

**The Effects of Climate Change on the Coffee Production Industry
And Life in the Western World**

A Thesis Report
In STS 4600
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Chemical Engineering

By
Cameron Williams

May 11, 2023

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.

ADVISORS

Rider Foley, Department of Engineering and Society

INTRODUCTION

While the hole in the ozone layer is in every elementary school science textbook, climate change itself remains a highly politically contested topic. 99% of scientists agree that climate change is real and poses a significant threat to humankind. From the increasing severity of weather patterns to mass extinctions, climate change is projected to affect everyone on the planet in one way or another. The average temperature on Earth has risen 0.08° Celsius per decade since 1880, but this rate has more than doubled since 1981, rising 0.18° C per decade in recent years. The effects of global warming are driving regional and seasonal temperature extremes. These extremes have played a role in melting glaciers, intensifying hurricanes, extreme heat waves, and drastically altering the habitats that many life forms depend on for survival (Lindsey, 2022).

One of plants that will struggle significantly due to the effects of climate change is the coffee plant. Coffee consumption became extremely popular in the U.S. during the Civil War, leading to the invention of instant coffee in the late 1860s. Instant coffee remained supreme until the first Starbucks opened in Seattle in 1971 (Wulff, 2016). But recently, the practice of drinking coffee has become less about socializing and more about energizing. The capitalist nature of American life has created a need to live at an extreme pace that is dependent on the use of caffeine. Coffee is currently a more popular drink in the U.S. than tap water (“The Economic Impact of Coffee,” 2016). Starbucks allowed coffee to be transformed from a leisure activity to a form of human gasoline that the majority of people in the United States have come to rely on.

Changes in temperature and weather patterns will result in strains on the coffee industry that will be felt throughout the world, but especially in a society that depends on a significant amount of caffeine to function (“Most Unexpected Effects of Climate Change,” 2019). Different types of coffee will be affected in various ways with temperature, elevation, and rainfall affecting the two different types of coffee, Arabica and Robusta, differently (Chemura, 2021; Kath, 2021).

Through my research I will be learning about the ways in which the coffee industry will be affected by supply chain limits caused by climate change. I will also be researching the opinions of coffee consumers to learn about their general knowledge on coffee supply and demand, as well as their reactions to past and future cost increases.

SPECIFIC THEORY

One of the main issues with a decline in coffee production is that many Americans are not aware of the people or processes involved in the production of coffee. Susan Star defines infrastructure as having certain properties that demonstrate its relationship with humans and the surrounding environment. In my research to find the effects of coffee production decline in the US, I used this framework to view the impact coffee has on Western society and how the industry will react and change as a result of the threat of climate change. One of these ethnographic properties is how typically invisible aspects of working infrastructure become visible when broken. I believe that the average US coffee consumer does not think about the roughly 25 million small-scale farmers that produce their coffee thousands of miles away and rely on coffee production for their livelihoods (“How Climate Change is Killing Coffee,” 2019). However, the consumer will notice when coffee prices begin to increase due to those farms not being able to produce as much coffee as they have in previous years. The manner in which coffee infrastructure is embedded into Western culture in relation to social interactions, standards of practice, and transparency is also analyzed to determine how the coffee industry will react to the imminent threat of climate change in coming years.

RESEARCH QUESTIONS

Through my research I answered the questions of how the coffee industry has impacted social interactions and patterns, how coffee producers and consumers are affected by the current decline in coffee production and increase in prices, what procedures and methods coffee producers plan to enact to continue their businesses, and how badly the coffee industry will have to decline for the people of the United States to notice and to decide it is important to change.

RESEARCH METHODS

To research the effects of a decline in coffee production I viewed case studies as well as surveyed and interviewed three different types of people: a standard everyday coffee drinker, the owners of coffee chains such as Dunkin or Starbucks, and the owners of a local coffee shop. I

used these groups to analyze how economic constraints caused by climate change and other factors affect different participants in the industry.

The first aspect of my research included a survey for coffee consumers. I sent out a survey to my friends, family, and the UVA student body through email, Groupme chats, and text message. Some of the questions I asked the coffee consumers in the survey is how price affects where and when they buy coffee, as well as if they have noticed a decline in the quality of coffee in past years and what they have done about it.

For shop owners I asked them about their import process and how they plan to deal with future supply chain issues. The source of my interview results comes from Greenberry's Coffee Company to include a small business in my analysis. Due to time constraints and communication issues, I relied heavily on research of large corporations and an interview with a small-scale coffee shop for data. I chose the companies Starbucks and Dunkin as the basis for my research results since these corporations are some of the largest coffee producers in the United States. The purpose of meeting with these three groups of people is to see how they are affected by the current decline in coffee production and quality and the increase in prices to analyze their plans for future price increases and production decline.

RESULTS

In the following sections I will be analyzing the results of my research including the survey and interview conducted as well as research on large-scale coffee corporations. I will be using the term "Western world" to describe the respondents and the places affected by my research of the coffee industry. This term was chosen instead of American for three reasons. The first reason is that some of my survey respondents are not currently living in the United States due to them studying abroad or recently moving to Europe. Since everyone in the survey resides somewhere in the Western world, I thought this term was more appropriate. The second reason is that Nestlé, one of the companies that I am analyzing for this paper, is a Swiss company which is also based in Europe. Though I am mainly interested in the United States in this paper, I didn't want to exclude the other countries that are influenced by this corporation. The third reason lies in the term "American" itself. There are many countries in the Americas, in all of which, citizens could refer to themselves as American. Though residents of the United States are the main group

which use the term, in a scientific paper, I wanted to be more inclusive of the different groups discussed.

Survey Results:

A survey was conducted to analyze coffee consumption and opinions on the ethical situation of the coffee industry. The survey was conducted with a primary focus on college students as they consume a significant amount of caffeinated beverages and will be affected by large changes in coffee production in the coming 10-25 years. The total number of responses collected amounted to 62 participants. The chart below shows the age ranges of the respondents:

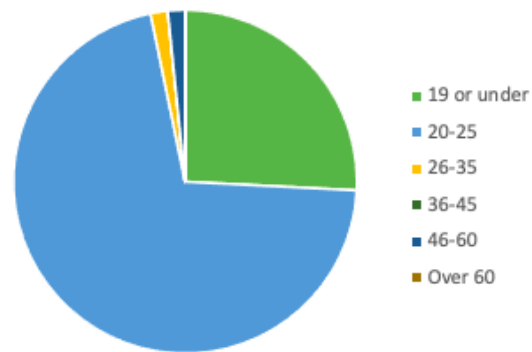


Figure 1: Age Ranges of Survey Respondents (Williams, 2023)

The majority of respondents were college-aged students as well as recent college graduates to gain understanding about the use of coffee in younger generations. The respondents were asked how often they consume coffee and their primary source of coffee with 45.2% of the respondents saying that they drink coffee once a week or less and 32.3% of respondents drink coffee every day or more than once a day. The responses are depicted in the chart below:

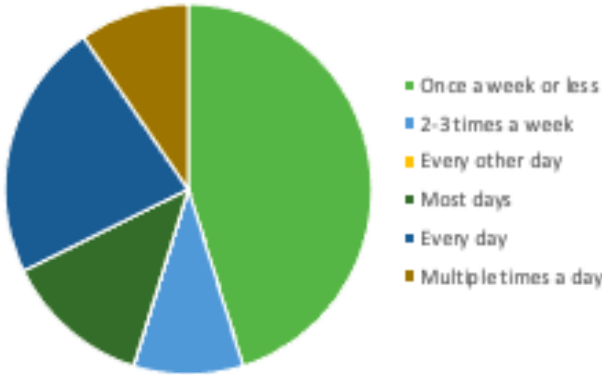


Figure 2: Survey Respondents' Coffee Consumption Habits (Williams, 2023)

Of the 61 respondents, 52% purchase their coffee from chain coffee shops and restaurants, 21% from grocery stores, and only 10% from local shops. This is most likely due to the availability of chain coffee shops on college campuses as well as the ability to buy coffee in bulk quantities from the grocery store at cheaper prices than one would pay for a singular coffee. The respondents were then asked about other sources of caffeine consumption with 19 of the respondents stating they also drink tea, 12 stating they drink energy drinks, nine drink soda, four take pre-workout powders or drinks, and 18 stating that they only drink coffee for caffeine. The responses for these questions are depicted in the graphs below:

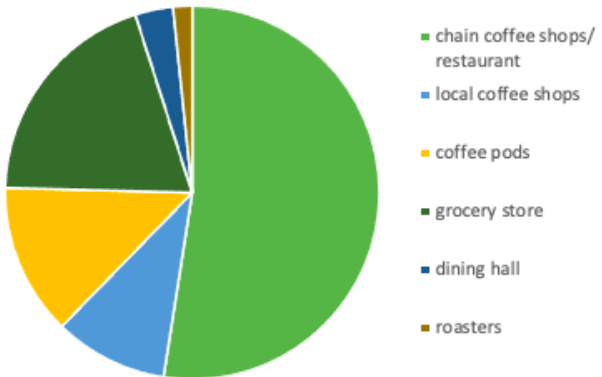


Figure 3: Survey Respondents' Methods of Coffee Purchase (Williams, 2023)

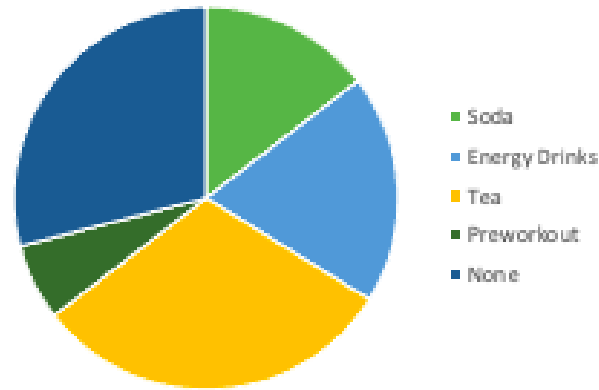


Figure 4: Survey Respondents' Other Methods of Caffeine Consumption (Williams, 2023)

Figure 4 includes some personal groupings of different responses due to the question being open-ended which are shown in Appendix B. These results show that the younger generation is highly reliant on and possibly addicted to caffeine. College students are expected to work on their class significantly more outside the classroom as well as maintain a healthy social life, potentially work, and take care of themselves. This does not provide a lot of time for students to sleep, meaning that a significant number of students turn to caffeine to maintain their energy levels. In terms of recent college graduates, they are in the lowest levels of their career and expected to bear a large load of grunt work for their corporations to “pay their dues” to the company. This results in these people also relying on caffeine to maintain their heavy workload.

The respondents were then shown a series of eight statements regarding the coffee production industry and asked to rate their agreement with the statement on a scale of 1 to 5. The results of this section are shown below with the number of respondents who selected each value of 1 through 5:



Figure 5 (a-f): Ethical Consumption of Coffee Survey Responses (Williams, 2023)

For the questions about coffee knowledge, ethical consumption, and coffee purchasing, the average answer varied from 2.27 to 4.16. The table below shows the average respondent answer for each of the questions:

Questions	Average Response	Most Common Response
I know a lot about the coffee production industry	2.53	2
I know where my coffee comes from	2.27	2
I care about the ethical consumption of coffee	3.71	4
Coffee has decreased in quality in recent years	3.11	3
Coffee has gotten more expensive in recent years	4.16	4
I am concerned about the increase in coffee prices in coming years	2.97	3
I am concerned about the decrease in coffee production in coming years	3.55	4
If coffee prices continue to rise, I will stop drinking coffee or look for cheaper methods of consumption	3.32	4

Table 1: Average and Most Common Respondent Answers

From these survey responses, we can learn that a lot of college students and recent college graduates are mostly concerned with the increasing price of coffee. This is most likely due to the low income and high debt averages for this group. Younger generations are also more socially conscious than older generations, meaning that they have the desire to inflict change in

the world, but lack the monetary ability and the knowledge about the coffee industry to make the necessary changes.

Interview Results:

Due to time constraints and a lack of availability by coffee vendors, only one interview was able to be obtained for this project. The rest of the coffee companies were analyzed based on research discussed in the next section. The company interviewed was Greenberry Coffee Company based in Charlottesville, Virginia was founded in 1992 by Sean and Roxanne Simmons with the purpose of bringing high-quality coffee to the people of the Charlottesville community. The interview mainly focused on the coffee selection process and the advantages and disadvantages of being a small coffee producer.

Greenberry's primary coffee imports come from Royal Coffee, a company based out of New York state. This company and Greenberry's are members of the Rainforest Alliance, a foundation whose purpose is to maintain biodiversity, protect the climate and rural livelihoods, as well as monitoring the coffee production industry for human rights abuses. The coffee obtained from members of this foundation is fair trade organic coffee which means that the producers and vendors have a transparent relationship based on communication and mutual respect. The goal of this certification is to create greater equity on both sides of the partnership. When asked, the employees of Greenberry's Coffee stated that the owners routinely meet with representatives from Royal Coffee and the coffee producers themselves showing that they do have the level of transparency that they pledge.

The next series of questions included the advantages and disadvantages of being a small coffee vendor when the industry is mainly controlled by large corporations such as Nestle and Starbucks. The employees said that many of them had worked for large corporations before coming to Greenberry's and that there was a stark difference between the two. The employees said that there were more opportunities for growth in the company and that they felt that there was a deeper personal connection between the workers at Greenberry's. I had the chance to meet one of the bagging managers, a 19-year-old college student, who has a significant role in the company despite her age. To have someone so young in such an important position shows that this company fosters the growth of even their youngest employees.

The main disadvantage of a small coffee vendor seemed to lie in the coffee purchasing itself. In 2019, a single pound of coffee purchased from Royal Coffee was \$1 USD. In 2020, Guatemalan coffee from the same company was priced at \$5 per pound. This was mainly due to the COVID-19 pandemic which hurt the production rates of every industry. However, due to their small size, Greenberry's struggled with the increasing prices. Even now, the same coffee is priced at \$4 per pound which is over a 200% increase from three years ago. The price increases and production decreases led to Greenberry's contracting a second supplier for their coffee imports, the name of which was not given in this interview. I was not told if this second company was also a member of the Rainforest Alliance, meaning that there is no guarantee that this coffee is produced ethically like Royal Coffee. The price increases in coffee production as well as a decrease in sales due to the pandemic may be leading to companies to choose less ethical practices to keep their business afloat.

Research Results:

Dunkin:

The Dunkin corporation is operated and owned by Nestlé. When contacted for an interview, both Dunkin and Nestlé did not respond to requests. The Nestlé corporation is currently under investigation for human rights abuses by the Organization for Economic Cooperation and Development (OECD) as well as other human rights groups such as the State of Minas Gerais Rural Employees' Group in Brazil also known as ADERE-MG (*Slave Labour on Coffee Farms Denounced at the OECD*, 2018). Nestlé claims that they are "working continuously to improve [their] green coffee supply chain and make every cup more sustainable," through an initiative called Nescafé. Nescafé is a global coffee sustainability initiative based in regenerative agriculture which aims to "work with farmers to help them adopt regenerative agriculture practices that will help reduce carbon emissions and help improve farms' productivity, with the aim of improving farmers' incomes," (*Sustainable Coffee*, n.d.). According to ADERE-MG, seventeen coffee farms were identified between 2018 and 2022 in the Minas Gerais region of Brazil for human rights violations. Mediators called "gatos" would lure workers onto these farms under precarious conditions. The workers would then experience contemporary

forms of slavery, such as debt bondage and degrading working conditions as well as food shortages, the absence of personal protective equipment, and irregular hiring and payment practices (*Sustainable Coffee*, n.d.).

This is not the first time that Nestlé has been implicated in human rights abuses and violations. In the 1970s, Nestlé began marketing infant formula in developing nations. This led to widespread boycotts as the formula began making infants ill. In 1984 it was found that the company violated the World Health organization code by distributing free samples of the same formula to hospitals in the same nations. 50 years later in 2012, Nestlé continued to deepen its involvement in the infant formula market by purchasing Pfizer's infant formula business for over \$11 billion. In addition to these violations, Nestlé has also been cited for foreign labor violations, environmental violations, and the abuse and forced labor of child workers in their cocoa and coffee supply chains (Mattera, 2021).

Starbucks:

When contacted for an interview through the Starbucks human resources page, the company responded with an email that had no relation to the email sent and never followed up on the interview request despite stating that they would be in contact (Appendix A, Image 1). This is most likely due to their partnerships with Nestlé and the backlash that Starbucks has received from activists and human rights groups since their conception.

For two decades, activists were pressuring Starbucks to commit to fair trade for their supply chains. The peak of Starbucks' fair trade purchases was 8.6% in 2014. The following year, instead of committing to fair trade, Starbucks launched their own Corporate Social Responsibility code named C.A.F.E. Practices. Using this code, Starbucks was able to claim that 98% of their coffee was ethically sourced in 2015 (Canning, 2019). Starbucks claims that their C.A.F.E. practices, "promote transparent and sustainable coffee growing practices while also helping protect the well-being of coffee farmers and workers," however, there are many issues with the C.A.F.E. practices (*Starbucks 2020 Global & Social Impact*, 2021). In the years before 2015, Starbucks had made little effort to progress their company towards more ethical forms of coffee production. Despite there only being a year between their 8.6% fair trade purchases in 2014, Starbucks claimed 99% "ethically sourced coffee" in 2015. Developing their own

Corporate Social Responsibility code allowed for Starbucks to change the parameters of the definition of “ethically-sourced” coffee to make their company appear better than they are.

In 2018, Brazilian labor inspectors published reports tying Starbucks to multiple plantations that have been cited for modern slavery which includes forced labor, debt bondage, dangerous and degrading conditions, and debilitating work days (Penha, 2018). Starbucks was able to get away with these conditions on plantations due to the C.A.F.E. inspection practices that allow inspections to occur as infrequently as every 3 years depending on the previous inspection score. Starbucks’ C.A.F.E. practices also contain no minimum purchase price, unlike fair trade practices, which affects the ability of the coffee farmers to stabilize their work environments (Canning, 2019). In 2020, Starbucks was also cited for violations of child labor laws at multiple coffee farms in Guatemala and Brazil when Channel 4’s Dispatches team filmed children as young as 8 years old working 40-hour weeks for little pay (Doward, 2020). The newer citations demonstrate that In the years since the development of their C.A.F.E. practices, Starbucks has not improved their negative social and environmental impact as they claim.

DISCUSSION

Susan Star defines infrastructure as “a part of human organization, and as problematic as any other,” which has the properties of embeddedness, transparency, scope, learned as part of membership, links with convention of practice, embodiment of standards, built on an installed base, becomes visible upon breakdown, and fixed in modular increments (Star, 1999). Using these properties, the coffee industry can be analyzed as a type of infrastructure and the effects of major environmental events such as climate change on the industry can be predicted.

The modern coffee industry was built on the basis of the Mid-Atlantic Slave Trade. Though 80% of coffee is produced on small-scale farms, countries such as Brazil and Guatemala have large-scale plantations that were established in the 18th and early 19th centuries by landowners who brought enslaved peoples from Africa (Canning, 2019). After slavery was abolished, the power imbalance between the landowners and workers remained, allowing for the workers to continue to be manipulated throughout history and into modern times.

The coffee industry is embedded into culture in the United States and has a large influence on Western society. Coffee is one of the most popular drinks in the Western world and

as shown in the survey, over 50% of respondents drink some form of coffee or caffeine more than once a week. Coffee is available for purchase in most stores that sell food and coffee shops are prevalent around the country. The consumption of coffee is highly normalized in U.S. culture to the extent in which it is abnormal for someone to not drink coffee with the exception of during pregnancy. In college, coffee is an extremely popular drink and most people, if they have not started drinking coffee before then, use coffee to increase their productivity in college. It is also linked to many different social interactions. It is common in the United States for coffee to be present at meetings, restaurants, interviews, as well as coffee shops being common places to socialize with friends or potential romantic partners. In some of these situations, coffee is expected to be provided. It is extremely rare to walk into an office building that does not have at least one coffee machine on each floor, if not one in almost every room. Many executives in companies even have personal coffee machines in their offices.

Issues within the coffee industry, such as supply strains, are noticeable to the public but only upon price increases. The majority of survey respondents were concerned about the increase in coffee in addition to stating that they desired cheaper products. However, also knew little about the coffee industry or where their coffee is produced, showing that they are only aware of the coffee industry when pricing changes. The avoidance of price increases leads to smaller companies such as Greenberry's choosing less ethical means of production and larger companies such as Starbucks and Nestlé to choose unethical coffee farms and plantations to avoid increasing their prices to maintain their consumer rates and profits.

Despite constant backlash from human rights advocates for over twenty years, the coffee infrastructure of the Western World has been slow to implement change. As Starbucks chose to rewrite the definition of ethically-sourced coffee instead of changing their production methods, other companies that face similar issues are slow to resolve them. Many companies chose to participate in the "straw ban" in the late 2010s as an effort to show the public that their corporations were environmentally conscious. However, the same companies such as Starbucks and Nestlé ignored the blatant human rights and environmental violations for which they were being cited in the same time period.

The most significant limitation of this research is the small survey pool. There were 61 respondents of which the majority were college students or recent college graduates. Though the survey respondents were from many different colleges and universities and live in various areas

around the country, the majority of them reside on the East Coast of the United States. Future studies would be able to enhance the effectiveness of this research by broadening the survey to include respondents of different age groups and different areas of the United States outside of the East Coast.

Another limitation of this research was the inability to interview more than one coffee vendor. Due to the time constraints of this project and the schedules of others, Greenberry's Coffee shop was the sole source of the interview section. If one has more time in the future, I would recommend attempting to interview more local coffee shops in the area to learn how different small-scale producers are affected by economic strain. In addition, large coffee corporations are very difficult to schedule to contact interviews with. I would recommend initiating contact as soon as possible and following up multiple times to increase the likelihood of interviews with large corporations.

The concept of ethnographic research has been used to analyze different interactions between infrastructure and the world with regards to online interaction, social media, and other technological advances (Star, 1999). It can also be used to predict the ways in which a certain infrastructure will react when faced with complications. As climate change poses a significant threat to the Western world's coffee infrastructure, it is important to understand the ethnography of the coffee industry in order to predict climate change's effects. Since the coffee infrastructure of the Western world is resistant to changes -even improvements- and fixed in slow, modular increments instead of large-scale, systemic change, it is easy to predict that the infrastructure will struggle significantly in the coming years due to the effects of climate change.

CONCLUSION

The only ways to elude the effects of climate change demand quick, large-scale changes in many industries such as agriculture, energy production, and transportation. In the same manner, the coffee industry would need to implement drastic measures to avoid drastic decreases in production quantity and increases in production cost. As Greenberry's and other small coffee companies shift to environmentally conscious methods of production, it is imperative that large corporations change their methods of production as well. Convincing these corporations that their profits will suffer as a result of climate change and that the shift to environmentally

conscious coffee production is necessary will demand a major effort on the part of consumers as monetary gains are the primary incentives for such corporations. Consumers must use their money to choose environmentally-friendly products to force corporations to change their methods to avoid dramatic negative effects on the industry.

Works Cited

- Ahmed, S., Brinkley, S., Smith, E., Sela, A., Theisen, M., Thibodeau, C., Warne, T., Anderson, E., Van Dusen, N., Giuliano, P., Ionescu, K. E., & Cash, S. B. (2021). Climate Change and Coffee Quality: Systematic Review on the Effects of Environmental and Management Variation on Secondary Metabolites and Sensory Attributes of *Coffea arabica* and *Coffea canephora*. *Frontiers in Plant Science*, *12*, 708013. <https://doi.org/10.3389/fpls.2021.708013>
- Becoming Resource Positive*. (n.d.). Starbucks. Retrieved March 13, 2023, from <https://www.starbucks.com/responsibility/planet/>
- Canning, A. (2019, June 17). *Starbucks Has a Slave Labor Problem*. Fair World Project. <https://fairworldproject.org/starbucks-has-a-slave-labor-problem/>
- Championing Ethiopia's Coffee Farmers in the Birthplace of Arabica*. (2022, August 25). [Article]. Rainforest Alliance. <https://www.rainforest-alliance.org/in-the-field/championing-ethiopias-coffee-farmers-in-the-birthplace-of-arabica/>
- Chemura, A., Mudereri, B. T., Yalew, A. W., & Gornott, C. (2021). Climate change and specialty coffee potential in Ethiopia. *Scientific Reports*, *11*(1), 8097. <https://doi.org/10.1038/s41598-021-87647-4>
- Climate Change Effects on Coffee*. (2021, January 12). Coffee & Climate. https://coffeeandclimate.org/climate-change-effects-on-coffee/?gclid=Cj0KCQjwnP-ZBhDiARIsAH3FSRd68FzJ9NX6yJu7tM4W68Em-z1cfU8ZCUDupzpyHSXMPoyGrHgVnuQaAqWgEALw_wcB

Dawson, A. (2023, February 25). *Always-on Work Culture: Advantages and Disadvantages*.

WikiJob.

<https://www.wikijob.co.uk/jobs-and-careers/employment/always-on-work-culture>

Doward, J. (2020, March 1). Children as young as eight picked coffee beans on farms supplying Starbucks. *The Observer*.

<https://www.theguardian.com/business/2020/mar/01/children-work-for-pittance-to-pick-coffee-beans-used-by-starbucks-and-nespresso>

Gibbens, S. (2022, January 26). *What climate change means for the future of coffee and other popular foods*. National Geographics.

<https://www.nationalgeographic.com/environment/article/what-climate-change-means-for-or-future-of-coffee-cashew-avocado#:~:text=By%202050%2C%20in%20all%20three,F or%20cashews%2C%20declines%20varied%20widely>

Grüter, R., Trachsel, T., Laube, P., & Jaisli, I. (2022). Expected global suitability of coffee, cashew and avocado due to climate change. *PLOS ONE*, 17(1), e0261976.

<https://doi.org/10.1371/journal.pone.0261976>

Haggar, J., & Schepp, K. (2012). *Coffee and Climate Change: Impacts and options for adaption in Brazil, Guatemala, Tanzania and Vietnam* (NRI Working Paper Series No. 4; Climate Change, Agriculture and Natural Resources, p. 55). University of Greenwich.

<https://www.nri.org/publications/working-paper-series/4-coffee-and-climate-change/file>

How A Two-Year Project Used Climate-Smart Agriculture to Uplift Women's Leadership in Coffee. (2021, March 4). [Partner Update]. Rainforest Alliance.

<https://www.rainforest-alliance.org/in-the-field/how-a-two-year-project-used-climate-smart-agriculture-to-uplift-womens-leadership-in-coffee/>

How Climate Change is Killing Coffee. (n.d.). Retrieved October 7, 2022, from

<https://knowledge.wharton.upenn.edu/article/coffee-climate-change/>

Kath, J., Mittahalli Byrareddy, V., Mushtaq, S., Craparo, A., & Porcel, M. (2021).

Temperature and rainfall impacts on robusta coffee bean characteristics. *Climate Risk Management*, 32, 100281. <https://doi.org/10.1016/j.crm.2021.100281>

Lindsey, R., & Dahlman, L. (2022, June 28). *Climate Change: Global Temperature*. NOAA Climate.Gov.

<https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature>

Mattera, P. (2021, June 29). *Nestlé: Corporate Rap Sheet | Corporate Research Project*.

Corporate Research Project.

<https://www.corp-research.org/nestle#:~:text=In%202005%20the%20International%20Labor,West%20African%20cocoa%20supply%20chain.>

Our Approach. (1987). Rainforest Alliance.

https://www.rainforest-alliance.org/approach/?_ga=2.52308649.1204352163.1678739136-1672988894.1678298074

Penha, D. (2018, September 18). *Slave labor found at Starbucks-certified Brazil coffee plantation*. Mongabay Environmental News.

<https://news.mongabay.com/2018/09/slave-labor-found-at-starbucks-certified-brazil-coffee-plantation/>

Rogers, K. (2022, May 6). *Starbucks hit with sweeping labor complaint including over 200 alleged violations*. CNBC.

<https://www.cnn.com/2022/05/06/starbucks-accused-of-more-than-200-labor-violations-in-nlrb-complaint.html>

Slave labour on coffee farms denounced at the OECD. (2018, June 19). Conectas.

<https://www.conectas.org/en/noticias/slave-labour-coffee-farms-minas-gerais-denounced-oecd/>

Star, S. L. (1999). *The Ethnography of Infrastructure*. University of California, San Diego.

<https://collab.its.virginia.edu/access/content/group/ac717feb-1b4c-426f-9fa4-4ff01a1196fe/Course%20Readings/00027649921955326.pdf>

Starbucks 2020 Global Environmental & Social Impact Report (Global Environmental & Social Impact Report, p. 23). (2021). Starbucks.

<https://stories.starbucks.com/uploads/2021/04/Starbucks-2020-Global-Environmental-and-Social-Impact-Report.pdf>

Starbucks 2021 Global Environmental & Social Impact Report (Global Environmental & Social Impact Report, p. 69). (2022). Starbucks.

<https://stories.starbucks.com/uploads/2022/04/Starbucks-2021-Global-Environmental-and-Social-Impact-Report-1.pdf>

Sustainable coffee. (n.d.). Nestlé Global. Retrieved April 21, 2023, from

<https://www.nestle.com/sustainability/sustainable-sourcing/coffee>

The Economic Impact of the Coffee Industry. (n.d.). National Coffee Association USA.

<https://www.ncausa.org/Research-Trends/Economic-Impact>

Worland, J. (2018, June 21). *Your Morning Cup of Coffee Is in Danger. Can the Industry Adapt in Time?* Time. <https://time.com/5318245/coffee-industry-climate-change/>


Wulff, A. (2016, November 29). *A Brief History of American Coffee Culture.* The Culture Trip. <https://theculturetrip.com/north-america/usa/articles/a-brief-history-of-american-coffee-culture/>

Appendix A

Image 1: Starbucks Response Email

Starbucks Information <info@support.starbucks.com>
 Reply-To: Starbucks Information <info@support.starbucks.com>
 To: cew7kr@virginia.edu

Fri, Jan 27, 2023 at 3:28 PM



Recently you requested personal assistance from our support center. Please find our response below.
 Thank you for contacting us.

Response (01/27/2023 12:28 PM)

Hello Cameron,

Thank you for contacting Starbucks. I appreciate you taking the time to share your concerns with us.

Cameron, I feel so happy to know that you want to have the interview of our employees regarding the climate change. At Starbucks, we recognize that our customers are number one and we always welcome your suggestions. I will be glad to assist you.

We take your concerns seriously. As a result, I would like to share your comments and feedback with the appropriate teams. I totally understand the inconvenience caused and appreciate you bringing your thoughts to our attention.

If you ever have any questions or concerns in the future, please don't hesitate to get in touch!

I wish you a nice rest of the day!

Sincerely,
 Mahamed M.
 Starbucks Customer Care

Visit us online at www.Starbucks.com.

Customer (01/27/2023 12:05 PM)

Good afternoon,

My name is Cameron Williams and I am a senior at the University of Virginia School of Engineering and Applied Sciences. For my thesis I am researching the impact that climate change will have on coffee production and I would love to learn about the specific issues that Starbucks will face and what plans you have to combat the future struggle to produce coffee. I would really appreciate the chance to interview some of your employees. Thank you for your time.

Best wishes,
 Cameron Williams

Incident Reference # 230127-009763

Appendix B

Due to Figure 4 being an open-ended question, the responses were grouped to make the results more legible and easier to read. The groupings according to the designated responses are described below:

Grouping	Items Included
Soda	Soda, Mountain Dew, Diet Coke, Coke
Energy Drinks	Energy drinks, Celsius, Red Bull, Monster
Tea	Tea, bubble tea, green tea, black tea, iced tea, Matcha lattes, milk tea
Pre Workout	C4, Beyond Raw Lit, Alani, Ghost
None	Nothing, nope, no, just coffee