Impact of Generative Artificial Intelligence on Business Profitability

Author: Abhiram Tetali
Supervisor: Professor Felipe Csaszar

Independent Study: Strategy 399
Term: Winter 2024

ABSTRACT
This independent study focuses on providing an answer to the following question: *How to assess Generative Artificial Intelligence (GenAI) implications on business profitability?* To answer this question, this paper begins by providing background information on GenAI. Subsequently, the paper details the methodology taken for answering the question at hand. The methodology showcases the development of two frameworks that assess GenAI use cases. The first framework allows the assessment of a selected firm's long-term profitability when deploying a GenAI use case, and the second framework allows assessment of a selected industry's attractiveness when its incumbents deploy a GenAI use case. The paper then delves into analysis of both frameworks that incorporate randomly selected GenAI use cases. Ultimately, the paper concludes with overarching insights.

1. INTRODUCTION
GenAI is a type of artificial intelligence that can create content, including text, images, audio, code, videos, and synthetic data (Kanbach et al., 2023). The applications of GenAI are both vast and diverse. GenAI applications can range from creating breathtaking images of nature to mimicking human voices. To view a larger list of applications, Appendix A outlines several GenAI use cases, the industry they are most likely to be used in, etc. There has been significant advancement in the GenAI space, famously spurred by OpenAI's release of ChatGPT (powered by GPT-3.5) to the public in November of 2022 to capture a record 100 million users in 2 months (Hu, 2023). Individuals utilize ChatGPT by prompting it with text such as "please explain the concept of quantum mechanics" or "write a thank you email to my interviewer". The usage of GenAI, however, does not simply halt as a service for an individual's daily usage. GenAI could add the equivalent of $2.6 trillion to $4.4 trillion annually in value among all industries globally (Kamalnath et al., 2023).

2. BACKGROUND
This paper is motivated by the widespread influence of GenAI on businesses. From my experience at a management consulting firm, I observed a consistent theme across client conversations – the disruptive potential of GenAI within their industries. This observation prompted me to explore the impact of GenAI on businesses and industries. In this section, I provide information on the history of GenAI, common mistakes individuals make surrounding its classification, and its cost structure to provide a well-rounded foundation that aids in answering the overarching question.

2.1 History of GenAI

In 1906, the Markov chain – a statistical model for predicting random sequences – was developed by Andrey Markov to model stochastic processes. A key property of the Markov chain is "memorylessness" – the predictions associated with a Markov process are conditional on its current state and are independent of past and future states (Patel, 2022). A common usage of the Markov chain is showcased by Google. Google may predict the next word within a Gmail sentence based on the previous entry. This method is quite simplistic compared to modern society algorithms, but its novelty at the time is due to the reason that it represents a way to generate something.

The Markov chain inspired what would be coined as a chatbot in the 1960s. During this time period, a chatbot named ELIZA was developed. ELIZA functioned by using "keyword and pattern matching to select predetermined response templates" (Al-Amin et al., 2024). However, ELIZA had "no true understanding of syntax, semantics, or context as it simply matched surface patterns without analyzing deeper meaning or tracking prior conversation" (Al-Amin et al., 2024). ELIZA proved to be an improvement to the Markov chain, but more work needed to be done to emulate true human behavior.

Between 1995 and 2000, Artificial Intelligence Markup Language (AIML) became prominent. AIML is centered around Pattern Recognition / Matching, and it became used to create more conversational chatbots than ELIZA of the 1960s. The responses were more human-like than chatbots like ELIZA, but the advancement was still not considered close to being "human-like" behavior.

In the early 2020s, however, another advancement changed the artificial intelligence landscape. Applications that are quite popular in modern society (e.g., Bard and ChatGPT) utilize Transformer Neural Network Architecture. This architecture allows for improved performance on various language tasks, better handling of long-range dependencies, and the ability to capture complex linguistic patterns better than previous advancements (Al-Amin et al., 2024). This novel approach in neural networks allows applications to generate more "human-like" responses than previous models and methods.

2.2 Misclassification of GenAI (Predictive AI vs Generative AI)

It is common to see a phrase such as "our new GenAI-embedded product" or "our new GenAI-software" in business advertisements. There are instances, however, that the business is completely misclassifying the type of artificial intelligence that is being used.

Within the realm of Artificial Intelligence, there are several subsets that differ in what they do and how they are used. As a result, companies misclassify the subset of AI they are utilizing. One such common mix up is between Predictive AI and Generative AI.

Predictive AI focuses on "making decisions based on historical data and current information" (Lawton, 2023). Predictive AI is typically used to predict demand trends or detect anomalies that are likely to occur. For example, Walmart could utilize predictive artificial intelligence to maintain specific stock levels of bananas at its stores. Generative AI, as mentioned earlier in the paper, can create content, including text, images, audio, code, videos, and synthetic data

(Kanbach et al., 2023). For example, Adobe Photoshop can generate a background image for a graphic design based on text input from the user.

2.3 Generative AI Cost Structure

A staggering statistic is that it costs OpenAI approximately $700,000 a day to operate ChatGPT (Elimian, 2023). The information in this section provides insight into how this cost is incurred.

A key cost associated with deploying a Generative AI model is the inference cost. This cost refers to the "cost of calling a large language model (LLM) to generate a response" (Huang, 2023). For example, the inference cost of GPT-4 API is typically around $0.006 per 1,000 output tokens plus $0.003 per 1,000 input tokens (Huang, 2023).

Another cost associated with Generative AI models is the fine-tuning cost. Fine-tuning is the "process of adapting a pre-trained GenAI model to a specific task or domain" (Huang, 2023). OpenAI estimates that the costs for a specific fine-tuning job would be the (base cost per 1k tokens) * (number of tokens in the input file) * (number of epochs trained).

Additional costs associated with Generative AI models are prompt engineering costs, cloud expenses, talent costs, and operations costs.

Appendix B provides information for two popular models and their structures for input / output.

3. METHODOLOGY

To answer the question at hand, the following tasks were performed: curation of GenAI use cases, classification of GenAI use cases, and repetition of the process till sufficient exhaustion of GenAI use case curation and classification. Thereafter, two frameworks were created based on selecting categories and building upon previous frameworks to assess profitability from both a firm and industry perspective. In the end, a random subset of the GenAI use cases were selected to be assessed using the two frameworks.

GenAI use cases were identified from real-world experience of use cases or by scanning the internet. By noting down GenAI use cases from reputable sources (e.g., company reports) and mainstream use cases in modern society (e.g., ChatGPT), several GenAI use cases were collected in an Excel spreadsheet.

As GenAI use cases were collected in the Excel spreadsheet, categories that could classify use cases and their relationship to profitability were introduced. For instance, investigation of how a GenAI-driven story generator could revamp the entertainment industry and potentially increase audience engagement led to the creation of a 'Willingness to Pay' category. GenAI-powered customer chatbots, for example, led to creation of the 'Cost' category for use cases that focus more on lowering costs. This process was conducted till sufficient exhaustion of use case curation and generation of categories relating to profitability.

The next step was to generate two methods of assessing GenAI's impact on both firm and industry profitability.

From a firm’s perspective, the core of profitability is subtracting its costs from its revenue. However, the dynamics of revenue and costs are rarely static over time. When disruptive technology such as GenAI comes into the picture, inimitability becomes pivotal in maintaining a firm's competitive advantage and ensuring profitability in the long run. Thus, assessing a firm's potential for sustained profitability through the adoption of a GenAI use case involves considering factors like willingness to pay (the perceived value of the GenAI application), cost implications (including both increases and decreases associated with its implementation), and the degree of inimitability (which includes accompanying complementary assets needed to leverage the GenAI use case). Because inimitability is analyzed by looking at the complementary assets of a specific firm, a firm within the respective industry will be chosen to deploy the GenAI use case.

When examining the impact of a GenAI use case from an industry perspective, Porter's Five Forces framework provides a structured approach to assess industry attractiveness, which serves as a proxy for industry profitability. The Porter's Five Forces framework evaluates the competitive forces within an industry that influence its attractiveness. These forces include the threat of new entrants, the bargaining power of buyers, the bargaining power of suppliers, the threat of substitute products or services, and the intensity of competitive rivalry. Building upon of this framework and looking into how a GenAI use case would change Porter’s Five Forces would indicate how the GenAI use case would impact industry profitability.

After developing the two frameworks, a randomly selected sample of GenAI use cases were used to populate them. With the inclusion of diverse GenAI applications into each framework, critical insights were generated.

4. FRAMEWORK #1: GENAI’S EFFECT ON FIRM'S LONG-TERM PROFITABILITY

A firm’s long-term profitability can be roughly approximated with the following equation:

$$\textit{Long-Term Profitability} = (\textit{Price} - \textit{Cost}) \times \textit{Quantity} \times \textit{Time}$$

This equation is quite commonly used in the business world. A firm’s long-term profit from selling an item is the monetary difference between what the item costs to make and what the item is sold for, multiplied by the quantity of the item sold, and finally multiplied by the period / quantity of time it is sold for.

But as described in the methodology section, three factors were stated to significantly impact a firm’s long-term profitability. Those factors are Willingness to Pay, Cost, and Inimitability. Therefore, the traditional long-term profitability equation can be re-written as follows:

$$\textit{Long-Term Profitability} = (\textit{Willingness to Pay} + \textit{Cost}) \times \textit{Inimitability}$$

Willingness to Pay
Willingness to Pay (WTP) represents the maximum price a customer is willing to pay for a product or service, and it is affected by several factors including income, age, competing products, environmental impact, etc. (Stobierski, 2020).

WTP can indirectly provide an indication as to how much quantity of a product or service can be sold. For example, if a customer has a higher WTP for a product than the price of that product, the customer may be willing to purchase more than one unit of the product. Therefore, WTP can be considered a term that combines both price and quantity. For this framework, WTP will be assessed as the value a user obtains from using a GenAI use case.

Cost
In this framework, Cost encompasses both the upfront investment of the GenAI use case and the lifetime cost associated with it. However, Cost also considers the reduction or addition in cost from the previous method that the GenAI use case is either replacing or enhancing. As seen in the framework equation and explained below in the framework explanation, the cost factor is reverse coded, which is why WTP and Cost are being added together in the re-written long-term profitability equation.

Inimitability
Inimitability in this framework represents the ability of other individuals or firms to not be able to imitate or create ready substitutes for the product or service that is being focused on (Morris, 2021). This is critical to consider as it encompasses the factor of profitability over time.

This framework will work as follows:

1. A firm and GenAI use case will be selected.
2. WTP of the selected firm's customers on the GenAI use case will be scored from a value between -2 and 2. A more negative value indicates decrease in WTP, and a more positive value indicates increase in WTP.
3. Cost of the selected firm employing the GenAI use case will be scored from a value between -2 and 2. A more negative value indicates an increase in cost, and a more positive value indicates a decrease in cost.
4. If WTP + Cost is less than or equal to 0, the firm should not employ the GenAI use case.
5. If WTP + Cost > 0, more forward to the next step
6. Inimitability of the selected firm employing the GenAI use case will be scored between 0.1 and 0.9. A lower score indicates the GenAI use case is more imitable, and higher score indicates that it is less imitable.
7. Finally, (WTP + Cost) * Inimitability will derive a final score. The higher the score, the more likely this GenAI use case is to be profitable for the business in the long run.

Down below, there are some example GenAI use cases that are analyzed using this framework to provide a better understanding on how it works.

Framework Example #1

Firm: Disney
Use Case: Voice Cloning

Description: GenAI can be used to replicate the voice of target speaker and generate phrases using that voice with the desired text and voice input (e.g., the phrase "Generative Artificial Intelligence is intriguing" can be stated with Michael Jackson's voice).

Overall Score: 1.4

Willingness to Pay Score: 0
There is no change in WTP when Disney utilizes a GenAI-powered voice cloning service. Disney is one of the largest firms in the entertainment industry, and it offers a variety of products and services (e.g., movies, theme park resorts, consumer products). This GenAI use case would be an internal tool for the company that would aid in the process of conducting voice acting for a Disney movie. There can be an argument made that the uniqueness of voices incorporated in Disney movies may raise willingness to pay, but there is not much evidence that supports customers valuing or watching more of a company's movies based on the voices of the characters in the film. Therefore, there is no change in the WTP pay if Disney deploys this GenAI use case.

Cost Score: 2
At the end of March 2024, OpenAI had its preview debut of Voice Engine – a service that is a voice cloner. TechCrunch states that Voice Engine was listed as costing $15 per one million characters, or roughly 162,500 words. This would translate to approximately 18 hours of audio, making the price under $1 per hour. In comparison, voice actor salaries on ZipRecruiter range anywhere from $12 to $79 per hour (Wiggers, 2024). For Disney, the cost savings of using a voice cloner over a human voice is substantial. Additionally, the GenAI use case creates convenience for the entity using it because now there is no issue of a potential voice actor bailing on the team, not having a "good" day, or having their own goals in mind – this GenAI use case will provide more constant results.

Inimitability Score: 0.7
A member of product staff at Open AI, Jeff Harris, mentioned that Voice Engine is trained on both "licensed and publicly available data" (Wiggers, 2024). Additionally, the article mentions how models such as Voice Engine are trained with vast amounts of speech and voice recordings, which can act as a barrier to imitation. Though some firms may be able to create a voice cloner by using small samples of training data, the voice cloners that will be considered the enterprise-ready will be difficult to create due to the necessity of training data required. A firm like Disney has access to more complementary assets than other firms in the entertainment industry, which would result in this GenAI use case being fairly inimitable.

Framework Example #2
Firm: Microsoft
Use Case: Customer Service Chatbots

Description: GenAI can be used as a customer service representative by generating personalized responses when individuals submit text or speech prompts.

Overall Score: 1.25

Willingness to Pay Score: 0.5
There is a little increase in WTP if Microsoft deploys GenAI-powered customer service chatbots. Microsoft is one of the most innovative companies in the world with many offerings (e.g., software products, computing devices, gaming services). In dealing with technology, many individuals run into issues that require support. Therefore, Microsoft receives an abundance of customer inquiries each day, but human customer service representatives are limited. Customers would value Microsoft higher if the quality of customer service is increased. In this case, there would be shorter wait times for a customer inquiry about a Microsoft product to be answered because there can theoretically be an infinite number of chatbots the firm utilizes to aid in customer service.

Cost Score: 2
Customer service chatbots create cost savings for Microsoft. For example, a global specialist in sustainable energy added GenAI capabilities to its customer service platform to help teams draft rich and thorough email responses more quickly than was previously possible. The application already responds to a third of all customer inquiry emails, creating capacity for agents to support more complex, high-growth products like electric vehicles and home electricity generation (Bamberger et al., 2023). This example showcases how customer service chatbots can free up time for individuals to perform higher value add tasks, and it can replace individuals at the call center task level.

Inimitability Score: 0.5
Poor customer service chatbots can be replicated easily by firms, but quality customer service chatbots can be difficult to replicate. According to BCG, there are 5 stages of AI-enabled customer service, three of which are enabled by GenAI. For example, Stage 3 (Human-like self-service for more complex journeys) is a category many firms can achieve with their chatbots – it simply describes versatile and human-like responses from the chatbots. However, Stage 5 (AI-enabled continuous assistance for all journeys) can only be replicated by firms with heavy training data and capabilities to do so – this category contains chatbots that are essentially fully customer-centric assistants (Bamberger et al., 2023). A firm like Microsoft has the capabilities to deploy this use case, but so do some other firms. Therefore, this use case is seen to be somewhat inimitable.

5. FRAMEWORK #2: GENAI'S EFFECT ON INDUSTRY PROFITABILITY

Porter's Five Forces is a framework developed by Michael Porter to help in "understanding the competitive forces at work in an industry" to assess industry attractiveness (Harvard Business School). In utilizing Porter's Five Forces, the perspective of an incumbent in the industry being examined is taken. The components of Porter's Five Forces are as follows:

1. *Rivalry Among Existing Competitors*
2. *Bargaining Power of Buyers*
3. *Bargaining Power of Suppliers*
4. *Threat of New Entrants*
5. *Threat of Substitutes*

‘Profitability’ can be used to serve as a proxy for ‘Attractiveness’. Therefore, Porter’s Five Forces serves as the foundation upon which a new framework that considers the impact GenAI has on industry profitability is built.

To understand the impact that GenAI use cases have on industry profitability, the new framework will consider be used:

Industry:
GenAI use case:

1. *Change in Rivalry Among Existing Competitors*
2. *Change in Bargaining Power of Buyers*
3. *Change in Bargaining Power of Suppliers*
4. *Change in Threat of New Entrants*
5. *Change in Threat of Substitutes*

Each of these five categories will be ranked using a component from the set down below:

[Decreases, Moderate Decrease, Slight Decrease, No Change, Slight Increase, Moderate Increase, Increase]

For purposes of obtaining a numerical figure to interpret, the items from this set are parallel to…

[-3, -2, -1, 0, 1, 2, 3].

By analyzing the changes to the original five components of Porter’s Five Forces, one can see if an industry is equally as profitable as before, more profitable, or less profitable due to the introduction of the GenAI use case.

Down below, there are some example GenAI use cases that are analyzed using this framework.

Framework Example #1

Industry: Education
GenAI Use Case: Digital Teachers

Description: GenAI can be used to hyper-personalize digital teachers that can adapt to student learning needs.

Change in Industry Rivalry: Moderate Decrease
The education industry typically competes on differentiation rather than on a cost basis (e.g., parents typically look at the reputation and quality of extracurricular academic programs or schools when deciding where to enroll their child). Both traditional schooling programs and extracurricular academic programs would be able to differentiate their offerings more with the inclusion of digital teachers. Traditional schooling programs will potentially be able to provide courses solely created by a digital teacher that can adapt to student needs, and extracurricular

programs can be more beneficial with a digital teacher / assistant that can provide aid outside of the program. Because the core offering of this industry is more differentiated, industry rivalry will decrease. The decrease is moderate instead of substantial because there are other factors that people consider when choosing an educational program (e.g., faculty expertise, location).

Change in Threat of New Entrants: Decrease
Digital teachers enhance the core offering in this industry: the education provided. Digital teachers can increase both the quality (e.g., adapting to student needs) and quantity (e.g., digital teachers would have more scope of knowledge than humans). The reason it is quite difficult for new entrants to enter this industry falls under a cause-and-effect chain. The first cause and effect relationship is that firms adopting this GenAI technology would cause customer stickiness to these firms, and the switching costs for education institutions / programs is quite high. The next cause and effect chain is that new entrants would want to incorporate this GenAI technology, which causes them to look for complementary assets to do so. Because the complementary assets required (e.g., training data on education subjects, student performances) are hefty and difficult to obtain for a newer education institution / program, the threat of new entrants would be significantly decreased in this industry.

Change in Bargaining Power of Buyers: Moderate Decrease
As mentioned in the 'Change in Industry Rivalry' section, customers typically look for differentiating factors when choosing an educational institution / program. Because this GenAI use case allows for heavy differentiation from traditional institutions / programs, parents will be more inclined to enroll their child in institutions / programs that employ digital teacher technology. The real decrease in bargaining power comes from the fact that there are high switching costs associated with enrolling a student in a different institution / program (e.g., loss of friends, monetary sunk costs, new pick-up / drop-off routine). This decrease is moderate instead of substantial because, as mentioned previously, some customers care more about the convenience of the institution / program rather than the quality education aspect of it.

Change in Bargaining Power of Suppliers: Slight Decrease
In this industry, the instructors are the suppliers. In the current and foreseeable future state of GenAI, human intervention is typically required to supplement and oversee the GenAI use case. In some simple cases, however, digital teachers can fully replace the human instructors. But in most of the cases, instructors would still be required to potentially explain to the students their progress in-person, check-up on students regarding their mental well-being, etc. Therefore, the bargaining power of suppliers would decrease, but it would only decrease slightly because there will still be demand for instructors.

Change in Threat of Substitutes: No Change
As mentioned in the 'Threat of New Entrants' section, the core offering in this industry is the education provided. The ones who provide the education are the instructors. Digital teachers may be able to supplement, and in some simple cases, even replace the instructors, but the core offering of this industry cannot be substituted with this GenAI use case. Because this GenAI use case only enhances the process of delivering the core offering of education to students, there is no change in the threat of substitutes in the education industry from GenAI-powered digital teachers.

Framework Example #2

Industry: Fashion Modeling
GenAI Use Case: Digital Fashion Models

Description: GenAI can create digital fashion models that will showcase fashion products.

Change in Industry Rivalry: Slight Decrease
Modeling agencies compete on differentiation rather than on a cost basis (e.g., firms that require models typically choose a modeling agency depending on either their relationship with the agency or the models signed with the agency). GenAI-powered digital models now provide modeling agencies with an additional service they can provide to their customers. Therefore, this new layer of differentiation of the core offering decreases overall industry rivalry. This decrease, however, is only slight for two reasons: the culture surrounding modeling and the scenarios in which models are required. Modeling is considered by many to be an art form that individuals participate in, which could deter firms from using GenAI-created models. Additionally, models are still needed for live events (e.g., fashion shows), and they cannot be replaced through a digital medium. For these reasons, the change in industry rivalry is a slight decrease.

Change in Threat of New Entrants: Slight Decrease
Building on top of the 'Change in Industry Rivalry' section, GenAI-powered digital models are mainly considered an addition to the human models that are offered by modeling agencies. A new entrant would be reluctant to enter the industry if it is trying to compete on the aspect of digital modeling – the complementary assets required (e.g., quality data on images of human to create any type of model) will be difficult to acquire to compete with some of the top firms within the industry that also employ this GenAI use case. But because digital models are considered a 'nice to have' within this industry, the threat of new entrants decrease slightly instead of drastically because many modeling agencies will be mainly competing on the reputation and human models employed by the agency.

Change in Bargaining Power of Buyers: No Change
The buyers in this industry are the firms that reach out to modeling agencies for models. As mentioned previously, two key decision-making factors a firm has in choosing a modeling agency is the reputation and relationship the firm has with the agency. Even if a non-reputable name modeling agency has better GenAI-powered digital models than a modeling agency a firm has been with for years, the firm is likely to stick with the modeling agency it has been with for years because the switching cost of building a new relationship with another modeling agency is quite high, and the reputation of the agency is lower. Therefore, there is negligible change in the bargaining power of buyers within this industry.

Change in Bargaining Power of Suppliers: Slight Decrease
In some cases (e.g., digital marketing campaigns), GenAI-powered digital models could replace human models. Therefore, there will be a decrease in the bargaining power of suppliers because the demand for them would theoretically decrease given the addition of this GenAI use case. However, there are many scenarios in which GenAI-powered digital models cannot be used (e.g., fashion shows). Additionally, previous discussion centered around how some firms would prefer

to use human models due to the culture surrounding modeling underscores this change in bargaining power of suppliers. Therefore, there will be a slight decrease in the bargaining power of suppliers in this industry.

Change in Threat of Substitutes: Slight Increase
As mentioned in the 'Change in Threat of New Entrants' section, GenAI-powered digital models are mainly considered an addition to the human models that are offered by modeling agencies. However, previous discussion showcased that in some cases (e.g., digital advertising), digital models could completely replace human models. Even though this is the case, discussion above mentioned how some agencies do not want to deploy GenAI models due to the culture in modeling, and how firms may not want to switch modeling agencies regardless of if they offer GenAI-powered digital models due to creating new relationships and weighing reputations of modeling agencies. Therefore, there is only a slight increase in the threat of substitutes.

6. ANALYSIS

6.1 Analysis on GenAI's Impact on Firm's Long-Term Profitability

20 GenAI use cases were applied to this framework. These GenAI use cases span across several major industries, and leading firms within those industries were selected as inputs. All data inputs and final scores in descending order are shown in the exhibit down below:

Firm	Industry	GenAI Use Case	WTP Score	Cost Score	Inimitability Score	Final Score
Disney	Entertainment	Story Generation	2	1	0.9	2.7
BuzzFeed	Journalism	News Content Creation	2	0	0.9	1.8
Disney	Entertainment	Voice Cloning	0	2	0.7	1.4
Amazon	Ecommerce	Customer Service Chatbots	0.5	2	0.5	1.25
Universal Music Group	Music	Music Creation	2	-0.5	0.7	1.05
Government	Government	Language Translation	2	0	0.5	1
Disney	Entertainment	Content Creation	2	-1	0.9	0.9
Walmart	Retail	Virtual Try-ons	2	-1	0.9	0.9
Large Private School	Education	Digital Teachers	2	-1.5	0.9	0.45
Mayo Clinic	Healthcare	Healthcare Data Analyzer	1	-0.5	0.7	0.35
Walmart	Retail	Product Specification Translation	1	-0.5	0.7	0.35
TravelMania	Tourism	Itinerary Planning	1	-0.5	0.7	0.35
Mayo Clinic	Healthcare	Automated Medical Writings	0	1	0.3	0.3
ModelManagement	Modeling	Digital Models	1	-0.5	0.5	0.25
Ford	Manufacturing	Product Design Optimization	2	-1.5	0.5	0.25
Citi	Finance	Financial Report Generation	0	0.5	0.3	0.15
Walmart	Retail	Product Description Creation	0	-1	0.5	No Profit
Microsoft	Technology	Code Assist	0	-1	0.7	No Profit
Disney	Entertainment	Text-to-Image Creation	0	-1	0.7	No Profit
Microsoft	Gaming	In-Game Material Creation	0.5	-0.5	0.9	No Profit

Overarching statistics that provide insights on WTP, Cost, Inimitability and Final Scores are shown in the exhibit down below:

Metric	WTP Score	Cost Score	Inimitability Score	Final Score
Mean	1.050	-0.225	0.670	0.841
Median	1.000	-0.500	0.700	0.675
Max	2.000	2.000	0.900	2.700
Min	0.000	-1.500	0.300	No Profit

The first takeaway is that deploying a GenAI use case typically results in long-term profitability for leading firms within their respective industries. This is proven with the mean of 0.841 and median of 0.675, both of which are positive values.

The second takeaway is that WTP on average showed a moderate increase, whereas Cost on average fell on the side of barely increasing. Analysis of WTP in the first chart illustrates that this increase is predominantly observed when the GenAI application impacts or enhances the core product offering rather than serving as an internal efficiency booster. As per Cost, the data in the first chart indicates a slight uptick in costs for leading firms across most GenAI use cases. In many instances, GenAI does not entirely replace human workers or significantly enhance cost efficiency, resulting in a net increase in costs rather than a reduction. Stemming off this insight, there is a common tendency to associate high willingness to pay with high potential for business profitability, overlooking the cost implications. The framework demonstrates that certain GenAI

use cases with high willingness-to-pay, such as Product Design Optimization, may not necessarily translate to long-term profitability for firms when considering associated costs. Conversely, GenAI use cases with lower willingness-to-pay, such as Translating Product Specifications, could potentially lead to greater profitability due to more manageable cost implications.

The third takeaway is that as per inimitability, the extent varies depending on the firm and the nature of the GenAI use case. For instance, while Disney possesses extensive training data regarding stories for GenAI-powered story generation due to its ongoing work in entertainment, it may lack comparable data on pure voice acting, resulting in a lower inimitability score for voice cloning compared to story generation. Thus, resulting in a lower overall final score for voice cloning.

Overall, GenAI use cases impact profitability uniquely across different firms and industries. This emphasizes the importance of assessing specific GenAI applications rather than treating GenAI as a generic category. For example, Walmart may benefit more from utilizing GenAI-powered virtual try-ons compared to GenAI-powered product description creation. This nuanced understanding allows for a deeper exploration of the long-term profitability implications associated with each use case.

6.2 Analysis on GenAI's Impact on Industry Profitability

The framework was applied to 19 GenAI cases (not applied to "Language Translation" due to Government industry use case). The data inputs and final scores in descending order are shown in the exhibit down below:

Firm	Industry	GenAI Use Case	Change in Rivalry Among Existing Competitors	Change in Threat of New Entrants	Change in Bargaining Power of Buyers	Change in Bargaining Power of Suppliers	Change in Threat of Substitutes	Final Score
Large Private School	Education	Digital Teachers	-2	-3	-2	-1	1	-7
Disney	Entertainment	Voice Cloning	-3	-2	-2	-3	3	-7
BuzzFeed	Journalism	News Content Creation	-2	-2	-1	-1	1	-5
Walmart	Retail	Virtual Try-ons	-2	-1	-2	-1	1	-5
Disney	Entertainment	Story Generation	-2	-1	0	-2	1	-4
Disney	Entertainment	Content Creation	-2	-2	0	-1	2	-3
Microsoft	Gaming	In-Game Material Creation	-1	-1	-1	-1	1	-3
Disney	Entertainment	Text-to-Image Creation	-2	-2	0	-1	2	-3
Walmart	Retail	Product Specifications Translation	-1	0	-1	-2	1	-3
ModelManagement	Modeling	Digital Models	-1	-1	0	-1	1	-2
TravelMania	Tourism	Itinerary Planning	-1	-1	0	0	0	-2
Microsoft	Technology	Code Assist	-1	-1	0	-1	1	-2
Citi	Finance	Financial Report Generation	0	0	0	-3	1	-2
Universal Music Group	Music	Music Creation	-1	-1	0	-1	1	-2
Amazon	Ecommerce	Customer Service Chatbots	0	0	0	-3	2	-1
Mayo Clinic	Healthcare	Healthcare Data Analyzer	-1	0	0	0	0	-1
Mayo Clinic	Healthcare	Automated Medical Writings	-1	0	0	-2	2	-1
Walmart	Retail	Product Description Creation	0	0	0	-1	1	0
Ford	Manufacturing	Product Design Optimization	-1	0	0	-1	2	0
Government	Government	Language Translation	-	-	-	-	-	-

Overarching statistics that provide insights on the five forces and final scores are shown in the exhibit down below:

Metric	Change in Rivalry Among Existing Competitors	Change in Threat of New Entrants	Change in Bargaining Power of Buyers	Change in Bargaining Power of Suppliers	Change in Threat of Substitutes	Final Score
Mean	-1.263	-0.947	-0.474	-1.368	1.263	-2.789
Median	-1.000	-1.000	0.000	-1.000	1.000	-2.000
Max	-3.000	-3.000	-2.000	-3.000	0.000	-7.000
Min	0.000	0.000	0.000	0.000	3.000	0.000

The first takeaway is that a GenAI use case is likely to make an industry more profitable for an industry incumbent. This is proven with the overall mean of -2.789 and median of -2.000, and the minimum score being 0.000.

The second takeaway is the force that changed the least is the Change in Bargaining Power of Buyers. This indicates that GenAI use cases do not affect buyers as much as the other forces. By looking at some of the GenAI use cases, this makes complete sense. For example, 'Code Assist for Developers' will aid the efficiency of a software team within a firm, but it truly has no significant effect on the buyer within the industry. It is not providing the buyer a more "refined" or "quality" output that is significant enough to change their bargaining power greatly within the industry.

The third takeaway is the force that changed the most is Bargaining Power of Suppliers. In most cases, GenAI is not a direct substitute for the core offering within a firm. In the use cases above, GenAI typically enhances something in the process of creating the core offering or enhances the core offering itself. In turn, this decreases the bargaining power of the suppliers because they are theoretically less in demand if something can do a part of their jobs to make the core offering more appealing to the customer.

Overall, the analysis highlights the nuanced impacts of GenAI across different industry forces, providing valuable insights for industry incumbents to navigate the evolving landscape of this technological disruption.

7. CONCLUSION

GenAI is one of the most disruptive innovations in recent times. As mentioned earlier in the paper, GenAI could add the equivalent of $2.6 trillion to $4.4 trillion annually in value among all industries globally (Kamalnath et al., 2023). Therefore, it is critical to assess the impact of GenAI use cases on the profitability of businesses and industries.

To assess this, two frameworks were created. The first framework incorporated the factors of WTP, cost, and inimitability to assess long-term profitability impact of a GenAI use case when deployed by a specific firm. The second framework was built upon the foundation of Porter's Five Forces to see how each force changes based on the introduction of a GenAI use case by an

industry incumbent. By implementing randomly selected GenAI use cases into these frameworks, two critical and overarching insights appeared.

The first insight is the types of businesses that can cut costs effectively with GenAI usage are the ones likely to profit greatly from deploying a GenAI use case. By looking at the results from Section 6.1, the WTP score never went below 0. The Cost score, however, fluctuated between -1.500 and 2.000. This indicates that a GenAI use case will not decrease the WTP of a product / service, but a GenAI use case could increase the costs for a firm. Thus, businesses that can cut costs using the GenAI use case are likely to be more profitable than businesses that blindly look at the impact on WTP. The results of Section 6.1 highlight three of the four GenAI use cases with the highest long-term profitability final scores have Cost scores that are positive. This insight is critical to understand because it levels the 'hype' surrounding GenAI in modern society. Firms should not simply deploy a GenAI use case because they believe the value of a product / service will increase significantly due to the GenAI-powered backing – the costs are a vital consideration for long-term profitability.

The second insight is that within the same industry, the impact of GenAI utilization varies depending on the specific use cases adopted by the industry's incumbents. Statements such as "Banking, high tech, and life sciences are among the industries that could see the biggest impact…" (Chui et al., 2023) spur a notion that any GenAI use case deployed by one of these industries' incumbents would have a big impact on the industry. However, the results of Section 6.2 reveal a divergence in the industries affected by their incumbents' deployment of specific GenAI use cases, evidenced by the variation of final scores (e.g., the Retail industry is in the top quarter of final scores for the "Virtual Try-Ons" use case, but the industry is also in the bottom quarter of final scores for the "Product Description Creation" use case). This insight is significant because it pushes the notion to delve deeper into GenAI's influence on industry profitability by analyzing specific GenAI use cases rather than merely examining the broad category of GenAI usage.

Ultimately, the frameworks showcased in this paper offer a structured approach to answer the following question: *How to assess Generative Artificial Intelligence (GenAI) implications on business profitability?* By leveraging these tools, anyone can make informed decisions, mitigate risks, or capitalize on opportunities in a GenAI-driven world. As GenAI continues to evolve, society must learn to adapt its methods and processes to assess the impact of GenAI on business profitability.

8. REFERENCES

1. Adobe. 2024. *Welcome to Generative AI*. Adobe.
2. Al-Amin, Md., Ali, M. S., Salam, A., Khan, A., Ali, A., Ullah, A., Alam, M. N., & Chowdhury, S. K. 2024. *History of Generative Artificial Intelligence (AI) chatbots: past, present, and future development*. arXiv.org.
3. Amazon Web Services. *Generative AI Use Cases and Resources*. Amazon Web Services.
4. Bamberger, S., Clark, N., Ramachandran, S., & Sokolova, V. 2023. *How Generative AI is Already Transforming Customer Service*. Boston Consulting Group.
5. Chakraborty, U., & Kumar, S. 2023. Rise of Generative AI and ChatGPT: Understand How Generative AI and ChatGPT are Transforming and Reshaping the Business World.
6. Chui, M., Hazan, E., Roberts, R., Singla, A., Smaje, K., Sukharevsky, A., Yee, L., & Zemmel, R. 2023. *The Economic Potential of Generative AI: The Next Productivity Frontier*. McKinsey & Company.
7. Deloitte. *The Generative AI Dossier*. Deloitte.
8. Dwivedi, Y. K., Pandey, N., Currie, W., & Micu, A. 2023. *Leveraging ChatGPT and other Generative Artificial Intelligence (AI)-based applications in the hospitality and tourism industry: practices, challenges and research agenda*. Emerald Insight.
9. Elimian, G. 2023. *ChatGPT costs $700,000 to run daily, OpenAI may go bankrupt in 2024*. TechNext.
10. Harvard Business School. *The Five forces*. Harvard Business School - Institute for Strategy And Competitiveness.
11. Hu, K. 2023. *CHATGPT sets record for fastest-growing user base - analyst note | reuters*. Reuters.
12. Huang, H. 2023. *What CEOs Need to Know About the Costs of Adopting GenAI*. Harvard Business Review.
13. Kamalnath, V., Lerner, L., Moon, J., Sari, G., Sohoni, V., & Zhang, S. 2023. *Capturing the full value of Generative AI in banking*. McKinsey & Company.
14. Kanbach, D. K., Heiduk, L., Blueher, G., Schreiter, M., & Lahmann, A. 2023. *The GenAI is out of the bottle: Generative Artificial Intelligence from a Business Model Innovation Perspective*. Springer Link.
15. Lawton, G. 2023. *Generative AI vs. Predictive AI: Understanding the differences*. Enterprise AI.
16. Margolis, S. 2024. *Generative AI pricing: 3 major considerations + an AI glossary*. SADA.
17. Morris, J. 2021. *VRIO Analysis*. Strategic Management 2E.
18. OpenAI. 2021. *Dall·E: Creating Images from Text*. DALL·E: Creating images from text.
19. Patel, V. 2022. *Markov Chain Explained*. Built In.
20. Powell, K. 2024. *NVIDIA Generative AI Is Opening the Next Era of Drug Discovery and Design*. NVIDIA.
21. Schuller, S. 2023. *A 6-category Taxonomy for Generative AI Use Cases*. Nuvalence.
22. Stobierski, T. 2020. *Willingness to Pay: What It Is & How to Calculate*. Business Insights.

23. Taulli, T. 2023. *Generative AI: How ChatGPT and Other AI Tools Will Revolutionize Business*. Springer Link.
24. Wiggers, K. 2024. *OpenAI built a voice cloning tool, but you can't use it... yet*. TechCrunch.

9. APPENDIX

Appendix A: GenAI Use Cases

Industry	Title	Description	Categories
Entertainment	Automated Content Tagging	GenAI can be used to auto-tag and index massive media libraries for easier se	Complimentary Assets Needed
Healthcare	Automated Medical Writings	GenAI can generate reports to provide patients with clear and concise informa	Effect on Willingness to Pay
Healthcare	Chest Radiograph Creation	GenAI can create CXR images, which can be controlled to a new extent by usin	Effect on Cost
Healthcare	Claims Submission Simplifier	GenAI can categorize incoming claims and analyze and assign accurate codes (	Risk / Cost of Hallucinations
Technology	Code Assist	GenAI can be used to supplement the work of software developers by helping (	Potential Price Point
Entertainment	Content Creation	GenAI tools can facilitate content creation (e.g., conversational editing, text-to	What Use Case Replaced / Enhances
Finance, Ecommerce	Customer Service Chatbots	GenAI generates personalized responses when individuals submit text or speec	Target Customer
Modeling	Digital Models	GenAI can create video and still images to showcase products to a diverse set	-
Education	Digital Teachers	GenAI can be used to hyper-personalize digital teachers that can adapt to stud	-
Life Sciences	Drug Discovery	GenAI tools can be used to generate novel molecules likley to possess desired	-
Finance	Financial Report Generation	GenAI can create financial reports when provided with financial data	-
Healthcare	Healthcare Data Analyzer	GenAI analyzes patient data and provides real-time findings / updates to healt	-
Gaming	In-Game Material Creation	GenAI can creates materials from text prompt	-
Tourism	Itinerary Planning	GenAI can create itineraries	-
Government	Language Translation	GenAI can be used to scale content across regions by translating and convertin	-
Government	Legislative Document Summarization	GenAI can help legislative staff more rapidly transcribe and summarize hearni	-
Entertainment	Lyric Generation	GenAI model can generate lyrics when provided with the aura / mood of the s	-
Ecommerce	Marketing Strategy Creation	GenAI models can be trained on the vast amounts of consumer data to genera	-
Healthcare	Medicine Recommendation	GenAI can create personalized treatment plans based on a patient's genetics,	-
Music	Music Creation	GenAI can create music when given prompts such as "a calming violin melody'	-
Journalism	News Content Creation	GenAI can enhance its quizzes and personalize content for audiences	-
Retail	Optimized Pricing	GenAI models can continuously run simulations to set optimal pricing for good	-
Manufacturing	Product Design Optimization	GenAI can generate and assess countless design options (e.g., semiconductor (	-
Retail	Product Specifications Translation	GenAI can generate summaries of technical specifications for customers base	-
Retail	Production Description Creation	GenAI model can analyze product specifications and features and craft engagi	-
Finance, Marketing	Promotion Planning	GenAI can be used to prepare promotion plans, negotiation materials, pre-wor	-
Entertainment	Sports Highlight Creation	GenAI can detect hightlights and automatically generate polished packages an	-
Entertainment	Story Generation	GenAI can create a story when provided with some information (characters, sa	-
Entertainment	Text-to-Image Creation	GenAI can create images from text inputs	-
Life Sciences	Trial Enrollment Creation	GenAI can match patients to clinical trials bsaed on inclusion and exclusion crit	-
Government	Urban Planning Simulation	GenAI can create thousands of 3D images to refine a city design	-
Retail	Virtual Try-ons	GenAI can synthesize realsitic images of people wearing different items	-
Entertainment	Voice Cloning	GenAI can create a voice clone based on inputted voice and text to be said	-

Appendix B: GenAI Input / Output Structure

Company	Model	Type	Price
OpenAI	GPT 4.0 8k context	Input	$0.03/1k tokens
		Output	$0.06/1k tokens
	GPT 4.0 32k context	Input	$0.06/1K tokens
		Output	$0.12/1K tokens
	GPT-3.5 Turbo 4k context	Input	$0.0015/1K tokens
		Output	$0.002/1K tokens
	GPT-3.5 Turbo 16k context	Input	$0.003/1K tokens
		Output	$0.004/1K tokens
Google	PaLM 2 for Text	Input	$0.0005/1K characters
		Output	$0.0005/1K characters
	PaLM 2 for Chat	Input	$0.0005/1K characters
		Output	$0.0005/1K characters