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FINANCIAL ANALYSIS OF BIG TECH GIANTS

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Financial Analysis of Big Tech Giants

I. Introduction

The technology sector has experienced significant growth in recent years, particularly with the rise of artificial intelligence. This industry includes companies involved in research, development, and distribution of technology-based goods, services, and products. Tech giants like Google, Microsoft, Amazon, and Apple lead in innovation, but maintaining a healthy financial performance is crucial. This project focuses on analyzing their financial statements to ensure long-term stability and growth.

II. Objectives

This project aims to:

Analyze financial trends of major tech giants over the past five years.

Examine financial statements from annual reports, including balance sheets, income statements, and cash flow statements.

Identify key performance metrics, such as revenue growth, net income, and earnings per share. The metrics can be compared across years to identify trends or changes in performance.

Assess stock performance to gauge investor valuations. Assessing stock performance can provide insights into investor valuations of a company. The stock price of a company reflects the market's perception of its value, and factors in various aspects such as financial performance, industry trends, and market conditions. Therefore, by analyzing the performance of a company's stock over time, you can gain insights into how investors perceive the company's financial performance, growth prospects, and potential risks.

Monitor revenue trends and segment performance. Monitoring revenue trends and segment performance can provide insights into the health and growth prospects of a company.

Analyzing the annual report of a company can provide a wealth of information about its financial performance, operations, and prospects. The annual report is a comprehensive document that provides an overview of the company's business activities over the past year, including financial statements, segmental revenue, product categories and market trends.

III. Data Description

1. Annual reports of Google, Microsoft, Amazon, and Apple from 2018 to 2022
2. Balance sheets of Google, Microsoft, Amazon, and Apple (obtained using yfinance)
3. Opening & Closing Stock prices

IV. Data Preparation

1. Five CSV files were prepared after fetching the balance sheets of Google, Microsoft, Amazon, and Apple.
2. The data was read from the file using python and was transformed as Data Frame.
3. The following variables were used for analysis:
    a. Revenue
    b. Earnings per share
    c. Open stock price
    d. Closed stock price
    e. Gross profit
    f. Net Income

V. Methodology

1. Balance Sheet Analysis

I. The CSV files were imported into python and pandas were used to read and convert the files into Dataframe using pd.read_excel() function in pandas.

II. Data cleaning and preprocessing: Use Pandas and Python functions to clean, process, and transform the data. This step may involve removing missing or incorrect data, handling duplicates, and converting data types.

III. To analyze the earnings data from the csv files, panda's library in Python was used including NumPy and Matplotlib. Pandas combines them into a single data frame, and computes some basic statistics:

IV. Calculated the key financial metrics: Calculate key financial metrics such as revenue growth, net income, earnings per share, and return on equity using Pandas.

V. To plot the earnings data from the four csv files on a line graph, matplotlib library was used which plotted the revenue data for each company over time. It then selected the 'Revenue' column for each company and plotted it using the plot function. The legend function adds a legend to the plot using the names of the companies. The xlabel, ylabel, and title functions set the labels and title for the plot. Finally, the show function displays the plot.

VI. The above step was performed to plot the Revenue generated by the four companies from 2018 to 2022. Similar step was performed to analyze the earnings sheet for the companies further.

VII. Visualizations were created for Gross Profit and Net Income to further get more insights into the financial performance of these companies in last five years.

VIII. The revenue trends were plotted over the years for each of the four Data Frames using Matplotlib on a line graph to which titles and labels were also added to identify each data frame.

IX. Then the plot was made for the net income trends over the years for each of the four Data Frames on a bar plot

X. Lastly we will plot the gross profit trends over the years on a histogram 2x2 grid of subplots using the subplots () method of matplotlib. For each data frame, it plotted the histogram of

the Gross Profit column using the hist () method of the corresponding subplot. The number of bins for the histogram is set using the bins parameter.

2. Stock Price Analysis

I. Further stock analysis was done to know the performance of the stocks of the companies over the last years.

II. For analysis of the stock performance, calculate the moving averages for each stock in the stock_data Data Frame. The rolling () method is used to create a rolling window over the Close column of each stock, and the mean () method is called on the rolling window to calculate the moving average. sma_20 calculates the 20-day simple moving average for each stock, while sma_50 calculates the 50-day simple moving average for each stock.

III. Then a plot was generated using the plt.plot() function in Matplotlib. The loop iterates over the four stock tickers and plots the stock prices, 20-day moving averages, and 50-day moving averages for each ticker. The functions are used to add a title, x-axis label, y-axis label, and legend to the plot.

IV. In this analysis the stock data for four companies, calculates their moving averages, and plots the prices and moving averages over time were plotted using matplotlib and it then calculates the percentage change in the stock prices for each year and the total percentage increase in the stock prices over the entire four-year period, and plots the latter on a bar plot.

3. Annual Report Analysis

Step 1: Conversion of multiple PDF files to JSON format, which can be helpful for text analysis.

I. The analysis of the report were done do further to provide information about its financial performance, operations, revenue and its segment streams , products of the technical giant as well as insights into the industry and their performance overall.

II. I had downloaded the pdf files of the annual reports of Google, Amazon, Microsoft and Apple. The pdf files were further processed for its analysis. The pdftotext library in python was used to convert the PDFs, for preprocessing the text and converting into a JSON file.

The resulting JSON files were saved in a new directory with the same name as the PDF directory, but with the suffix _json. Necessary libraries were imported including os,json and pdftotext.

III. The files were preprocessed to remove the unwanted characters and the extra white spaces.

Step 2: Creating a financial analysis Chatbot

I. For the financial analysis of the multiple annual reports of four companies over the last five years I decided to create a chatbox that would assist in the financial analysis of the annual report text files using ChatGPT API.

II. To create this interface the necessary libraries and modules for the financial analysis were imported. The openai library provides an interface to OpenAI's GPT-3 API, while the gradio library provides a user interface for the chatbot.

III. The search_model module contains a SearchModel class and a load_searching_model function for searching for relevant information in the financial reports. These were used to generate a prompt for the GPT-3 engine. This was done due to the limitation of prompt size i.e. 4096 tokens and the annual reports are often <=100K plus words.

IV. For the python code the “def_generatetext” was used this function generates text using OpenAI's GPT-3 API. It takes in an OpenAI API key, a prompt(which the user will provide), and an engine name (defaulting to gpt-3.5-turbo), and returns the generated text.

V. Then the function “def generate_answer” takes in the question or the prompt given by the user, the OpenAI API key (provided to the user), a searching model object and prompt instructions, and returns the answer generated by OpenAI GPT-3.5-turbo engine. It first uses the searching model to find the top N relevant chunks of text from the annual report (using semantic search) data for the given question. It then creates a prompt containing the background information, the search results, the prompt instructions, and the question.

Finally, it calls the generate_text function to generate the answer from the prompt using the OpenAI API.

VI. The interface that will be created will have four parts of questions for this the function will take four arguments: company, year, question, and openAI_key.This openAI_key is used to generate answer to the user's input. The function first checks if the openAI_key is empty and returns an error message if it is. It then checks if the company and year inputs are valid and returns an error message if they are not. Finally, it loads the appropriate searching model for the given company and year, and passes the question, OpenAI key, searching model, and prompt instructions to the generate_answer function to generate a response to the user's question.

VII. The last step of this part is creation of the web interface or an application using the necessary libraries. The application is built using the Gradio library, which allows for easy creation of web-based user interfaces for machine learning models. for the user to input the company name, year, question, and OpenAI API key. Once the user clicks on the submit button, the question_answer function is called, and the answer is displayed to the user in the answer text box.

VIII. The prime function of this part will be the question_answer function, which will take as input the name of any of the companies, the year of an required annual report which needs to be analyzed, a user's question, and an OpenAI API key. The function then uses a pre-trained model to search the annual report for relevant information based on the user's question, this information is added as the background information in the prompt. It is then provided this prompt which includes the background information, question and the instructions(for the model) Then this prompt was sent to the OpenAI model which generates the answer.

VI. Results

1. While analysis the revenue trends using the balance sheet and generating the line bar which plotted the revenue data for each company over time it showed that total revenue for all the tech giants – Google, Amazon, Microsoft and Apple have increased from 2018 to 2022 despite two years of pandemic. There was a steep increase seen in the total revenue of Amazon from 2018 to 2022 and exponential increase for Apple from 2020 to 2021 during the first covid year which was very similar to Google's. The revenue for Microsoft increased linearly.

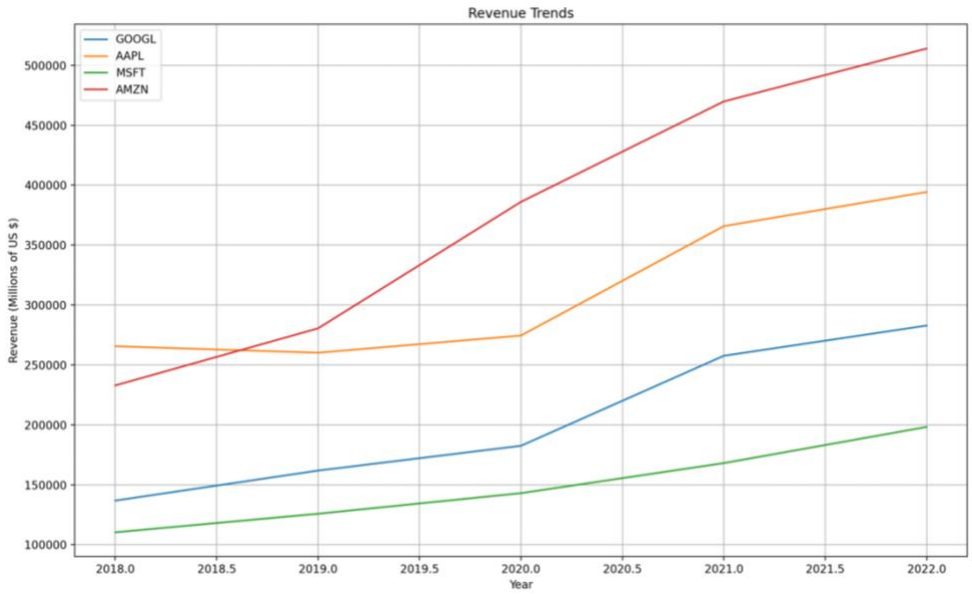

Figure 1: Line Bar of Revenue Trends over last five years

2. While analyzing the Net Income using the balance sheet using a bar plot, the net income has only increased over the last five years for Microsoft and Apple as shown in the graph. Microsoft saw a linear increase overall despite the pandemic. The net income for Apple was stagnant till 2020 after which it saw a exponential increase. After the pandemic i.e. from 2021 to 2022 the net income of Google and specially Amazon saw a sudden decline. This can be used to less use of the ecommerce and online platform and services post pandemic. During the late quarters of 2022 Amazon faced significant losses.

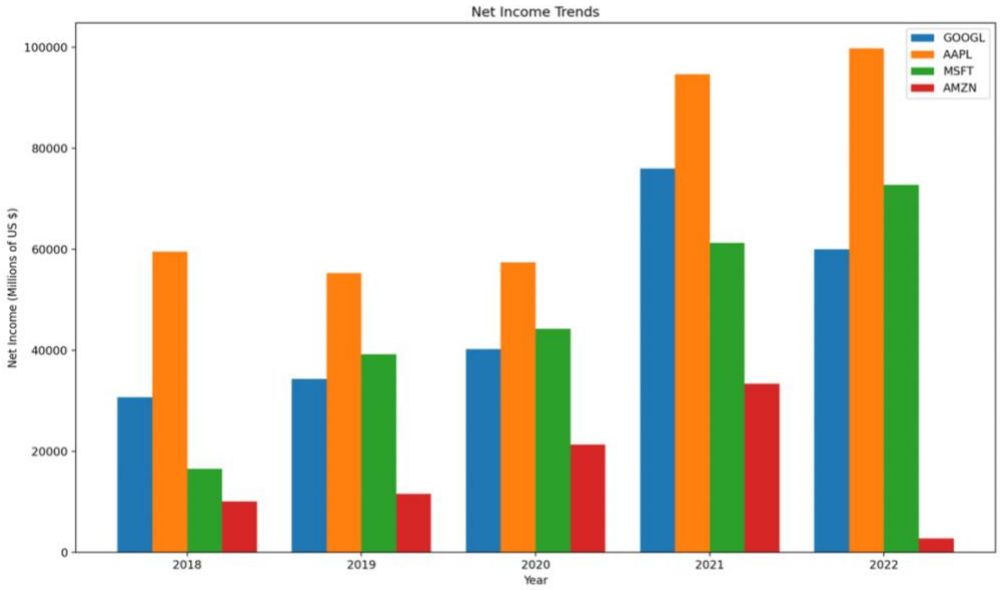

Figure 2: Bar Plot of Net Income over last five years

3. The trend for the Gross Profit using the balance sheet and generating the line bar which plotted the revenue data for each company over time it showed that total profits for all the tech giants – Google,Amazon,Microsoft and Apple have increased from 2018 to 2022 despite two years of pandemic.

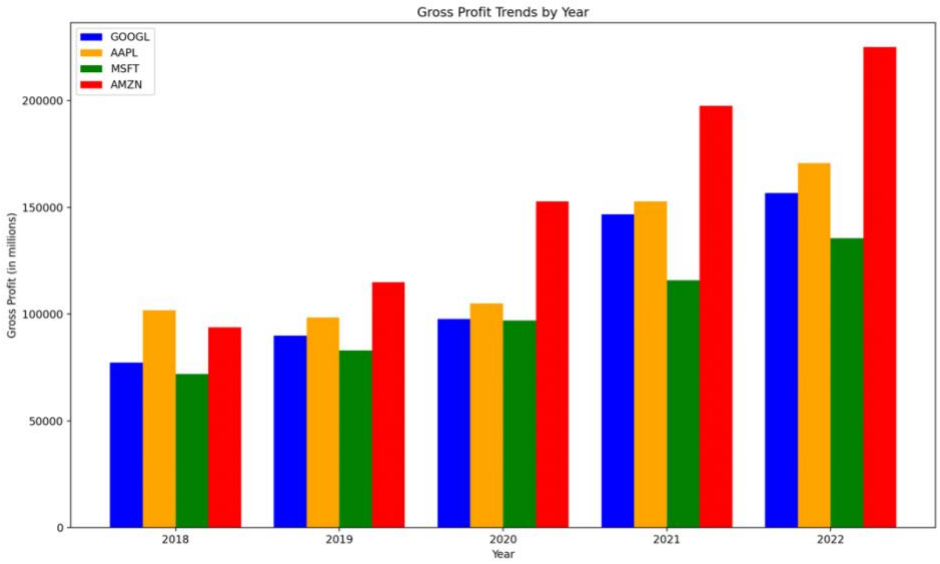

Figure 3: Bar Plot comparing Gross Profit over last five years

4. The trend for the Stock prices were observed using the moving averages for 20 and 50 days over the time. Microsoft and Apple have seen increases in the prices of their stocks over the time as suggested by the gross profit, whereas Amazon's stock price slashed and so did Google's.

Figure 4: Line Graph with moving averages of the stocks

5. The below bar plot shows the percentage increase in the stock prices over the five years for Apple being the highest and as shown by the moving average curve as well Amazon had the lowest stock price.

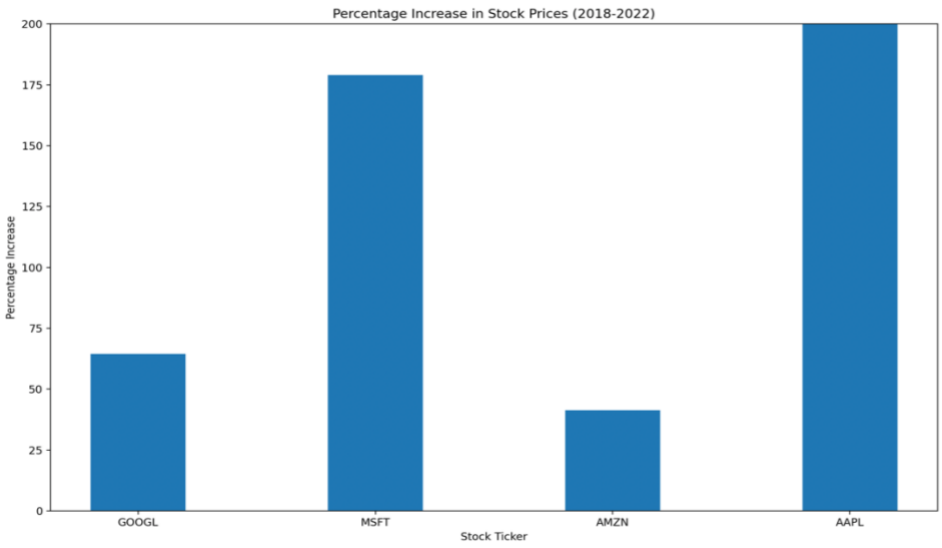

Figure 5: Bar plot showing percentage increase in stock prices

6. Financial Analysis using the Chatbot: -

Step 1: A hyperlink for the interface obtained using the gradio library will be created in the output console which will direct to the webpage where the user can obtain its OpenAI API key.

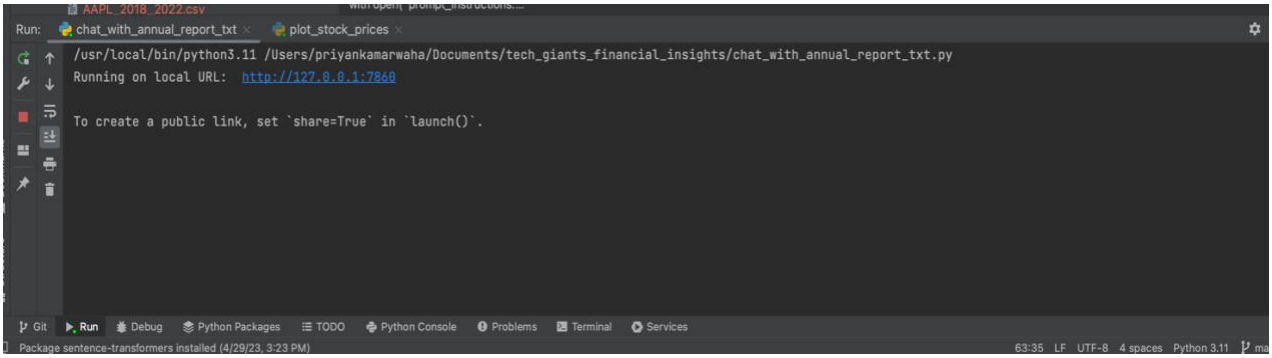

Figure 6: Screenshot of hyperlink generated directing to the interface

Step 2: The Chatbot for the financial analysis would be created at this interface which will take four entries: The OpenAI API key, the name of the company, the year and the question/keyword for the required analysis.

In this case the entry was provided with the company name as Apple, the year 2019 and the user wanted to know- “Which product category generated the maximum revenue” After doing the analysis the GPT uses a pre-trained model to search for relevant information in the financial report and generates a prompt that is fed into the GPT-3.5-turbo engine to generate an answer. The answer is displayed in a textbox on the Gradio interface.

The answer tells the user how he can find this relevant information on page 23, present in the Apple’s annual report for the year 2019..

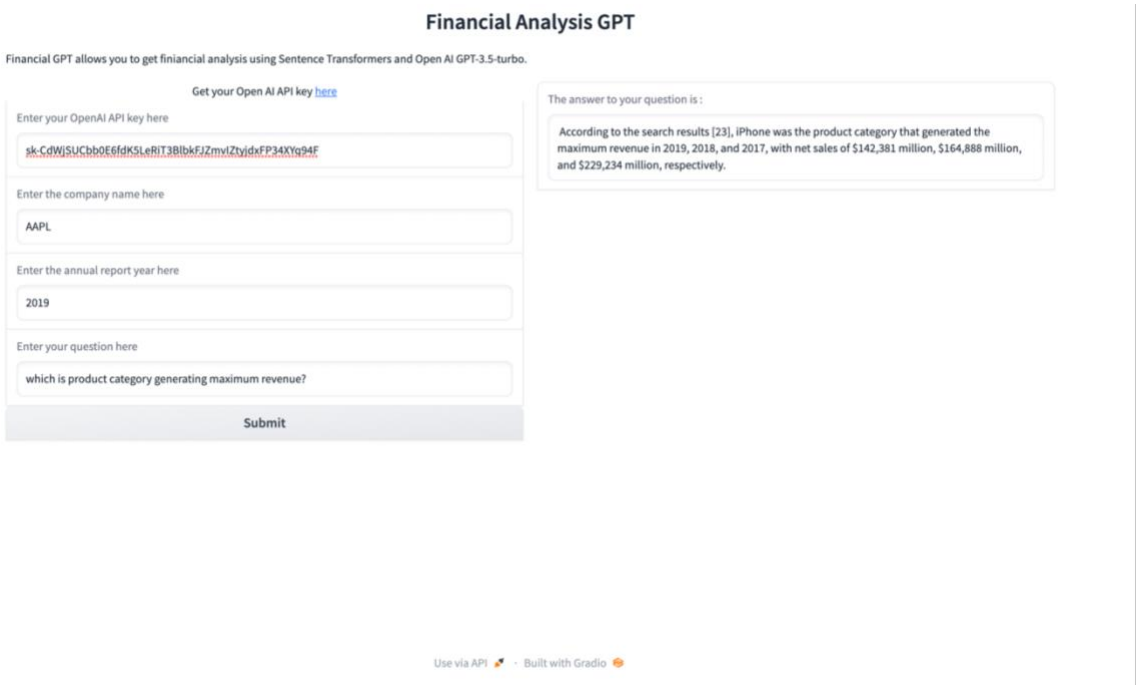

Figure 7: Screenshot of the Chatbot based on ChatGPT 3.5 for the financial analysis

Here we have more examples how the financial Chatbot can be used for analyzing different kinds of information present in the annual report of a company. We can extract information like Challenges faced by the company or which product/country generates maximum revenue.

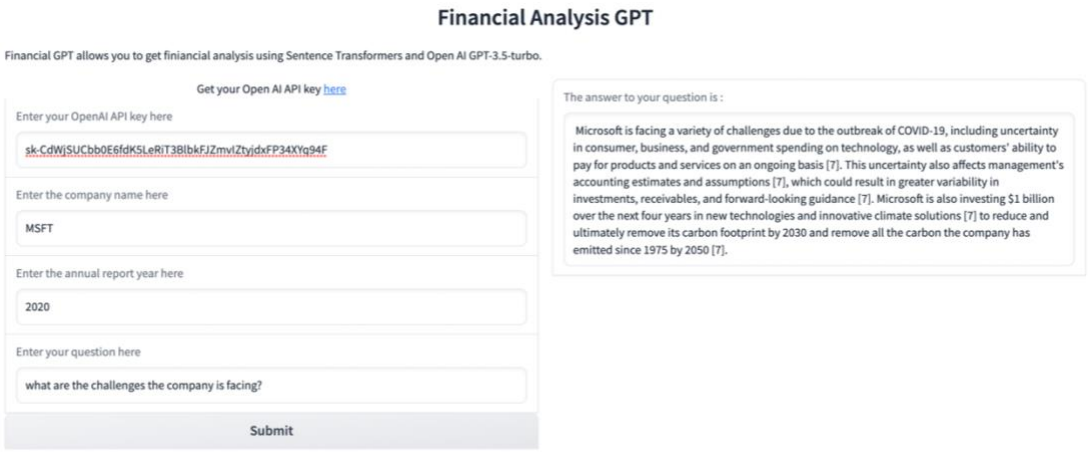

Figure 8: Screenshot of the Chatbot analyzing Microsoft's annual report

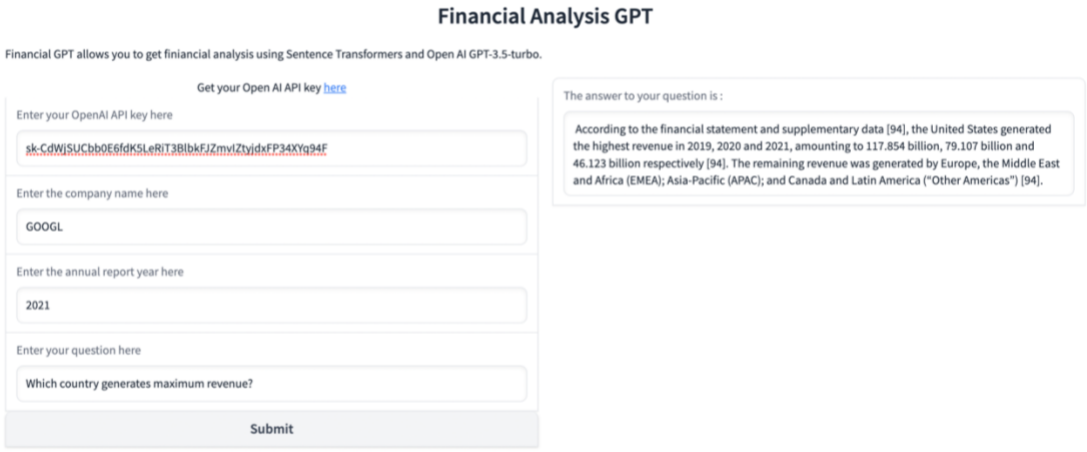

Figure 9: Screenshot of the Chatbot analyzing Google's annual report

VII. Conclusions

From the above results and by carrying out the above financial analysis of four different technical giants. We can drive the following conclusions: -

1. All the four companies i.e. Apple, Amazon, Google and Microsoft have generated exponential revenues through the last five years, the business was expanding for these companies since in all the cases revenue was increasing over the time.

2. In the case of analyzing the net income we see that Amazon saw a steep decrease vs all the other four giants followed by Google this also shows why these companies have been in losses post pandemic even after generating more revenue since the last year it indicates that the company's expenses have increased at a faster rate than its revenue. This could be due to various factors such as an increase in the cost of goods sold, higher operating expenses, or increased investment in research and development, marketing, or other areas of the business. While higher revenue is generally seen as a positive sign for a company, it is important to consider the profitability of the company as well. A company may generate more revenue but if its expenses are increasing at a faster rate than its revenue, it may not be sustainable in the long run.

3. Since we can see in the above results the profitability of Amazon and Google have gone down vs that of Apple and Microsoft, it also reflects in the price of their stocks as well as in the decrease in the value of their stocks over the time which also shows their market performance. If a company's stock is falling despite an increase in revenue just as in case of Google and Amazon, it could indicate that investors are concerned about the company's profitability or future growth potential. While revenue growth is a positive sign for a company, it may not necessarily translate into higher profits or a higher stock price which can lead to investors concern about the company's ability to sustain revenue growth.

4. The Chatbot has enabled to carry out smooth analysis of the annual reports which are generally quite large to analyze. The chatbot can be helpful in extracting specific data from the annual reports which can tell about the Company’s financials, businesses, operations, products and market position. The application of a chatbot for the financial analysis of an annual report of a company can be very useful for investors, analysts, and other stakeholders who want to quickly and easily access financial information and insights about a company.The chatbot can also provide insights into industry trends, competitive analysis, and other factors that may impact the company's financial performance.

VIII. References

1. Stock prices and Balance sheets values by yfinance

2. https://www.sbert.net/

3. pdfGPT :- https://github.com/bhaskatripathi/pdfGPT

4. Annual reports- Downloaded via Company's website