

**Utilizing AI and ML Techniques to Fight Rising Food Costs  
The Technical, Ethical, and Economical Dimensions of Cheating in Video Games**

A Thesis Prospectus  
In STS 4500  
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 Computer Science

By  
**Jack Donald Halliwill**

Fall, 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  
Rosanne Vrugtman, School of Engineering and Applied Science  
Bryn E. Seabrook, Department of Engineering and Society

## **Prospectus**

### **Introduction:**

In September of 2022 prices of United States food items like eggs, milk, and flour were 11.4% more expensive than the year prior, which sent people into a frenzy (Wiener-Bronner, 2022). Panic over 11.4% price increases would seem childish to Argentinians that are experiencing a daunting food inflation rate increase of more than 40% in a single year (TradingEconomics, 2023). The price of food has always been very volatile. However, the recent spikes have revealed the weaknesses in such a complex system.

These price spikes can be the result of production issues or global events. An outbreak of Avian Flu was the cause of the recent increase in egg prices. The current crises in Ukraine has disrupted global supply of agricultural products. Long-lasting challenges in supply chain management on a micro and macro scale (U. S. GAO, 2023). Climate change is also an expanding issue wreaking havoc on the agricultural industry. Extreme temperatures and rainfall can prevent crops from growing altogether. Warmer temperatures increase the growth of pests and weeds, costing the farmers additional fertilizers. Higher levels of CO<sub>2</sub> are shown to decrease the nutritional value of the products (EPA, 2023). All of these events have played a role in the overall price of the food we buy at the grocery store.

The impact of these price spikes is felt nationwide. From 2021 to 2022, the same period of time the 11.4% inflation occurred, 2.6% less households were food secure across the country (USDA ERS, 2023). As people are forced to spend more money on food, they spend less on other commodities and risks, in turn slowing down the economy. Not to mention that access to food is essential to promote the health and well-being of humans. This means the hike in food prices has some type of impact on each and every person. Businesses feel the impacts of these

spikes as well. From 2021 to 2022, prices of groceries jumped 13.5% and restaurant menu prices increased 8% (Wiener-Bronner, 2022). Citizens and businesses alike want to see a decrease in volatility and price of food products.

The current food supply infrastructure is fragile as demonstrated above. These problems are multifaceted and extremely complex. However, some of these complex problems can be solved by utilizing various machine learning and artificial intelligence techniques. This brings me to the company I have been interning with for almost 6 months now, SWARM Engineering. SWARM is a software as a service company focused on utilizing AI/ML techniques to provide optimizations in agri-food processes. In this paper I pursue the question: How does SWARM assist agri-food companies in reducing operational costs to provide savings for the end-use customer?

## **TECHNICAL:**

The technology created at SWARM can be classified into three categories: Challenge Modeler, Operator Dashboard, and Solution Engine.

The Challenge Modeler is the first step users will encounter when working with SWARM. Here, clients will view our array of predefined challenges that we have solutions to solve, for example Outbound Logistics, and then pick out a problem or challenge that contributes to their company's costs. From there, the company will fill out information that is specific to their business in a Mad Libs style way, and once finished, it becomes a Challenge Definition. SWARM is then able to view this Challenge Definition and assess whether we have a solution that works for the client's specific issue.

The Operator Dashboard is where the client runs their optimizations, or solutions to their provided problem. Here the customer can make changes to parameters, constraints, and datasets per run. The Dashboard runs the solution and returns a set of results in various forms such as Excel tables or Tableau visualizations. The client is able to easily interpret these results and is able to make more informed decisions.

The last piece is the Solution Engine. A distributed messaging system sends a message from the Operator Dashboard to the Solution Engine to assemble the computation. Data including the customer profile, what problem is attempting to be solved, client data, and more is assembled in a Kubernetes container. Once the data has been assembled, the machine learning technique(s) specific to the solution is run. The solution is then computed, and results compiled to send back to the Operator Dashboard.

SWARM offers a solution to agri-food companies by closely integrating and understanding the client's business. SWARM is a start-up so most of the time we are building a challenge and solution for the client from scratch. The company will approach SWARM with a problem costing the company lots of money. We then investigate the problem and attempt to research a machine learning approach that can solve the proposed problem. Once we have a solution, we craft the solution for the customer using their business as our test case for this specific optimization. SWARM's model is a good solution as it is very scalable and adaptable. Once an optimization is created for one company, that is the seed optimization. This seed can be adapted to account for minor changes based on the specific client's needs.

SWARM's work is important and has offered savings of 40% for some solutions. This is massive! By saving the client this much money, their resources can be allocated to improve other processes or lower their products' end cost (SWARM Engineering, 2023). These solutions can

also directly alleviate some of the issues previously discussed, specifically related to supply chain. By reducing the number of problems experienced by these agri-food companies and their transport carriers, a decrease in volatility of food prices is expected as a result.

It would be naïve to believe that every company SWARM does business with will use the savings to provide a lower end-cost to the customer. Large conglomerates are sometimes greedy in order to ensure quarterly earnings reports can be published. Companies have an underlying profit motive that contributes to every decision made. This fiscal perspective promotes doing anything necessary to succeed, and is a sad reality for many large companies.

### **Video Games' Cheating Epidemic:**

Today's gaming player bases contain toxic players who exploit the game to win by any means necessary, cheaters. However, it wasn't always like this. In some of the world's earliest and most popular video games like Sonic the Hedgehog and Mortal Kombat, cheat codes were placed intentionally into the game by developers. The codes allowed for easy debugging and testing (Tarantola, 2019). These codes were discovered by players and exploited for their own personal advancement. In today's massively multiplayer online game environment, people's identities are stripped from them, and they can act in any way they want with no tangible repercussions. Because players are anonymous and can hide behind their screens, they are more likely to cheat (Grazotis, 2018). This is a growing issue and has a huge impact on player experience. A survey done by Irdeto shows that 60% of players have had their gaming experience disrupted by cheaters on multiple occasions. 77% are likely to quit playing if others are cheating and ~50% are less likely to buy content in-game (Irdeto, 2018). These numbers are catastrophic to a company's bottom-line. So much so that lawsuits have been filed against those

who create cheats. A few court cases involving Bungie, Ubisoft, and Take-Two Interactive are indications that efforts are being made to dissolve the community of cheaters (Totilo, 2022). However, identifying and punishing cheat creators is not a sustainable solution. New cheats are created every day and companies do not have the time or money to eradicate every creator. These cheats can be very complex and hard to detect. Hardware, software, bug exploitation, and online attacks are some of the most common. To monitor all of these platforms while the user plays the game presents an extra layer of complexity in the design of the game. In this paper I seek to explore the technical, ethical, and economical dimensions of cheating in video games like Valorant and Overwatch.

I plan to use Susan Star's (1999) *The Ethnography of Infrastructure* as a framework to analyze cheating in video games. At the core, Star's framework defines a list of properties to describe the technological development of infrastructure. I will parallel her work on infrastructure to my topic of cheating. Firstly, I would relate her property of scope to inspect the communities in which people cheat. When people cheat in games like Sonic or Mortal Kombat, there is no issue. These are single player/co-op games so when advancing unfairly, it impacts no other person. The issue occurs when the scope of games is expanded to include other people, specifically games where Player 1's actions can impact Player 2 in any way. In situations such as these, it is unethical to use cheats. Another property of the framework able to describe cheating in video games is visible upon breakdown. Speaking from personal experience, when playing in a game where I know there is a cheater on the other team, it is draining. I usually quit the game once finished. My voice is concurred with thousands of others by the works of Irdeto (2018). The system designed by the game design engineers is visibly broken to players, and the company pays for it in the form of lower overall playtime. Fixed in modular increments is the last of Star's

properties used to analyze the constant battle between game security engineers and the hackers. It is impossible for the game security engineers to always be prepared for what the next cheat produced will be. These games are extremely complex and have many vulnerabilities, so it is not the fault of the companies. But it is the responsibility of the engineers to take action to discover what is currently being exploited and fix the system in modular increments as patches.

## **METHODS:**

To understand the effects that cheaters can have on games, we must explore how cheaters have impacted players' gaming experience. Gaining insight to the players' perspective is extremely important for many concrete reasons: impact on company economics, game reputation, incentive for developers to address cheating, etc. This research is essential to hold companies and developers accountable. Internal company statistics or social media PR can show an overall low cheater rate, but still have an unhappy player base. This research is also important to the companies and developers themselves. Surveying is one of the few ways to extract an opinion from a particular audience. To address this question, surveys will be conducted with questions sourced from Irdeto's (2018) *New Global Survey: Widespread Cheating in Multiplayer Online Games Frustrates Consumers*. I will then compare my research to Irdeto's findings to discover any changes in player views since 2018.

Statistical analysis will be done on numerical questions to get information such as mean, range, correlations, etc. Text based answers will be reviewed in order to gain insight into different perspectives and can be used as evidence. These surveys will be given to communities of gamers known across Discord, Reddit, Twitch, and other forums.

## **CONCLUSION:**

Inflating food prices is a major issue that has been addressed by Congress many times. Agricultural subsidies are a prime contributor to cutting costs for farmers and stabilizing food prices (USDA NAL, 2023). But as displayed, these subsidies are not enough. The agricultural industry needs groundbreaking technology like SWARM to solve complex problems that once were not as complex. In order to provide food for equitable costs at scale, technology is necessary.

Cheaters abuse the advantage they have for their own enjoyment and progression. Even though these actions can result in serious ethical and economical griefs. This paper is expected to bring to light these griefs from different perspectives, communities/companies/cheaters, as well as explore the technical aspect of how cheating occurs in MMO games.



## REFERENCES:

EPA. (2023, September 8). Climate change impacts on agriculture and food supply.

<https://www.epa.gov/climateimpacts/climate-change-impacts-agriculture-and-food-supply>

Grazotis, E. (2018, April 27). *The negative effects of anonymity and excessive participation in online gaming communities*. Debating Communities and Social Networks 2018 OUA

conference. [https://networkconference.netstudies.org/2018OUA/2018/04/23/the-negative-effects-of-anonymity-and-excessive-participation-in-online-gaming-](https://networkconference.netstudies.org/2018OUA/2018/04/23/the-negative-effects-of-anonymity-and-excessive-participation-in-online-gaming-communities/#:~:text=In%20Chen%20and%20Wu's%202015,follow%20group%20and%20social%20cues)

[communities/#:~:text=In%20Chen%20and%20Wu's%202015,follow%20group%20and%20social%20cues](https://networkconference.netstudies.org/2018OUA/2018/04/23/the-negative-effects-of-anonymity-and-excessive-participation-in-online-gaming-communities/#:~:text=In%20Chen%20and%20Wu's%202015,follow%20group%20and%20social%20cues).

Irdeto. (2018). *New Global Survey: Widespread Cheating in Multiplayer Online Games*

*Frustrates Consumers*. <https://resources.irdeto.com/media/new-global-survey-widespread-cheating-in-multiplayer-online-games-frustrates-consumers?page=%2Firdeto-global-gaming-survey&widget=619fe088c38ad74c335a025d>

U. S. GAO (2023, April 11). *Sticker shock at the grocery store? inflation wasn't the only reason food prices increased*. U.S. GAO. [https://www.gao.gov/blog/sticker-shock-grocery-store-](https://www.gao.gov/blog/sticker-shock-grocery-store-inflation-wasnt-only-reason-food-prices-increased#:~:text=Disruptions%20and%20changes%20to%20the,available%E2%80%94causing%20prices%20to%20increase)

[inflation-wasnt-only-reason-food-prices-](https://www.gao.gov/blog/sticker-shock-grocery-store-inflation-wasnt-only-reason-food-prices-increased#:~:text=Disruptions%20and%20changes%20to%20the,available%E2%80%94causing%20prices%20to%20increase)

[increased#:~:text=Disruptions%20and%20changes%20to%20the,available%E2%80%94causing%20prices%20to%20increase](https://www.gao.gov/blog/sticker-shock-grocery-store-inflation-wasnt-only-reason-food-prices-increased#:~:text=Disruptions%20and%20changes%20to%20the,available%E2%80%94causing%20prices%20to%20increase).

STAR, S. L. (1999). The Ethnography of Infrastructure. *American Behavioral Scientist*, 43(3),

377-391. <https://doi.org/10.1177/00027649921955326>

SWARM Engineering (2023). Scenarios. <https://swarm.engineering/scenarios>

Tarantola, A. (2019, June 18). *A brief history of cheating at video games*. Engadget.

<https://www.engadget.com/2019-06-15-a-brief-history-of-cheating-at-video-games.html>

Totilo, S. (2022). *Lawsuits suggest some video game cheating could be illegal*. Axios.

<https://www.axios.com/2022/12/16/video-game-cheating-lawsuits>

TradingEconomics. (2023). Food inflation. Food Inflation - Countries - List.

<https://tradingeconomics.com/country-list/food-inflation>

USDA ERS. (2023). *Key Statistics & Graphics*. USDA ERS - Key Statistics & Graphics.

<https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/key-statistics-graphics/#foodsecure>

USDA NAL. (2023). *Agricultural subsidies*. Agricultural Subsidies | National Agricultural

Library. <https://www.nal.usda.gov/economics-business-and-trade/agricultural-subsidies>

Wiener-Bronner, D. (2022, September 24). Food prices are soaring, and that's changed how we

eat | CNN business. CNN. <https://www.cnn.com/2022/09/24/business/food-inflation-habits/index.html>