenue which caused the government to reduce spending on social programs (Steger and Roy 2010). Despite causing growing wealth inequality in the US and a larger budget deficit, the US experienced a reduction in unemployment and inflation during Reagan's administration, which was his stated goal (Amadeo 2022). Because of this, there are many supporters of so-called "Reaganomics" or "trickle-down economics," but they do not necessarily label this as "neoliberalism."

Greater transparency is often touted as something that will bring about positive change. Adams (2018) argues that it can be a function of neoliberalism. The logic of transparency, according to Adams (2018), commodifies information as a good that is exchanged and makes people think that they can trust society. This logic assumes that with more information, individuals will be better off, but this is contingent on individuals taking on the responsibility to act on this information. Sharma (2017) investigates the effect of the Right to Information Act in India, which was hailed as providing greater transparency to the public. For this transparency to have any effect, according to Sharma (2017), citizens were expected to hold the state accountable themselves.

Who else is trying to answer this question?

In "See No Evil," Miriam Posner argues that technologies such as blockchain can be used to make supply chains more transparent, allowing consumers and producers to have more choice and control over their products. Unfortunately, this technology is not currently being used for the sake of transparency. Instead, it is currently being used to move the links in supply chains in the most efficient way. These links, however, remain anonymous. Posner (2018) describes how Tony's Chocolonely wanted to make the first chocolate bar produced without the exploitation of labor. Their experience proved that not just consumers, but even suppliers cannot fully know the details of their supply chains (Posner 2018). While transparency is important, Adams (2018) argues that it places responsibility on consumers to act on this information, ignoring other possible barriers to changing their consumption.

The Case for Degrowth argues that the pursuit of economic growth has led to environmental damage, inequality, and exploitation (Kallis et al. 2020). The authors make a case for degrowth, arguing that instead of economic growth, societies need to prioritize human and environmental well-being (Kallis et al. 2020). This argument is a response to the emphasis on economic growth as a measurement of success. The United Nations has a set of 17 sustainable development goals, including things from ending poverty and hunger to climate action (United Nations 2022). Only one of these goals, to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all," mentions economic growth (United Nations 2022).

In *Capital in the 21st Century,* Piketty argues that in order to combat rising inequality, there needs to be an international effort to tax wealth. This global wealth tax, according to Piketty, might mitigate the trend toward 19th-century inequality that Piketty argues we are heading towards (Piketty 2014). Because global capitalism depends on global supply chains, global supply chains are a part of this trend. Global supply chains don't just move goods and services, they also facilitate the distribution of wealth, which, as Piketty argues, is concentrating in fewer and fewer hands (Piketty 2014).

What assumptions are being made?

Global supply chains, while global, include specific situated places where materials are extracted, manufactured, transported, used, and finally, disposed of. There is extensive documentation of ecological and human harm in global supply chains, including giant waste lakes in Mongolia (Maughan 2016), child labor in cobalt mines in the Congo (Kelly 2019), slavery in the fishing industry in Thailand (Lawrence 2014), and toxic waste dumps in the Global South (Hossain et al. 2015). These harmful effects of supply chains largely remain hidden by design (Maughan 2016). These are specific, situated places that are part of a larger, more diffuse network of supply chains that facilitates the movement of goods globally. Supply chains as a whole are largely unsituated and not tied to a specific place, but in contrast, nodes in a supply chain, such as cobalt mines in the Congo, are much more situated and specific.

Neoliberalism is a political rationality that extends market values beyond the economy and into everyday life (Brown 2003). In the 1980s and 1990s, the US government, the IMF, and the World Bank imposed neoliberal economic reforms, including privatization and deregulation on countries in the Global South in exchange for debt relief (Stiglitz 2002).

Thesis Statement

Lithium mining consumes a significant amount of the scarce water in the Atacama Desert, permanently altering the biodiversity and microclimate of the desert and causing indigenous Atacameños to feel like they are losing a means for survival. Despite this, consumers say they're not sure how to change their consumption because electronics are a necessity, and all electronics are currently made with lithium. To prioritize human and nonhuman wellbeing, research is necessary to develop less harmful alternatives in supply chains, such as sodium, a possible alternative to lithium.

Chile

Chile: A node in the supply chain for electronics

Chile has the world's largest lithium reserves, a total of 50% of the world's reserves, and is the second-biggest producer of lithium globally (Rapier 2020). Lithium is an essential element

of batteries, which are becoming more important as climate change drives the turn away from fossil fuels (Sengupta 2021). Upon purchasing electronics, information about their supply chains is not readily available to consumers. While Apple has created a "supplier responsibility" web page detailing how conscious their supply chains are, they have conveniently left out any information about the source of their lithium (Apple 2022).

Another node in the supply chain of electronic devices is the Congo. According to Kelly (2019), Apple and Google were named in lawsuits by Congolese families whose children were killed or injured while mining cobalt, a metal necessary for the production of electronics (Kelly 2019).

The US is largely in the consumption node of the supply chain for electronics. According to the US census bureau, 92% of households in 2018 had at least one computer and 84% of households had smartphones (US Census Bureau 2021). Consumers of electronics are geographically diffuse. For example, China has the world's largest share of smartphone users, but the other major regions of the world each make up 9-15% of the world's smartphone users (Turner 2022). Since electronic users are geographically, culturally, and likely, politically diffuse, it is interesting to note that the Atacama Desert in Chile is such a geographically situated context that provides the material necessary for these users.

Latin America, Extractivism, and Neoliberalism

Chile is one of many Latin American countries that depend on extractivism for their economic well-being. Perreault (2018) describes how extractivism in Latin America originates largely with the commodity boom that occurred in the 1990s, in conjunction with the implementation of structural adjustments, such as privatization, which allowed private companies to profit from natural resource extraction. This led to the ideology that Latin American countries needed to promote extractivism in order to develop economically (Perreault 2018).

Like its Latin American neighbors, Chile was encouraged to adopt neoliberal structural adjustments by the World Bank and IMF as a way to develop its economy and experience economic growth (Han 2012). Chile was hailed as the shining star of neoliberalism and economic development during the dictatorship of Augusto Pinochet (Carruthers 2001). Even

though Pinochet's military regime is associated with widespread human rights abuses and violence, Chile was touted as an example of the success of structural adjustments (Han 2012).

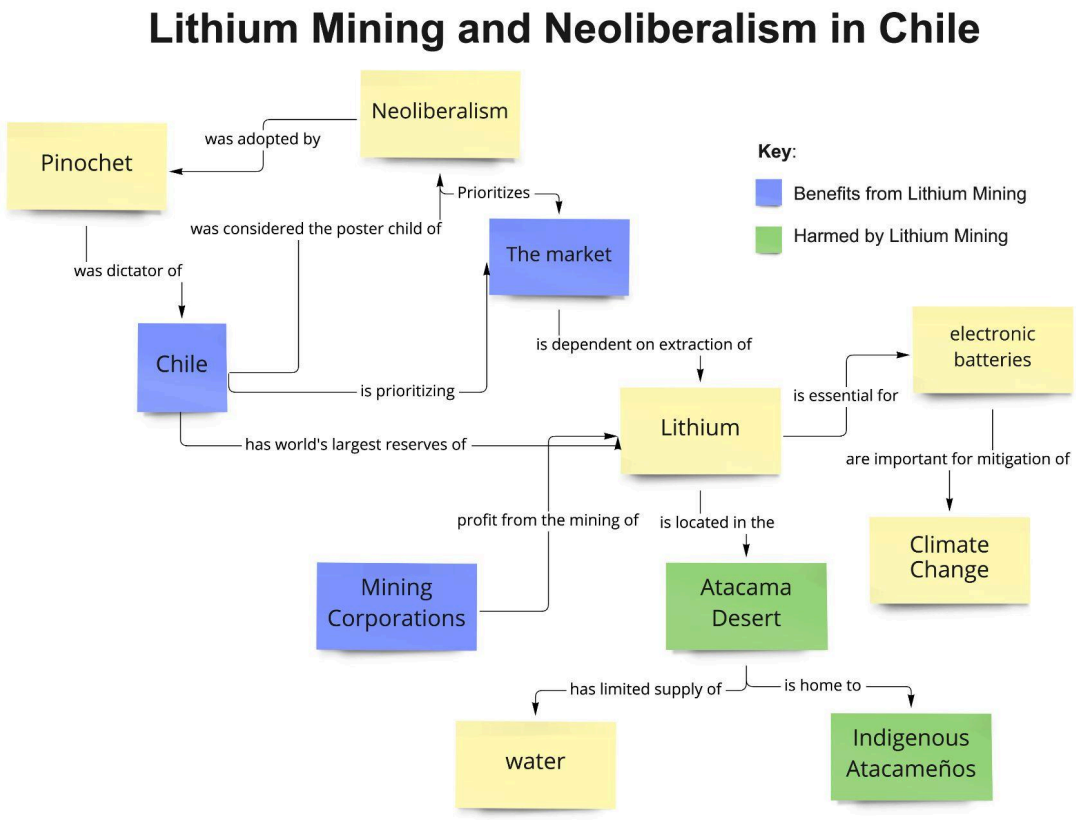
One of the major policies implemented by the famed "Chicago Boys" behind Chile's neoliberal economic policies is that of privatization (Carruthers 2001). The 1981 Water Code privatized water, enabling private mining companies such as Albemarle and SQM to own rights to water in the Atacama desert (Bartlett 2022 and Babidge 2016). SQM, which used to be a state-owned mining company, was given by Pinochet to his son-in-law, and now produces a fifth of the world's lithium (Sengupta 2021).

Indigenous Rights and Protest

In 1992, the post-dictatorship Chilean government implemented the Indigenous Law which recognized indigenous rights to water in the Atacama desert, limiting the use of subterranean water by mining companies in certain parts of the desert (Babidge 2016).

In 2019, Chileans took to the streets to protest the high cost of living and inequality, resulting in the creation of a constitutional convention that plans to rewrite the current constitution which was implemented by Pinochet's dictatorship (Conca-Chang 2019 and Ensalaco 1994).

Actors and Processes



How do consumers and indigenous Atacameños perceive and how is the Atacama Desert changed by lithium mining?

To understand how to make supply chains prioritize well-being, we must first ask how humans and nonhumans are currently perceiving and experiencing supply chains. By investigating the impact of lithium mining on consumers, indigenous Atacameños, and the Atacama Desert, I hope to shed light on what needs to be done to prioritize their well-being. I chose not to focus on actors that are largely benefitting from lithium mining, including the Chilean government, multinational mining corporations, and the market, because the benefit experienced by these actors is what is currently being prioritized in the supply chain. Instead, I

draw attention to the harm experienced by indigenous Atacameños and the Atacama Desert, as well as the lack of choice perceived by consumers.

Unlike the controversy surrounding neoliberalism in unsituated contexts, neoliberalism is more defined in Chile due to its association with the Pinochet dictatorship and the economic policies implemented at the time (Han 2012). The economic policies of the dictatorship were meant to address the high inflation rate the country was experiencing, which in the early 70s, was as much as 300-500% and by the end of the dictatorship, reduced to 14% (World Bank).

The Atacama Desert is one of the driest places on the planet and happens to have the world's largest lithium reserves (Rapier 2020). Conflict over precious water in the Atacama Desert has been the focus of international media attention as the move toward electric vehicles causes growing global dependency on lithium, the mining of which involves the evaporation of an abundance of water (Balch 2020, Bartlett 2022, Riofrancos 2021, and Sengupta 2021).

Methodology

Data Analysis of Consumer Survey

This method aims to focus on the consumption node in the supply chain for electronics and attempts to answer the question of how consumers perceive lithium mining in the Atacama Desert. More specifically, I address the questions, "How much do consumers say they know about the supply chain for electronics?" and "Do consumers say they would change their behavior once provided with information about the supply chain?"

I created a google form to be sent out to the Lewis & Clark community along with people I have access to through social media. By contacting these respondents through the internet, the assumption is that most if not all of them will be electronic consumers.

It is important to acknowledge that these respondents are self-reporting their own knowledge of the supply chain and their own willingness or lack of willingness to change their consumption. This means that they may be influenced by social desirability bias, which is the tendency to over-report socially desirable behavior and under-report socially undesirable behavior (Paulhus 1984). Paulhus (1984) explains that this can be due to two tendencies: self-deception and impression management. With impression management, people are attempting to create the impression that they are more socially desirable. With self-deception, people

perceive themself as more socially desirable than they actually are (Paulhus 1984). With social desirability bias in mind, it is important to consider if respondents overestimated their knowledge of supply chains or their willingness to change their behavior. While the survey was anonymous and respondents were made aware of this anonymity, it is possible their own sense of self does not align with their true actions.

Since a little under half of the respondents said they were Lewis & Clark students, it's possible that this group of respondents is more likely to overestimate their knowledge of the supply chains, exaggerate their willingness to change their consumption, or be more concerned with consuming responsibly than consumers in other parts of the world.

Narrative Analysis of Interviews

An analysis of interviews conducted with people indigenous to the Atacama desert, where lithium is mined, a Chilean biologist studying the impact of lithium mining, and an Australian anthropologist studying the town of Peine, which is surrounded by mines, will shed light on the perceived and real impact of the supply chain of electronics on indigenous communities and the Atacama Desert. This includes interviews with Celementino Lopéz (Danwatch 2019), a video published by *The Guardian* that is not an official interview but features the perspective of indigenous leader Sonya Ramos (Greenwood 2020), biologist Christina Dorador (Het Nieuwe Instituut 2021), and anthropologist Sally Babidge (UQx World101x 2014).

Image Analysis

To answer the question of how the Atacama Desert is changed by lithium mining, I asked myself how large lithium mines are and how much they have changed over time. This method used the Google Earth Pro desktop app to estimate the change in surface area of several lithium mines in Chile from 1985 to 2020. Since water was privatized in 1981 (Babidge 2016), and the dictatorship ended in 1990, these images can reveal the changes that took place in the landscape after privatization and during and after the dictatorship.

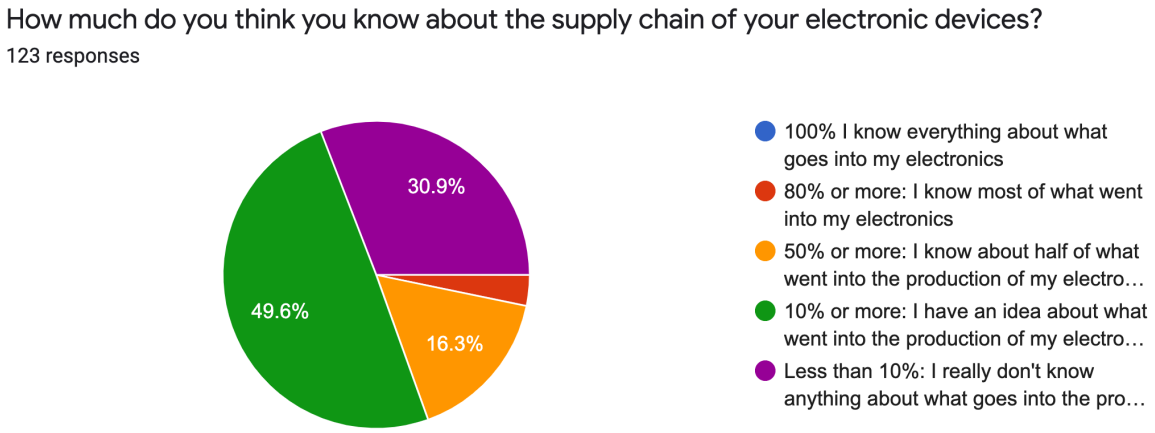
Analysis

Data Analysis of Consumer Survey

I created a google form that asks electronic users the following questions: “Are you a Lewis & Clark student?; What is your age?; Do you own or use a smartphone or a computer?; How much do you think you know about the supply chain of your electronic devices?; What part of the supply chain of electronics are you familiar with?; Where/How did you learn about the supply chain for electronics?; Before taking this survey, did you know that lithium is an essential material for the production of electronics?; Do you know where lithium comes from?; Did you know that lithium is mined in Chile?; Would you change your electronic consumption if you found out that the mining of lithium, an essential part of their production, involves environmental degradation and displacement of indigenous peoples?” I then sent the form over text to different groups of people I have access to. I also posted the form on Instagram and Facebook. On Facebook, some of my friends shared the form on their own profiles. Additionally, I emailed the form to the Environmental Studies (ENVS) Program which then forwarded the form to the ENVS email list. Once I gathered enough responses (123 total), I used the charts that google form automatically created to visualize the responses. Finally, I analyzed these responses.

I received a total of 123 responses to the survey, which included a variety of individuals from different age groups as seen in Figure 1. While the dominant age group was 18-22 years old (largely college-aged), significant amounts of respondents were 22-29, 30-39, 40-59, and 60+. A little under half (47.2%) of these respondents were Lewis & Clark students and 52.8% of them were not.

Figure 1



As seen in Figure 1, nearly half of all respondents said they know "10% or more" about the supply chain of their electronic devices. 30.9% of respondents said they know "Less than 10%," 16.3% said they know "50% or more," and finally, 3.3% of respondents (representing 4 respondents) said they know 80% or more. A vast majority of respondents, 80.5%, said that they know less than 50% about the supply chain of their electronic devices.

Figure 2

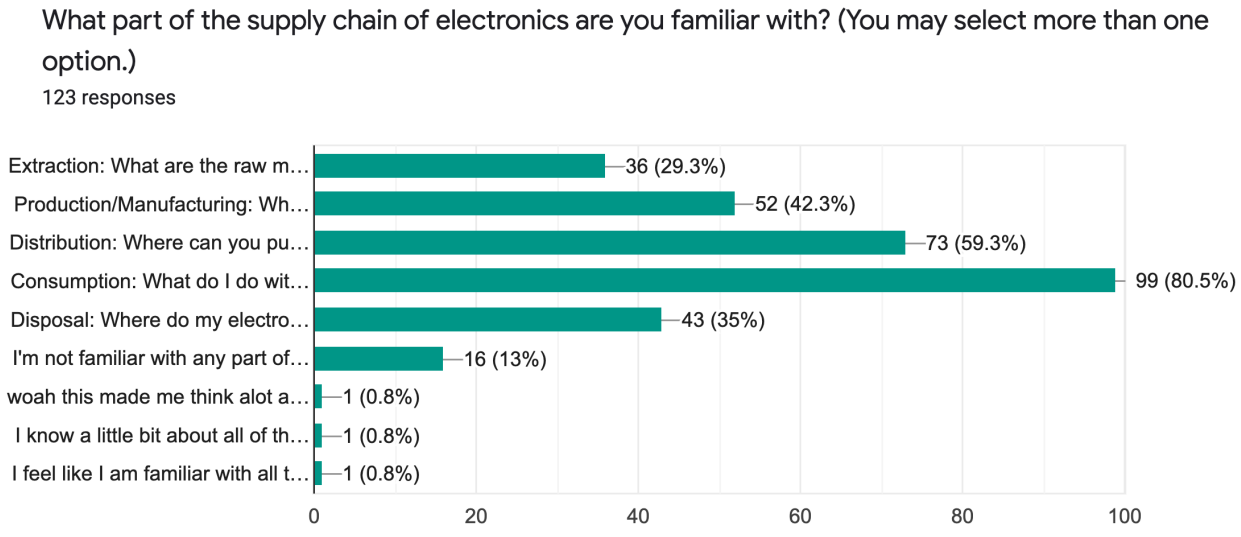
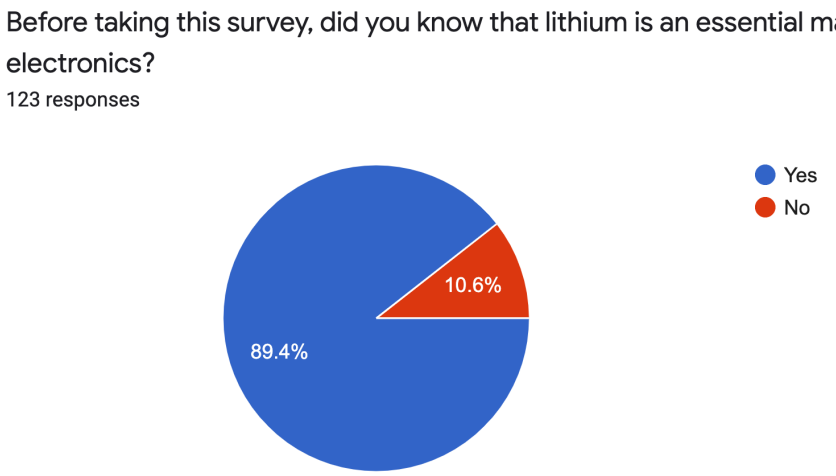


Figure 2 shows the results of the question, “What part of the supply chain of electronics are you familiar with?” Respondents were given the option to select multiple answers to this question. A majority of respondents said that they are familiar with the consumption part of the supply chain. Since this part of the supply chain is likely where respondents would situate themselves, their familiarity with this part of the supply chain was expected.

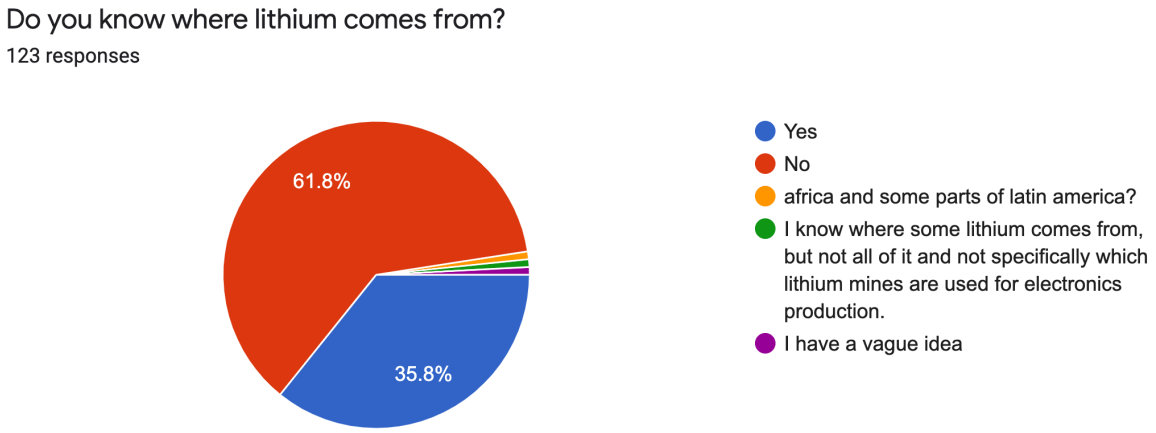
The next largest category is distribution, then production and manufacturing, followed by disposal, and finally, extraction. Of all of the parts of a supply chain, respondents said they were least familiar with extraction. If these respondents are representative of consumers of electronics, we might infer that consumers of electronics are least familiar with the extractive part of the supply chain. Lithium mining in Chile is part of the extraction node of the supply chain for electronics.

Figure 3



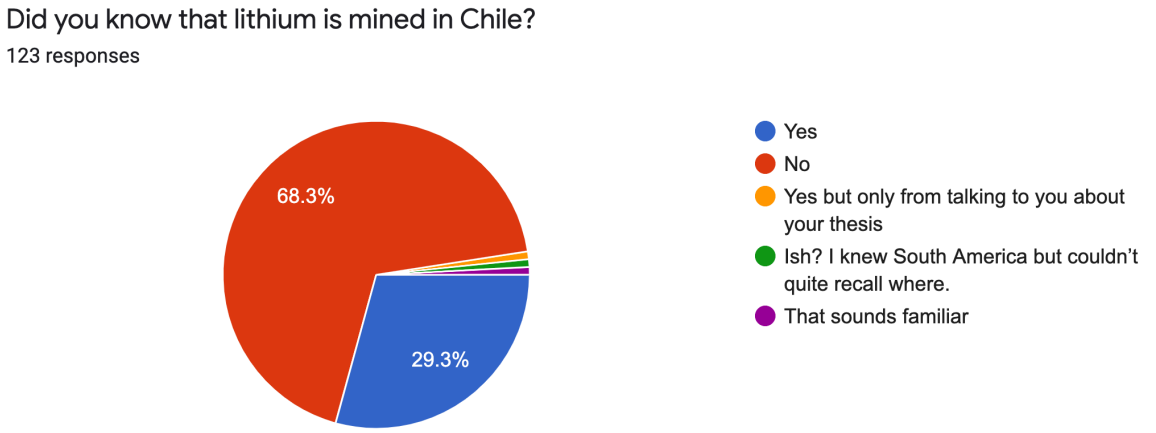
As seen in Figure 3, a vast majority (89.4%) of respondents said that before taking the survey, they knew that lithium is an essential material for the production of electronics. Only 10.6% said that they did not. This might seem unsurprising because of how commonly one might hear “lithium” and “battery” in the same context.

Figure 4



While Figure 3 shows that a majority of respondents said they knew that lithium is in their electronics, Figure 4 shows that a majority of respondents (61.8%) did not know where lithium comes from. A significant amount of respondents (35.8%) said that they do know where lithium comes from and a few had some additional guesses. While most respondents said they know about the existence and necessity of lithium, they do not know the details surrounding where it comes from and how it is acquired

Figure 5



A majority of respondents (68.3%) said that they did not know that lithium is mined in Chile, as seen in Figure 5. This compares to the previous question (Figure 4) which shows that

61.8% of respondents said they did not know where lithium comes from. 29.3% of respondents did know that lithium is mined in Chile, showing that this population of respondents has a large number of individuals who are aware of the origins of lithium. Three respondents had additional answers indicating that they had some knowledge of lithium mining in Chile or South America.

Figure 6

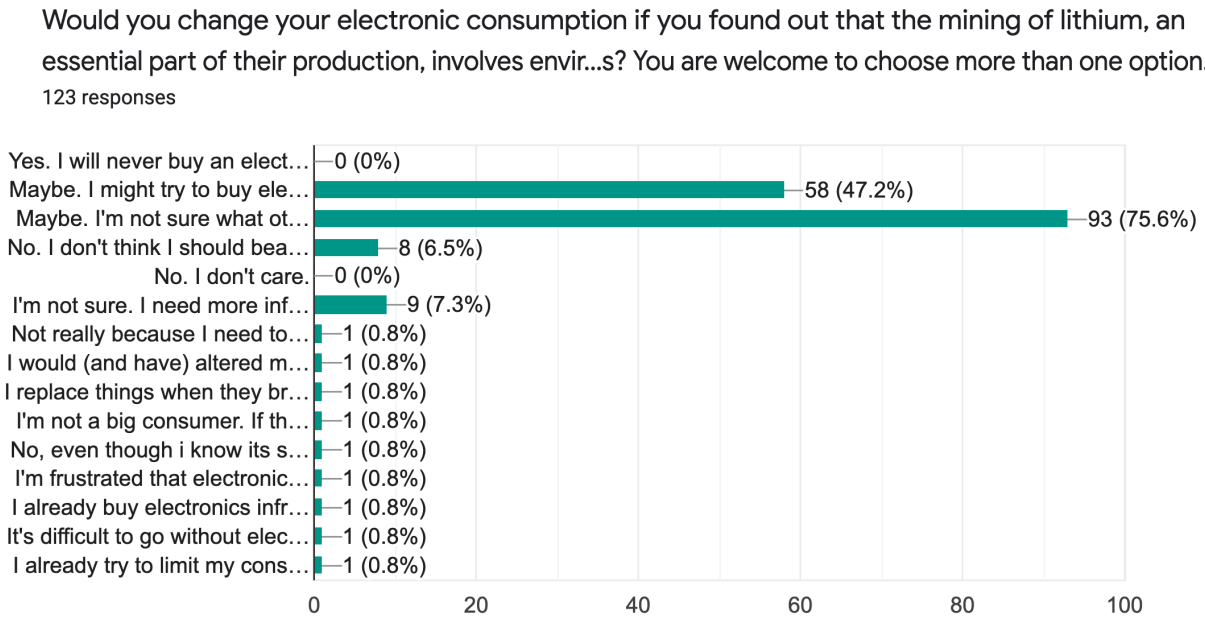


Figure 6 shows responses to the question "Would you change your electronic consumption if you found out that the mining of lithium, an essential part of their production, involves environmental degradation and displacement of indigenous peoples?" A large majority of respondents (75.6%) said that they might change their electronic consumption, but that they are unsure what other options they have. The next most popular option was "Maybe. I might try to buy electronics less frequently." 7.3% of respondents chose "I'm not sure. I need more information or proof" and 6.5% of respondents chose "No, I don't think I should bear this responsibility."

The responses that said "No, I don't think I should bear this responsibility," "No, even though I know it's shitty, because under capitalism, you are forced to act selfishly and in your own interest in order to participate in most social situations," and "Not really because I need to

use electronics in today's day and age," emphasize these individuals' opinion that they should not bear the responsibility of consuming in a way that avoids harm in supply chains. They assert that they need electronics to function and participate in other harmful supply chains with no other choice.

The respondents who said, "Maybe. I'm not sure what other options I have" (75.6%), "If they could find a better option, that would be great," and "I'm frustrated that electronic devices have become so essential, yet there are no alternatives that I know of that don't involve exploitative practices" all reveal that even when provided with information about the human and environmental harm of the supply chain for electronics, they are either not sure how to change their consumption or do not think there is another alternative.

Narrative Analysis of Interviews

I first searched google with the keywords, "indigenous," "Atacama desert," and "interview." Then, I found Danwatch (2019), Het Nieuwe Instituut (2021), Greenwood (2020), and UQx World101x (2014).

When watching and listening to these interviews, I looked for evidence of the two Atacameños' perceptions of lithium mining as well as evidence of the effect of lithium mining on the Atacama Desert. I conducted a narrative analysis, looking closely at each interviewee's subjectivity and unique perspective.

Interview with Clementino López

López was 67 years old at the time of filming this interview, which means that he has lived through most of the transformation of the Atacama desert by Lithium mining companies. He "is one of around 20,000 indigenous Atacameños (also known as Likan Antai) living in the Atacama Desert" (Danwatch 2019). He was born in Bolivia but has lived in Chile since he was 5 years old. He says that the Likan Antai "are a nation without borders," since their ancestral land, the Atacama desert, crosses the national borders of Chile, Bolivia, and Argentina.

López described a nearby lagoon that he has visited since the age of 12 when he would see people bring their animals there to graze and flamingoes that have dwindled in number since then. He said that since the water started to dry up due to lithium mining, people were forced to

leave. When he used to go there, the lagoon was full of water, but it has lost so much water over time that it becomes completely dry in the summer.

López said that these are the reasons why he and other indigenous Likan Antai are fighting the mining companies. He said, "por qué las mineras, lo que vean, agua. Agua. Y el agua es nuestra vida. El agua y la tierra es nuestra vida [The mining companies only see water. Water. And the water is our life. The water and the earth are our life]." López remarked that their ancestors used to say they could have bags of money but still wouldn't have anything to eat, reflecting his perspective on the mining companies' pursuit of profit at the expense of life in the Atacama desert. He said that every day there is less and less water and that the amount of water the mining companies have taken "makes you want to cry." López said, "That is the struggle we are in now. So they don't keep taking our water. We will have to fight until the end. So that our children, our grandchildren, do not say our grandparents did nothing." The protection of the desert and the water is seen as a responsibility that the Atacameños have to their ancestors and to generations to come.

López has a very long-term perspective of the desert, having lived there almost his entire life. He has witnessed the changes that have occurred to the landscape at the hands of the mining companies, including the reduction of human and animal life, and the loss of water every year. His relationship with the land and the water resembles that of a steward. He feels that he and other people indigenous to the desert must fight for the land and the water because it is their life. He expresses a sense of responsibility to fight for the desert for the sake of the future generations of Likan Antai. He is moved nearly to tears when talking about the loss of water at the hands of the SQM mining company, likely because of this connection he expresses between the water and his livelihood.

The Guardian's "Will Green Technology Kill Chile's Deserts?" with Sonya Ramos

In this video, *The Guardian* features Sonya Ramos, an indigenous leader fighting against the expansion of lithium mining in the Atacama desert (Greenwood 2020). The narrator explains that Ramos believes lithium mining is killing the desert, and that a growing number of Chilean scientists agree, including Christina Dorador, who is featured in the video talking to Ramos. Ramos said that if there is no water in the desert, that will lead to death. According to Ramos, the reason why the Atacameños are "fighting" is for future generations. The video follows Ramos on

her protest walk through the desert to the city of Antofagasta, where she hopes to meet government representatives to hear her argument.

Ramos believes there is no way lithium can be mined without destroying the fragile ecosystem of the Atacama desert. Shortly after her meeting with the government, a court in Antofagasta ruled in favor of Ramos and blocked SQM's proposed mine expansion. Ramos said that her ancestors made a spiritual pact with the territory. She said that the mining companies may think they're doing the right thing because from their perspective, globalization is the right thing, but according to Ramos, "there is so much more than energy here" and the Atacameños are fighting for life.

Like López, Ramos believes that the life of the desert is intimately connected to the life of their people, including the generations that are to come. Ramos and López both express feeling as though the current "fight" they are engaged in is their responsibility to future generations and that it is a fight for life. Ramos believes that a continuation of lithium mining will lead to death for the desert and for the people that live in the desert. Her perspective as an elder who is indigenous to the Atacama desert is important because she, too, has seen the desert transform due to lithium mining and she feels as though it is her responsibility to fight to stop this.

Interview with microbiologist Christina Dorador

Christina Dorador is a microbiologist and professor at the University of Antofagasta, Chile. She specializes in the microbiology of extreme environments, particularly the Chilean Altiplano and the Atacama Desert. The interview was conducted in August of 2020.

Dorador describes how the salt flats in the Atacama Desert are the remnants of the water that used to be on top of the desert. As a consequence of this, they have an important evolutionary history and have many endemic species. She says that the desert hosts many minerals and has such a large diversity of minerals and elements that the entire periodic table might exist under the desert.

Dorador explained that the existence of salt lakes and microbial communities is linked to water. She said, "Water is key here." She said that historically, these salt lakes have been used for mineral mining for over 60 years and that they have been irreversibly damaged. She said, "they will never be like before. At least four or five lakes have suffered large-scale damage." Dorador explained how lithium can be found in the saltwater, the brine, which is put in large evaporation

basins so that the lithium can accumulate. The climate in the desert favors evaporation, but what this means for the desert is large amounts of water loss. She said that "the continuous extraction of water from the salt lakes for lithium production in the long term results in lower lagoon water levels." This produces a "local climate change" by causing the water to heat up, which can change the microbiology of the salt lakes. She said, "when lagoons dry out, they disappear…But all of the biodiversity will diminish so there will be a loss of genetic biological and evolutionary heritage of humanity in its relationship with the environment which goes beyond the human practice of mineral mining."

Dorador's perspective as a microbiologist is reflected in her discussion of the effects of mining on the microbial community that exists in the Atacama desert. Her emphasis on the loss of biodiversity as a result of the water loss that has occurred due to mining shows that not only are the humans that live in the desert impacted, but the microorganisms are, too. The environment in the Atacama desert includes the people, animals, microorganisms, and water, and all of these are being permanently impacted by mining.

Interview with anthropologist Sally Babidge

At the beginning of the interview, Babidge tells the interviewer that you can see the SQM mine in the distance from where they are sitting. Babidge does fieldwork in Peine, a nearby town with a lagoon that is surrounded by mines. She said that water is an important resource in this area, and the people who live there use water from springs for agriculture. Babidge historically contextualizes the mines in the Atacama Desert, referencing Chile as the "neoliberal miracle," the economic reforms of the Chicago boys in the 1970s and 1980s, and the privatization of water in the 1980s.

Babidge describes how the introduction of mines to the Atacama desert changed indigenous ways of organizing labor. She said that many Atacameños sought jobs with the mines because of the economic advantage it would provide them, but as a result of this, it has impacted their ability to participate in traditional forms of communal labor within their communities.

Babidge said that the Atacameños understand water as part of nature, and both nature and water are considered beings. She said that the people who live in Peine are recognized by the state as Atacameños. This means that the state's form of recognition of indigenous identity in the Atacama desert is largely based on geographical location. Babidge says that despite this, some of

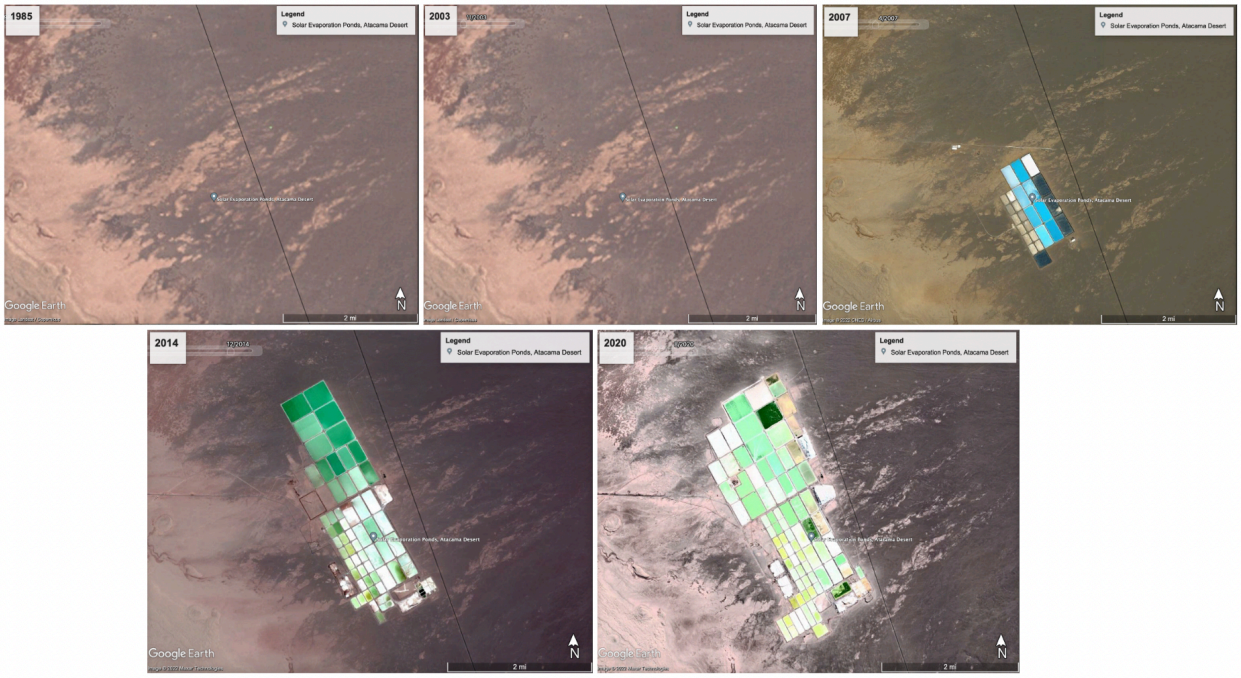
the people who live in Peine say that they aren't indigenous because of the prejudice that associates the word "Indio" (indigenous) with "primitive."

Babidge's perspective as an anthropologist studying the people living in Peine provides an external perspective on the experience of the indigenous Atacameños. Her knowledge of the history of the region, including the laws that have led to the current situation and the history of mining in the region, is extensive, and she connects this to the experience of the Atacameños today. Babidge explains that the Atacameños' understanding of water is as a part of nature, which is understood as a being. This means that water is also a being. This is why the loss of water in the region is so detrimental. As expressed by López and Ramos, the loss of water in the Atacama desert to mining is a loss of life.

Image Analysis

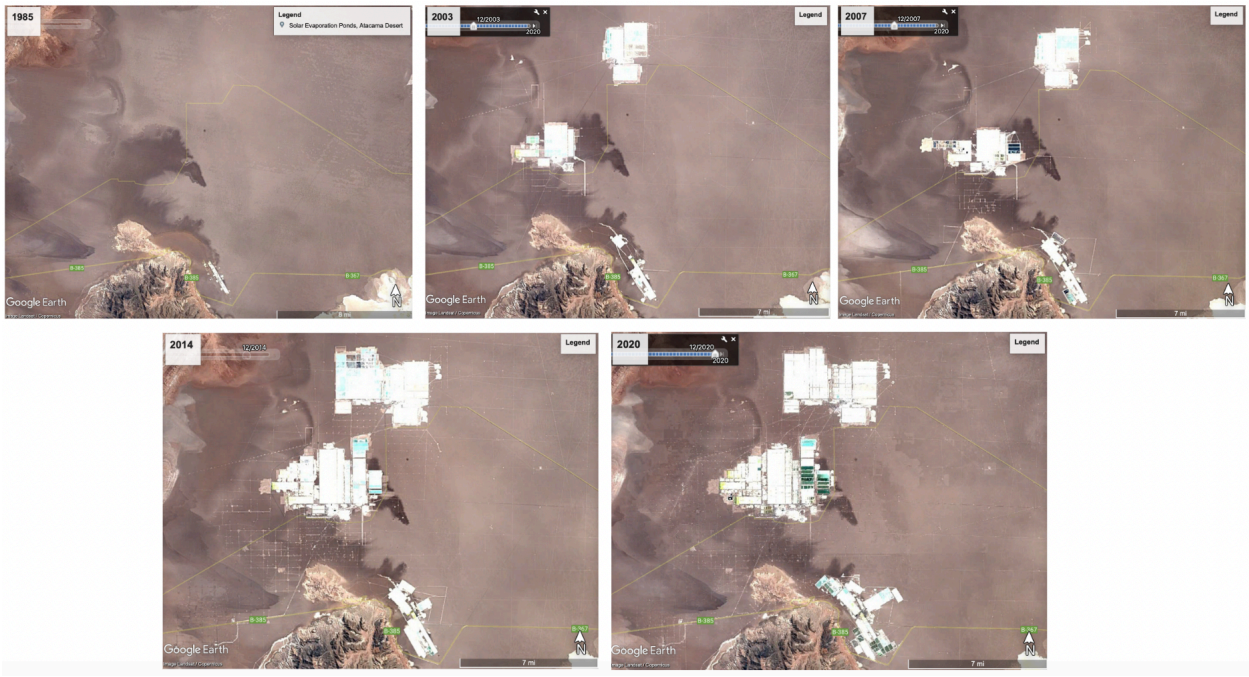
I used the Google Earth Pro desktop app to estimate the surface area of 4 different lithium mines over time. I chose these lithium mines because when I looked up "lithium mine" on google maps, these were the 4 mines in the Atacama Desert that came up in search results. I used the coordinates from the search results to look them up on the desktop app. Then, I took a snapshot of each mine for the years 1985, 2003, 2007, 2014, and 2020. These years were chosen because they were the only years that were available for each of the mines. I used the "ruler" tool on the desktop app to trace the outline of each mine. Once I traced the outline of each mine, the ruler tool gave me the estimated surface area of the mine in kilometers squared.

Figure 7



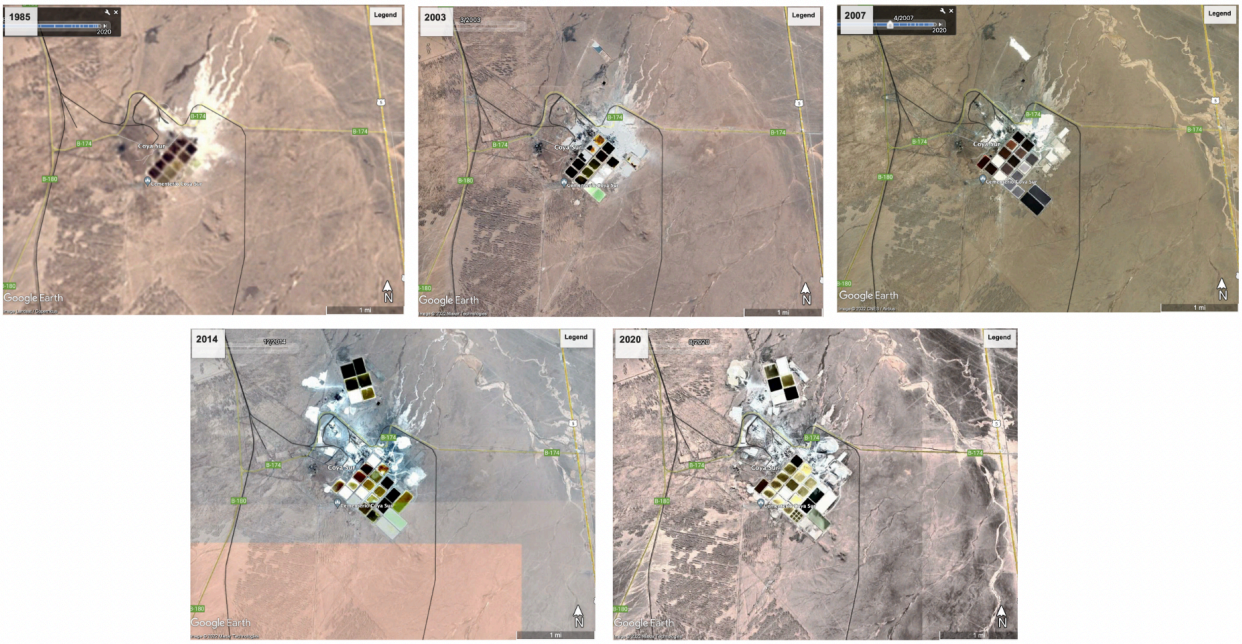
Instalaciones Besalco Minera Mine 1985, 2003, 2007, 2014, 2020

Figure 8



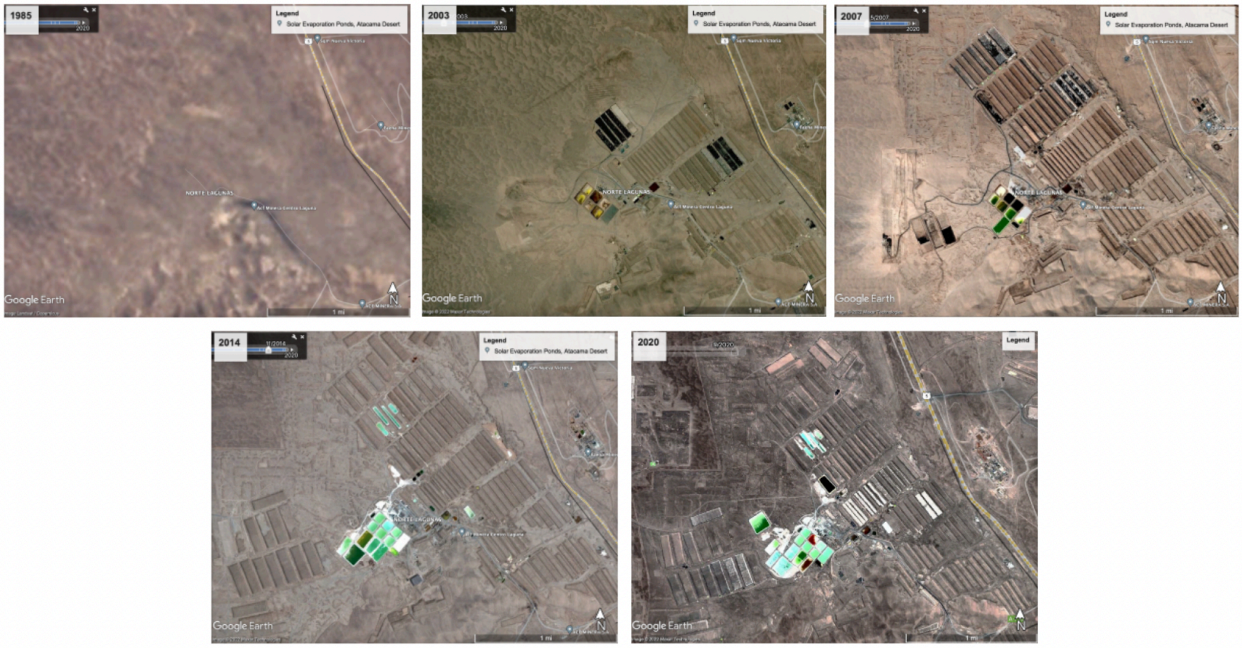
Albemarle Mine 1985, 2003, 2007, 2014, 2020

Figure 9



SQM Coya Sur Mine 1985, 2003, 2007, 2014, and 2020

Figure 10



SQM Nueva Victoria 1985, 2003, 2007, 2014, 2020

Figure 11

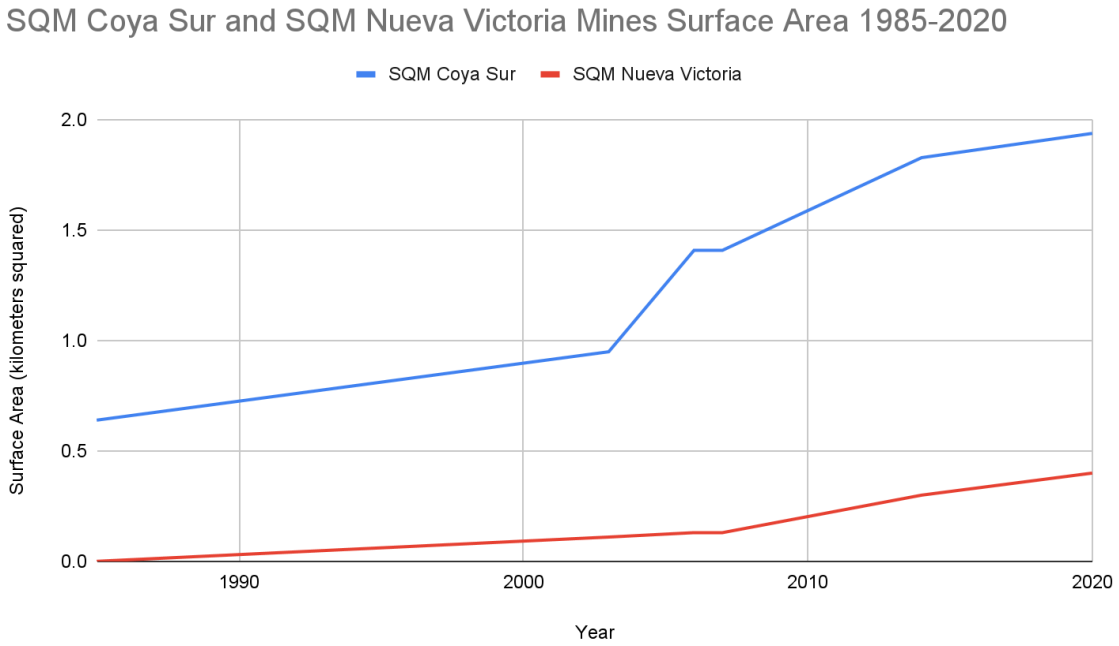
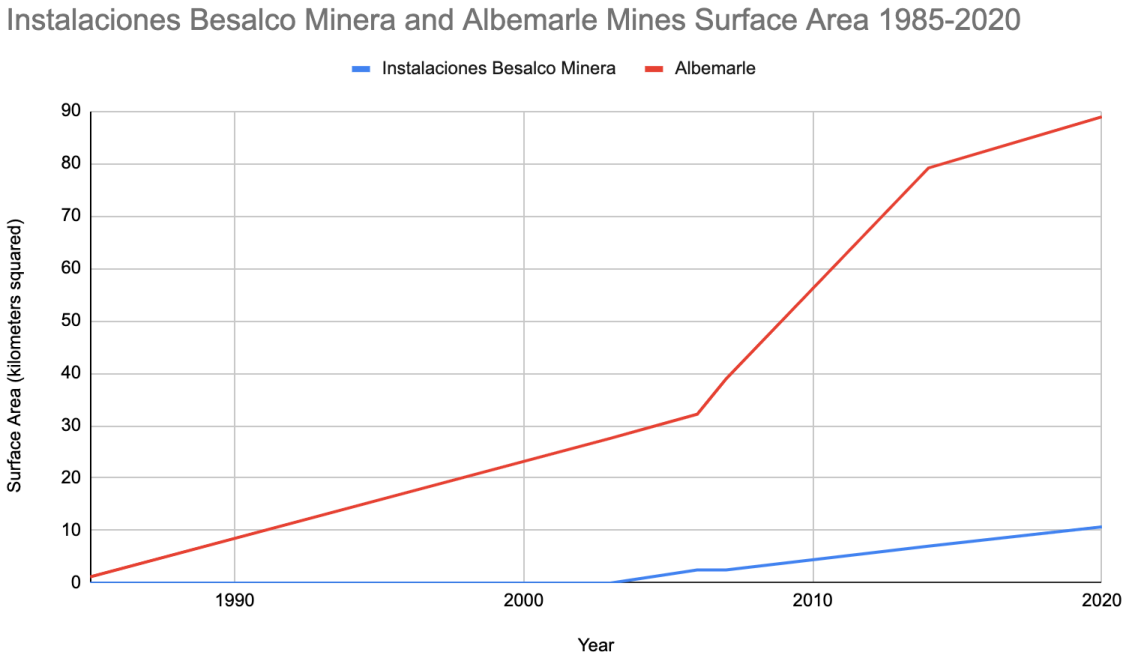


Figure 12



All four mines have experienced increasing surface area over time. While this increase has started at different times, the general trend is increasing. The largest mine, the Albemarle

mine, is 88.9 square kilometers today. This is almost the size of Disney World, which is 101 square kilometers (“100 square kilometers” 2022). The smallest mine measured, the SQM Nueva Victoria, is 0.4 square kilometers today. This is slightly larger than the Mall of America and almost as large as the Vatican City (“0.4 square kilometers” 2022). It is important to note that only the Albemarle and SQM Coya Sur mines show some development in the 1985 satellite images, only four years after the 1981 Water Privatization law. The rest of the years were after the 1992 Indigenous Law that supposedly protected some of the indigenous rights to water. Most of the rapid growth of the mines occurred since 2000 for all four mines, both after the dictatorship and after the 1992 Indigenous Law.

Results

Data Analysis of Consumer Survey

A vast majority of respondents, 80.5%, said that they know less than 50% about the supply chain of their electronic devices. Of all of the parts of a supply chain, respondents said they were least familiar with extraction. A vast majority (89.4%) of respondents said that before taking the survey, they knew that lithium is an essential material for the production of electronics, but a majority (61.8%) said they did not know where lithium comes from. Additionally, a majority of respondents (68.3%) said that they did not know that lithium is mined in Chile. When provided with information about the human and environmental harm of the supply chain for electronics, a majority of respondents (75.6%) said they might change their consumption but that they’re unsure what other options they have.

Even when provided with information about the human and nonhuman harm in the supply chain for electronics, consumers say they are not sure how to change their consumption because of a lack of an alternative. This suggests that instead of providing consumers with more transparency surrounding the supply chain of electronics, providing them with a viable alternative to lithium is more likely to change their consumption.

Narrative Analysis of Interviews

Having lived in the desert his entire life, Clementino López has witnessed the changes that have occurred to the landscape at the hands of the mining companies, including the loss of water and the corresponding reduction of human and animal life every year. He expresses a sense of responsibility to fight for the desert for the sake of the future generations of Atacameños.

Like López, Sonya Ramos believes that the life of the desert is intimately connected to the life of their people, including the generations that are to come. Ramos believes that a continuation of lithium mining will lead to death for the desert and for the people that live in the desert. Her perspective as an elder who is indigenous to the Atacama desert is important because she, too, has seen the desert transform due to lithium mining and she feels as though it is her responsibility to fight to stop this.

Dorador's perspective as a microbiologist is reflected in her discussion of the effects of mining on the microbial community that exists in the Atacama desert. Her emphasis on the loss of biodiversity as a result of the water loss that has occurred due to mining shows that not only are the humans that live in the desert impacted, but the microorganisms are, too. The ecosystem of the Atacama desert includes people, animals, microorganisms, and water, and all of these are being permanently impacted by mining.

Babidge's perspective as an anthropologist reveals how the community dynamics among the Atacameños have changed as a result of the lithium mines. While the lithium mines are causing harm to the desert and the Atacameños due to water and ecosystem loss and degradation, jobs at the mines are a source of income for many Atacameños who are finding new ways to stay involved with the community while maintaining an external income.

Image Analysis

All four of the mines measured have grown in surface area over time. The largest of the four mines is almost the size of Disney World and the smallest is almost as large as the Vatican City. Lithium mines in the Atacama Desert have grown over time and while they vary in size, they are relatively large uses of land.

How might global supply chains prioritize human and nonhuman well-being given the perceptions and realities of consumers of electronics, indigenous Atacameños, and the Atacama Desert?

Comparison and Generalization

The question "how do consumers and indigenous Atacameños perceive and how is the Atacama Desert changed by lithium mining in Chile?" looks into the consumption and extraction nodes of the supply chain for electronics. Indigenous Atacameños and the Atacama Desert are negatively impacted by the growth of lithium mining. Consumers are dependent on electronics that require lithium mining.

This study did not focus on actors that primarily benefit from lithium mining. The Chilean government receives 900 million US dollars annually from lithium mining (Erickson 2021). The SQM mining company experienced a five-fold profit increase this year as a result of rising lithium prices (Madry 2022). The supply chain for electronics is currently prioritizing these actors over the needs of indigenous Atacameños and the Atacama Desert.

A similar study could be conducted elsewhere in the supply chain for electronics or in another supply chain that the world is heavily reliant on. Another necessary component of electronics includes cobalt, 70% of which is mined in the Democratic Republic of Congo, where unregulated mines use child labor and expose nearby communities to toxic metals (Tabuchi and Plumer 2021).

Perreault (2018) describes how there is hardly a difference between so-called "neoliberal" and "post-neoliberal" governments in Latin America when you look at their extractivism. Whether or not the government is a dictatorship, a post-neoliberal democracy, or a neoliberal democracy, it is likely that the state continues to depend on extractivism as a main source of revenue (Perreault 2018). This is an important point given the evidence that the four lithium mines in my research grew more in size after the "neoliberal" dictatorship was no longer in power.

While transparency may not be the ultimate solution to injustice occurring in supply chains, Posner (2018) argues that it is the lack of transparency in supply chains that enables them to incorporate nodes in which humans and nonhumans are being harmed. In global supply

chains, when the goal is to produce goods quickly and profitably, transparency, environmental quality, and labor standards are an afterthought (Posner 2018).

Relevance to Framing Question

What, then, do my results suggest to the larger framing question of "how might global supply chains prioritize human and nonhuman well-being?" This was initially unanswered because supply chains operate on such a large and geographically diffuse scale. Looking closely at the supply chain for electronics and the situated context of the Atacama Desert, one can see how the mining of lithium is permanently impacting indigenous communities and the Atacama Desert.

While there are controversies surrounding the need for efficiency in supply chains as discussed in Free and Hecimovic (2020), the Atacama desert shows that it is profit that is being prioritized in today's supply chains, not necessarily efficiency. Researchers are looking at sodium as an alternative to lithium both because of its ionic qualities and the fact that it is cheaper and much more abundant than lithium (Levy 2021). If sodium does indeed turn out to be a cheaper and more abundant alternative to lithium, it is likely that this will be a more "efficient" alternative, but private mining corporations and governments that are currently profiting from lithium mining would likely prefer to continue making a profit than prioritize efficiency in the supply chain for electronics.

In the Atacama Desert, neoliberalism has a very specific consequence: the privatization of water that enabled private mining companies to own rights to water, and consequently, to mining (Babidge 2016). While it is the initial privatization of water that allowed mining companies to establish themselves in the desert, lithium mining has continued, and as seen in the four mines studied, grown more under the supposed post-neoliberal democratic government than under the "neoliberal" dictatorship. Whether the government is "neoliberal" or not, the Chilean government has continued to prioritize the profit received from lithium mining over the livelihood of indigenous Atacameños and the Atacama Desert.

In any supply chain, finding less harmful alternatives for consumers can be part of the solution, but relying on consumers to regulate their consumption is neoliberal (Adams 2018). Brown (2003) describes how neoliberal governmentality places responsibility for ensuring well-being on individuals rather than the government. This is dangerous to democracy because

states derive their legitimacy from economic success rather than well-being (Brown 2003). Responses to the consumer survey that said “No, I don’t think I should bear this responsibility” when asked if they would change their consumption suggest that even with transparency and a less harmful alternative, consumers may not be inclined to change their consumption.

Next Steps

Emphasis on broader supply chain justice should be placed on finding less harmful alternatives and when this is not possible, regulating harmful practices. When it comes to materials such as lithium, which is currently necessary for electronic batteries, research and development are necessary to find alternative materials. While transparency is still nice to have, and as Posner (2018) suggests, can help encourage some manufacturers to change their supply chains, it is not enough to enable consumers to change their consumption.

Sodium is currently being researched as a less harmful alternative to lithium for electronic batteries. Researchers at the University of Texas at Austin have made two recent advances that make sodium-ion batteries a more viable alternative to lithium (Levy 2021). After two decades of research, these advancements are hopeful, but the widespread use of sodium-ion batteries may not be possible in the near future. When applying this to other supply chains, one might wonder what materials we use that may have harmful impacts but no alternatives. Must we simply accept that human and nonhuman harm will occur in supply chains?

While it may be appealing to simply give up and accept that supply chains cause harm, research on alternatives such as sodium is necessary if we are to prioritize well-being. Supply chains need to start offering alternative chains that prioritize human and nonhuman well-being.

Importantly, simply providing consumers with an alternative is not enough. To avoid the neoliberal placement of responsibility on consumers to choose the “better” product, governments can implement regulations that make the product with the least harmful supply chain the cheaper or maybe even the only option for consumers. This would avoid the placement of responsibility on consumers to choose the least harmful product, as many respondents to the consumer survey said they would object to. Additionally, governments can regulate mining corporations and other corporations causing harm in supply chains, as seen when a court in Chile ruled in Ramos’s favor, limiting the expansion of the SQM mine (Greenwood 2020).

Further Research

I did not research other nodes in the supply chain for electronic devices. As mentioned, cobalt is another essential material for electronics that is linked to the use of child labor in the Congo (Kelly 2019). A similar study could investigate the experiences of those working in cobalt mines and living nearby. I also did not research supply chains beyond electronics. *The Guardian* has documented slavery in the fishing industry, which is another supply chain that the world is heavily reliant on (Lawrence 2014).

My lack of research in these areas is largely due to not having enough time. Entire theses could be written about cobalt mining or other supply chains that have negative impacts on people and ecosystems. I had not considered finding an alternative to lithium until I analyzed the results from the consumer survey.

To build on my research, I recommend researching the viability of alternatives to lithium. Researchers at the University of Texas in Austin have already found alternatives to lithium and cobalt in batteries that are promising (Levy 2021 and Oberhaus 2020). I also recommend researching if government regulation of mining companies has had a substantially positive impact on indigenous communities in the Atacama Desert. Since research and development of alternatives may take years, governmental regulation of extractive practices may be a necessary temporary solution to reduce harm not only to Atacameños and the Atacama Desert but also to those in other supply chains.

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