

**Creating a Model to Project Technological Disruptions
Generative AI: Current Impact on the Job Market**

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 Systems Engineering

By
Carter Dibsie

November 3, 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

Prof. Pedro Augusto P. Francisco, Department of Engineering and Society

Prof. Michael D. Porter, Department of Systems and Information Engineering

Introduction

The objective for my research is to tackle the current economic landscape that persists in modern society. Specifically, the major talking point is the next step in the modern digitalized age, that being Large Language Models (LLMs) and generative AI. Furthermore, understanding on both a macro and micro economic level of economic trends and challenges we currently face is essential for understanding what life currently holds for people like me who are beginning to enter the workforce.

When it comes to the technical research, in other words, my capstone project, the goal is creating a model that can predict technological disruptions for private companies. In order to give a full evaluation of technological trends, the capstone will focus on the semiconductor industry due to substantial economic growth in that industry as well as recent political policy such as the CHIPS act that has the US government invest significant capital into the semiconductor industry. The overall problem that is being addressed is analyzing what causes a company to become a technological disruption and creating a model to predict companies that can become a technological disruption and evaluate when and how they will breakthrough.

When it comes to sociotechnical side, my main focus will be on how technological innovations, specifically the rise of LLMs and generative AI will have a major impact on the job market. More specifically, I will dive into the history of the battle between the battle between humankind and technology and relay that forward into comparing and contrasting how the current rise of generative AI is shaping the new battle of humans competing against technology in the job market. All and all, how is generative AI having an impact on the job market and what can humans do to adapt with this substantial technological progression causing a cultural shift in how humanity and technology interact with each other.

When it comes to finding a connection between the technological and sociotechnical aspects of my research, there lies some connections between the two topics. The most significant one is that both topics dive into the economics of the current business world. The sociotechnical side focuses on the microeconomic scale by making the evaluation between how modern technological innovations such as generative AI are changing the way humanity is impacted by technological innovations. The technical side focuses on the macroeconomic side diving into the technological and financial progression of large private companies to determine their technological impact on their industries with the end goal being to evaluate if and how they can become technological disruptions. When it comes to answering what a technological disruption is, a simple definition when applying the business definition is a technical innovation that significantly alters or changes the way businesses operate. Today, there is no bigger technological disruption than generative AI as businesses across all industries are rapidly implementing LLMs into their business to keep up with the evolution of technological progression.

Creating a Model that Predicts Technological Disruptions

The goal for my technological research is to create a model that predicts technological disruptions. The root problem that will be addressed is to evaluate the semiconductor industry to find trends in companies that become technological disruptions and use those findings to diagnose and predict when and how semiconductor companies will become technological disruptions. As previously mentioned, the semiconductor industry was specifically targeted because of their massive economic growth, but more specifically, their annual sales have increased from \$139 billion in 2001 to \$573.5 billion in 2022. As also mentioned, the US government is making significant investments in semiconductor companies with their recent

CHIPS act allocating \$53 billion into investments in semiconductor companies. As such, with there being a massive amount of funds coming in, it is essential to identify which companies are worth investing in that will help shape the future of the semiconductor industry.

The main issue that we hope to solve with the capstone is creating a model that accurately predict technological disruptions. Metric utilized in order to predict such disruptions include number of funding rounds which helps indicate how many times a private/startup company to field investors who will help fund and grow the company. Another important metric is valuation of each funding round, as a funding round that yields a noticeably high amount of money raised is a huge indicator of potential success. As such, these metrics will give us the ability to build a model that will predict the timing of a potential technological disruption, give feedback on whether a company is worth investing in, and identify companies that are likely to develop a technological disruption.

The end goal of this model is after a company has its series A funding round, will said company be a success or failure within five years. The measurement for success will be if the company is expected to have a valuation of over \$500 million within those five years. We chose \$500 million since that indicates a solid benchmark where after being a startup for a few years including fielding investors, we found that a valuation of \$500 million is an indicator of the company having a potentially noticeable influence in the semiconductor industry.

As we continue to build our model, we hope to figure out types of patterns that persist in an evolving industry. By understanding how companies in the past grew and became key contributors to the semiconductor industry, we hope to build a model that accurately predicts the economic momentum of a company to allow us to make correct predictions on which companies have the potential to be future technological disruptors.

Generative AI: Current Impact on the Job Market

The battle between humanity against technology is not a brand new concept, but the next big technological innovation of LLMs and generative AI pose unique challenges for the job market. As such, there will be many people who will embrace this evolution in technology with them citing the added convenience and productivity the technology will possess. However, just like any technological innovation, there will be many detractors and those fearful about the future with concerns being about the replacement of human productivity and potentially leaving many talented workers not being able to use their talents. As such, one important question to ask is if generative AI is a net positive for the workforce?

To understand why this is an essential question, it's important to examine why businesses would be incentivized to utilize generative AI. Specifically, there needs to be evidence about the economic benefits generative AI can have on a business. So once we understand why businesses are rapidly integrating generative AI, it's important to understand the dichotomy between humanity and technology. This obviously isn't the first time that technology has had a significant impact on the job industry and it definitely isn't the first time people are skeptical and resistant to technological progression. To understand the societal role of this dichotomy, it's important to understand times when technology had significant consequences for businesses and relate that to how generative AI falls into that similar category. However, it is also important to establish how unique the issue is regarding generative AI and how this technological change is unlike anything that has progressed in the past.

Once we understand why generative AI is becoming increasingly prevalent in the work force, it's important to understand the impact it has already had. Researching for ways that generative AI has already increased convenience and productivity is essential. Another key part

about the current impact is if it has already impacted some people's livelihood in both a positive and negative way, and specifically for the job industry, can generative AI replace human productivity and if so, has that already been happening? There's always been a battle between technological innovation and blue collar workers, but many arguments have been made that it is actually white collar workers that can see the largest impact on the development of generative AI which is why it is important to analyze what is happening to come to a conclusion of how much weight that speculation holds.

The topic of generative AI is critical on the impact of society because evidence is pointing that this technology will be implemented into our daily lives. More specifically in the business world, this technology has the potential to generate serious economic growth across all sorts of industries.

Conclusion

The two topics I will be focusing on are as follows. On the technical side, I will focus on the predictability of potential technological disruptions in businesses and we can create a model to make wise investment decisions. However, on the sociotechnical side, looking at a huge technological disruptor in generative AI is essential in talking about the potential impact it will have on society at large. Despite generative AI being very new to the general public, there's already a societal awareness that it will have a substantial impact on the future of society which is why it is essential to dissect how we got here and what the future holds. As I continue to do further research, my expectation is that I will find both a ton of economic benefits generative AI will have on society but also some data to either support or refute major concerns regarding the implementation of generative AI.

References:

1. Chui, M., Hazan, E., Roberts, R., Singla, A., Smaje, K., Sukharevsky, A., Yee, L., & Zemmei, R. (2023). *The Economic Potential of Generative AI*.
2. AbuMusab, S. (2023, September 8). *Generative AI and human labor: Who is replaceable? - ai & society*. SpringerLink.
<https://link.springer.com/article/10.1007/s00146-023-01773-3>
3. Chohan, U. W. (2023, April 28). *Generative AI, CHATGPT, and the future of Jobs*.
4. Eisfeldt, A. L., Schubert, G., & Zhang, M. B. (2023, May). *Generative AI and Firm Values*. NEBR Working Paper Series.
https://www.nber.org/system/files/working_papers/w31222/w31222.pdf
5. Walkowiak, E., & MacDonald, T. (2023, October 3). *Generative AI and the workforce: What are the risks?*. SSRN.
<https://deliverypdf.ssrn.com/delivery.php?ID=375091000096119106064112067070068124060087060080003065108007069109065106104072086073057037122017121015000006071068014090105000029090059021059114015016090081019079100062061079027067076094108011087117096064112068078004118004074022071110007024084122088013&EXT=pdf&INDEX=TRUE>
6. Wach, K., Duong, C. D., Ejdys, J., Kazlauskaitė, R., Korzynski, P., Mazurek, G., Paliszkievicz, J., & Ziemba, E. (2023). The Dark Side of Generative Artificial Intelligence: A critical analysis of controversies and risks of chatgpt. *Entrepreneurial Business and Economics Review*, *11*(2), 7–30. <https://doi.org/10.15678/eber.2023.110201>
7. Sætra, H. S. (2023). Generative AI: Here to stay, but for good? *Technology in Society*, *75*.
<https://doi.org/10.2139/ssrn.4330244>

8. Lockett, J. (2023). Regulating generative AI: A pathway to ethical and responsible implementation. *International Journal on Cybernetics & Informatics*, 12(5), 79–92.
<https://doi.org/10.5121/ijci.2023.120508>
9. Weisz, J. D., Muller, M., He, J., & Houde, S. (2023, January 13). *Toward general design principles for Generative AI applications*. arXiv.org. <https://arxiv.org/abs/2301.05578>
10. Barrett, C., Boyd, B., Burzstein, E., Carlini, N., Chen, B., Choi, J., Cowdhury, A. R., Christodorescu, M., Datta, A., Feizi, S., Fisher, K., Hashimoto, T., Hendrycks, D., Jha, S., Kang, D., Kerschbaum, F., Mitchell, E., Mitchell, J., Ramzan, Z., ... Yang, D. (2023, October 17). Identifying and mitigating the security risks of Generative AI - arxiv.org.
<https://arxiv.org/pdf/2308.14840.pdf>