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**Group 05: Final Report**

**Submitted by: Group 5                                     Grade/Comments**

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Contents

[1. Executive Summary 3](#_Toc132750467)

[2. Introduction 3](#_Toc132750468)

[3. Business Problem Overview 4](#_Toc132750469)

[4. Analytics Question 5](#_Toc132750470)

[5. Scope Statement 5](#_Toc132750471)

[6. Data sources/key data entities and flows 6](#_Toc132750472)

[7. Data manipulation process and data output 9](#_Toc132750473)

[8. New solution design and it’s fit into the existing IT architecture 15](#_Toc132750474)

[9. New solution implementation and outcome testing 17](#_Toc132750475)

[10. Potential solution optimization 21](#_Toc132750476)

[References 24](#_Toc132750477)

[Appendix 24](#_Toc132750478)

# 1. Executive Summary

FSA Valuation Services is facing challenges with the misaligned structure of the summary page in their Excel sheet and the convoluted arrangement of sub-windows containing varied stock product ratings. These challenges hinder their analysis process and make it difficult for clients to comprehend the data's relevance. To address these problems, our team proposes adapting and personalizing the dashboards and their visual representations using the capabilities of Power BI software. This solution will enable FSA Valuation Services to present stock portfolio data more effectively and assist clients in determining whether their investment portfolio meets their goals and preferences based on the portfolio's risk and performance criteria. The report created through Power BI will provide a clear representation of complex financial data and aid in decision-making for businesses.

# 2. Introduction

FSA Valuation Services is a company engaged in the portfolio management of North American stock market-listed companies. They receive data from Morning Star, which requires data cleaning, manipulation, and processing techniques to ensure that the data is converted into a highly relevant and actionable format suitable for analysis and reporting activities. However, FSA Valuation Services is facing challenges with the misaligned structure of the summary page in their Excel sheet and the convoluted arrangement of sub-windows containing varied stock product ratings. These challenges hinder their analysis process and make it difficult for clients to comprehend the data's relevance.

To address these problems, our team proposes adapting and personalizing the dashboards and their visual representations using the capabilities of Power BI software. Power BI provides superior dashboard customization and visualization possibilities, faster data processing than Excel, and the ability to compare tables, reports, and data files. The report created through Power BI will provide a clear representation of complex financial data and aid in decision-making for businesses.

This report aims to provide an overview of the project, the benefits of using Power BI software, and the proposed solution for FSA Valuation Services. The report will also discuss the methods and techniques used to achieve the project's objectives, the expected outcomes, and the potential impact on the organization. Overall, the report will demonstrate how the proposed solution will enhance FSA Valuation Services' portfolio management services, improve clients' understanding of their investment portfolio's risk and performance, and aid in better decision-making.

# 3. Business Problem Overview

FSA valuation services are experiencing a significant influx of data with respect to the portfolio management of North American stock market-listed companies. The data originates from Morning Star, and FSA valuation services engage in data cleaning, manipulation, and processing techniques to ensure that the data is converted into a highly relevant and actionable format, suitable for use in their analysis and reporting activities.

FSA valuation is encountering a primary challenge related to the misaligned structure of the summary page in the Excel sheet. This misalignment has the potential to create difficulties for users in interpreting the data and comprehending its relevance. Additionally, the current visual presentation in the Excel sheet features a convoluted arrangement of sub-windows containing varied stock product ratings on one page, resulting in a challenging analysis process.

To address these problems, our team intends to adapt and personalize the dashboards and their visual representations using the capabilities of Power BI software. While Excel is a popular application, Power BI provides superior dashboard customization and visualization possibilities.

* Power BI can handle data processing more quickly than Excel. (Excel vs Power BI: Which One is Better?, n.d.)
* Power BI provides more visually engaging and interactive dashboards that are also highly configurable compared to Excel. (Excel vs Power BI: Which One is Better?, n.d.)
* Power BI surpasses Excel in its ability to compare tables, reports, and data files. (Excel vs Power BI: Which One is Better?, n.d.)

Using Power BI can resolve the problem and enable the organization to present stock portfolio data more effectively, assisting clients in determining whether their investment portfolio meets their goals and preferences based on the portfolio’s risk and performance criteria.

# 4. Analytics Question

1. In what way do you intend to utilize the dashboard?

Descriptive Analysis: Conducting this analysis will assist in determining the appropriate visual elements to include in the dashboard. This analysis will also help in eliminating any unnecessary visuals that do not provide meaningful insights.

2. Which parts of the existing dashboard do you consider crucial, and would you like to illustrate them in a different graph?

Descriptive Analysis: Considering how to measure the company's performance will assist the company in gaining immediate results of insights about the company via the dashboard. This could enhance the organization in increasing revenue. The data points required to assess the company's performance should be included in the visualizations.

3. Which dashboard visuals are complex that ought to be redesigned?

The tables and figures in the excel file include an abundance of information, which may make data interpretation difficult. Choosing key graphic components and removing unnecessary ones can help to create a more streamlined and understandable dashboard.

# 5. Scope Statement

FSA Valuation Service Inc. wants to give its shareholders, consultants, and investment managers the best share market survey and advice available. In order to achieve this goal, we created a project to visually represent the complex financial data in a way that is easy to understand. The goal of the project is to use PowerBI, a potent business analytics tool, to provide a clear report for the client businesses.

FSA Valuation Service Inc. delivers raw Excel spreadsheets with financial calculations and charts in order to accomplish this purpose. These spreadsheets are then utilised to produce a customised report in PowerBI. Scorecards and trendlines are included in the report to aid in the clear representation of financial data. Additionally, numerous dashboards are made so that clients can examine financial data in a more comprehensive fashion. The interactive nature of the report, which enables users to quickly filter and discover particular data sets, is one of the key benefits of utilizing PowerBI. With this capability, users may swiftly dig down to specific data points and get insightful knowledge when working with enormous data sets.

The report is then made available to the staff members who are legally permitted to work for the company once it has been finalised. This report is an effective tool for decision-making since it gives businesses the knowledge, they need to comprehend their financial data thoroughly.

# 6. Data sources/key data entities and flows

Data Sources:

1. SQL Database: All the raw data is contained in SQL database, giving a solid base for analyzing information, reporting, and decision-making processes.

2. MorningStar sheet in the QuickValuation excel document: The information from the SQL database was stored in this excel sheet and utilised for performing further calculations.

3. Intermediary calculations and data storage: On the basis of the data from the Morningstar sheet, intermediary calculations are made. This means that the Morningstar sheet is utilised as a source of unprocessed financial data, which is then put through intermediary calculations to fuel more in-depth research and reporting. Numerous other sheets—such as "CFIRR AND RETURNS," "INVESTED CAPITAL," "ASSET LIFE," etc.—are produced from which the users can learn more about how their assets or investments are performing financially.

4. Summary Sheet: All the visualizations are contained in the summary sheet. The financial information for the previous eight fiscal years is presented in the data tables, and prospective values for the next two years are predicted using line graphs, area plots, and trend lines. The company's operations appear to be briefly summarized in the summary sheets, where several corporations are represented by different ticker values. Depending on the ticker value chosen, the information on the summary sheet dynamically changes. Additionally, calculations can be automated using Excel macros, and the necessary data can be produced automatically.

Data Entities:

The main data entities used in this dataset are Value Drivers, Forecast, Business Description, and Valuation. An excel file serves as the current system of records for each data entity.

1. Value drivers: The value drivers contain data for the past eight fiscal years. The data attributes for the value drivers are as follows:

1. EPS
2. Gross invested capital.
3. Gross invested capital growth percentage.
4. Asset life
5. Salvage value % of invested capital
6. Cost of capital
7. Discount rate
8. EBITDA (Mil)
9. EBITDA per share
10. CF from Ops (Mil)
11. CF from Ops Per share
12. Shares Outstanding (Mil)

2. Forecast: Values for the following five years are shown in the forecast table. The data attributes for the forecast are as follows:

1. EPS
2. Gross invested capital.
3. Gross invested capital growth percentage.
4. Asset life
5. Salvage value % of invested capital
6. Cost of capital
7. Discount rate
8. EBITDA (Mil)
9. EBITDA per share
10. CF from Ops (Mil)
11. CF from Ops Per share
12. Shares Outstanding (Mil)

3. Business Description: Detailed information about each company in the ticker is provided in this table. The data attributes for the Business Description are as follows:

1. Company description
2. URL to the company’s website
3. Contact number of the company
4. No of employees

4.  Valuation: The intrinsic and market worth of equity, as well as a percentage split for each value, are included in the valuation table. A company's financial performance and health can be evaluated using this information, which can also be utilised to spot possible investment possibilities. The data attributes for the Valuation are as follows:

1. Infl. Adj Net Fixed Cap.
2. Value of WC
3. PV of Incremental CF
4. Enterprise Value
5. Value of debt
6. Value of equity

# 7. Data manipulation process and data output

FSA valuation services sells its products in the form of Excel Worksheets which represented a very complicated dashboard and very hard to understand for the clients. So, the company asked us to prepare Power Bi reports for the same which can be understood by the clients very easily.

For doing the same, we underwent the following three stepped Data Manipulation and Data Output process.

Step 1: Connecting to the company’s Database and preparing Data ready to import in Power BI.

Step 2: Importing Data from SQL Server to Power BI.

Step 3: Preparing Power BI Dashboard

Step 1 and Step 2 would be fairly included in the Data Manipulation Process whereas, Step 3 is considered as a Data Output process.

**Step 1: Connecting to the company’s Database and preparing Data ready to import in Power BI:**

The company has a 1 main SQL database, and it has 3 servers in that database. All the data is available in all the three servers. The purpose of using 3 servers is to avoid data breach and have multiple copies of data preventing the company from data loss. Following are steps to connect with company dataset:

* Get the user’s IP address registered with the company for the database access. The IP address from the user end can be found out with the help of using the following link: <https://whatismyipaddress.com/>
* The company will provide the server IP address and user ID and password to get connected to the company’s database. Once the user gets all the required details. He/she can enter those details by opening the SQL Server Management Studio as shown in the following image:

Graphical user interface, application

Description automatically generated

Image 1. Connecting to FSA’s Database using SQL

* The user will be now connected to the FSA’s Database. The user can find a very long list of tables containing numerous information regarding the financial information of the various listed stocks.
* Once the above steps are done, we will write the following query to get the necessary information using SQL:

We have used various summation and mathematical formulas to get the desired output as mentioned by the client.

1. DATEADD(YEAR, -14, GETDATE()) AND GETDATE() – get data for past 14 years from current date.
2. CONCAT(MCV.LegalName , ' (' , YD.Ticker , ')') AS 'Company Name' – to concat company name with its ticker value.
3. DebtAndEquivalents field is calculated using the sum of the following values: FBS.ShortTermDebt, FBS.LongTermDebt, FBS.CapitalLeaseObligations, FBS.NonCurrentDeferredRevenue, FBS.DerivativeProductLiabilities, FBS.PensionAndPostRetirementBenefits, FBS.LongTermProvisions, FBS.RegulatoryLiabilities ,FBS.NonCurrentOtherLiabilities, FBS.NonCurrentMiscellaneousLiabilities, FBS.MinorityInterest, FBS.PreferredSecuritiesOfSubsidiaryTrust, FBS.PreferredEquityOutsideStockEquity, FBS.PreferredStockEquity
4. 'Net Plant/Gross Plant' is calculated using following fields: ROUND ((FBS.NetFixedAssets/(FBS.AccumulatedDepreciationAndDepletion+FBS.NetFixedAssets))\*100,0)

The output is shown below:

Graphical user interface, text, application

Description automatically generated

Image 2. Preparing Data in SQL

**Step 2: Importing Data from SQL Server to Power BI:**

Once we done with writing SQL queries, we will open Power BI and establish live connection with SQL server. We will use the given IP address of the Server to connect with FSA’s Database. This can be depicted as follows:

Graphical user interface, text, application

Description automatically generated

Image 3. Loading Data in Power BI

Then we wrote the following DAX query for creating a measure to show the difference in the opening and the closing price of the stock in the scroller on the dashboard:

PercentChange = ((Query2[ClosePrice] - Query2[OpenPrice])/Query2[OpenPrice])\*100

Graphical user interface, application

Description automatically generated

Image 4. Power BI relational query view

**Step 3: Preparing Power BI Dashboard:**

After we are done with preparing data for Power Bi dashboard, we will move further with creating relevant dashboards. We have added the following in the Dashboard:

* Ticker name with scroll bar for Company name.
* The horizontal black moving scroller displaying the current and change in the stock price of all the listed 20 companies.
* The Date slicer representing the time frame of the given data.
* Then we have added two stickers representing the respective company’s currency and the name of the stock exchange where the company is listed.
* We have added one line graph representing the Net Plant/Gross Plant of the selected company by Date.
* Finally, we have added 3 bar graphs representing the following:
* Debt and Equivalents of the selected company by Date
* Total Revenue of the selected company by Date
* EBITDA of the selected company by Date

Following is the Screen shot of final Power Bi Dashboard:

Chart

Description automatically generated

Image 5. Final Power Bi Dashboard

# 8. New solution design and it’s fit into the existing IT architecture

1. Understanding the business requirements: The current dashboard is built in Excel, where all computations are performed, and data is gathered from many sheets using the raw data from MorningStar. However, the Excel file loads slowly due to a large number of computations. To address this issue, we plan to redesign the entire dashboard using Power BI and connect it directly to the SQL database.

2. Data Integration: After defining the requirements, we began by establishing a connection to the SQL server to analyze the data and understand how to preprocess, clean, or normalize it in case of missing data. Instead of directly working in Power BI, we decided to first understand the data in SQL Management Studio by running various queries such as finding individual columns and tables, joining different tables, and using other functions. Since this is financial data, we need to check the granularity of the data and determine if the visualizations need to be displayed on a daily, monthly, quarterly, or year-on-year basis, along with the specific CompanyID.

3. Report Building: Once we have analyzed the data and created a tabular format, which is easier for Power BI to understand, it is time to connect Power BI directly to the SQL server to pull the data from the database quickly and easily. We will create various charts such as bar charts, stacked bar charts, line charts, and column charts, along with slicer options to select the company and its prices in USD or CAD, descriptions text box, and a scroller that shows the opening price for the present day, the closing price for the previous day, and the percentage difference between both prices.

4. Improvement and Optimization: Since the stock market is closed during public holidays and weekends, we encountered a problem with some months missing when creating visualizations using monthly data for the past 14 years. To address this issue, we wrote a switch case query in SQL with multiple conditions to exclude these dates and select the previous dates just before the holidays. We will continuously test the visualizations to ensure that the data is updated correctly. Additionally, we will adjust the visualizations based on stakeholder feedback and client requirements to make them more user-friendly.

We want to use PowerBI to revamp the FSA dashboard. The dashboard is currently built in Excel, where computations are performed, and data is gathered from many sheets. The Excel file loads slowly due to a large number of computations, forcing a modification of the dashboard. This revamp would benefit from the use of PowerBI and SQL.

Below are the steps required for designing the dashboard:

Step 1: To create the visualization in Power Bi, first we need to connect the SQL server with the Power BI and get the required data for the visualization. This can be accomplished by entering the server’s name, username, and password.

Step 2: Once the connection is established, we need to write the SQL query in Power BI to get the data from the database which will pull the columns.

Step 3: After pulling the columns, we need to perform certain calculations like summing different entities to get one final entity, joining different columns like joining MSSecurityView with YahooDescription.

Step 4: After all the creating new values using different functions and getting all the data values which are required to create the visualization. Now we are moving ahead with creating graphs, tables, slicers and many more in the Power BI which is more user-friendly and easier to understand.

Fit into the existing IT architecture:

The current Excel dashboards are more difficult and cluttered, especially when working with big volumes of data. Excel may cause problems with real-time data processing, limiting its usefulness for monitoring and analysing quickly changing stock market data. As a result, we recommend using Power BI software instead of Excel because it features more organised and visually appealing dashboards that are easier to comprehend and navigate.

We can use Power BI as a data analysis and visualisation tool to enhance or replace Excel in this IT architecture. Power BI can connect to the SQL Server Management Studio database to retrieve data for the purpose of building interactive and customised dashboards and visualisations that can assist users in gaining insights into stock market patterns and performance.

# 9. New solution implementation and outcome testing

We want to use PowerBI to revamp the FSA dashboard. The dashboard is currently built in Excel, where computations are performed, and data is gathered from many sheets. The Excel file loads slowly due to a large number of computations, forcing a modification of the dashboard. This revamp would benefit from the use of PowerBI and SQL.

Step 1:

The IT professional must be given a public IPv4 address so that the device can be registered on the back end and the SQL server can be accessed.

Step 2:

Establishing a connection to the SQL server: To connect to the SQL server, you must know the server's name, login id, and password. We were able to gain an overview of the tables in the database and the data within them after connecting to the server.

Step 3:

Understanding the graphs: The next stage is to recognize a specific graph and the values that comprise it. The fundamental values and formulas required to build the graph. The database contains the basic values, and the formulae can be used in the SQL query.

Step 4:

Because the database's structure has 106 tables, identifying the values required for the visualisation got incredibly challenging. To accomplish this, we scripted a SQL search query that searches for terms specified in the search query in accordance with the data's header (much like pattern matching or a regular expression). The keyword could be part of the name of a column or a table. The next step would be to search every table in the search result for the value we're looking for. Every business has a ticker symbol, a ProductID, and a CompanyID. Viewing the remaining tables from the search results and searching for a specific value based on columns such as AsOfDate, or any other columns that aid in uniquely identifying a specific row. As a result, we chose the table for further examination. Once we've found the relevant table, the next step is to find the correct company data from the SQL database, which is quite large. By including a where clause that filters the data based on the CompanyID or Product ID.

Step 5:

Using the method described in step 4, we'll identify the correct tables and columns needed for the base calculation. The next step would be to start working on scripting the SQL queries that will help us prepare the data needed for the visualisations. SQL queries are built from SQL functions like SUM, DATEDIFF, GETDATE, DATEPART, and many more.

Step 6: After scripting the individual SQL queries for one of the visualisations, we repeat steps 2–4 for the remaining visualisations to be redesigned.

Step 7: Now that we've identified all of the data and created SQL queries for each visualisation, we need to combine all of the required columns and write a stored procedure. This stored procedure will be used to retrieve the data in PowerBI. This query will return all of the columns that would be required to redesign the graphs. Once the store procedure has been built, this table can be used to create the required visualisations.

Step 8:

To access the necessary data for visualization, we must connect the SQL server in Power BI. This is done by supplying the server's name, username, and password. FSA operates two servers. One server is operational during the first half of the month, and the other for the second half. There is a link to see which server is currently online. The active server has all of the most recent data, while the other server is updating on the other hand.

Step 9:

We need to get data from the database before connecting to the SQL server in Power BI. After connecting to the server in Power BI, we will use the stored procedure created in Step 6 to retrieve the data.

Step 10:

After connecting the SQL server and Power BI, the next step would be data transformation and cleansing. This is a vital step before beginning any analysis. We are altering the data types, eliminating the blank columns, and replacing the missing information with the mean and standard deviation of the given field to make the data more understandable and presentable. All of these data transformations can be performed in the power query editor window using DAX functions (Data Analysis Expressions).

Step 11:

The graphs are built in PowerBI by selecting the relevant visuals and values. The graphs are then checked for correctness of the value and interpretation of the graph. The insights derived from the graphs which are redesigned in PowerBI should be the same as the ones which are in Excel. Color, typeface, font, data labels, and other elements are employed to enhance the aesthetic attractiveness of the graphs. This will also make the graph easier to understand.

Outcome Testing:

Once we have established the dashboard, we must continue to test it using the many critical parameters. The following are the actions to take for outcome testing:

1. Defining the testing objective: Before we begin testing our Power BI, we must identify our objective, such as what we hope to achieve from this testing. For example, because our data is financial, it must be accurate and up to date in accordance with the stock market.
2. Create test cases: We must create test cases for our report based on the objectives that we have set. For example, for some visualisation, we require the previous day's closing price and the current day's opening price for each company listed on the stock markets.
3. Executing each test case: After constructing the test cases, it's time to put them through their paces in various circumstances. This can be accomplished by comparing data, visualisation, and so on and analysing them to see if they fit the desired requirements.
4. Implementing and assessing recommendations: In this step, we will add several items to improve and make the dashboard more user-friendly. Also, share the results with company stakeholders for feedback, and then implement the necessary modifications based on the needs.

# 10. Potential solution optimization

Any approach to problem-solving must incorporate optimisation, especially when the outcome deviates from the desired outcome. In these situations, the solution must be improved upon and re-implemented with the appropriate alterations. This tactic improves the answer's precision and potency, allowing it to better address the issue.

Our plan for the FSA evaluation company is to revamp the FSA dashboard using Power BI and SQL. The existing Excel file includes several computations and loads slowly; thus, a redesign is necessary. A public IPv4 address, connecting to the SQL server, understanding the graphs, locating the required data in the database, writing scripted SQL queries, creating a stored procedure, connecting Power BI to the SQL server, transforming and cleaning the data, and creating the required visualisations are all clearly outlined in the implementation section of the redesign process.

Overall, the method seems practical and efficient. When Power BI and SQL are combined, dashboard loading times will be sped up and there will be greater flexibility and possibilities for creating visuals. The phases that make up this redesigning process have been carefully considered and contain all necessary components. Additionally, it is a fantastic idea to use DAX functions in the power query editor window for data transformation and cleaning to make the data easier to understand and on display.

There are, however, a number of potential issues to consider. The SQL server has to be routinely updated and maintained in order to ensure that the data is accurate and up to date. Furthermore, if there are numerous tables, it could take longer to examine the database for relevant information. The usage of stored procedures in SQL may also make future code modifications and updates more difficult.

Overall, it seems that the solution is a practical replacement for recreating the FSA dashboard, and with the proper upkeep and modifications, it may be a helpful tool for monitoring and evaluating financial data.

1. Examine the data architecture: The first step in enhancing the FSA dashboard is to examine the data architecture. The data architecture should be inspected to ensure that the data is properly organised and normalized. The tables, relationships, and structure of the database must be examined for this. Inconsistent data might cause queries to take longer to process and may contain inconsistencies. (Stedman, 2021)

2. Enhance SQL queries: The present FSA dashboard's poor performance is mostly attributable to the numerous computations and data retrievals from several Excel sheets. SQL queries should be streamlined to minimize calculations and data retrieval in order to remedy this. This may be accomplished by avoiding complex subqueries and utilizing the right indexes. (Optimize query computation, n.d.)

3. Use the right data types: Using the right data types is another method for making SQL queries stronger. For columns with small values, smaller data types, for instance, can lower the amount of processing RAM and disc I/O required.

4. Use views and stored procedures: Performance may be improved by utilising views and stored procedures to recalculate and cache frequently used queries. Views may help simplify query logic by hiding the intricate details of joins and filters. Stored procedures can be used to optimise queries by condensing several queries into a single file and saving them in the database for speedier execution. (How do you optimize stored procedures for performance and maintainability?, n.d.)

5. To make data more efficient for reporting and analysis, use the Power BI data model. A robust data modelling engine is provided by Power BI. Relationships between tables, computed metrics, and hierarchies must be specified.

6. DAX calculation optimisation: By choosing the appropriate functions and avoiding complicated calculations, DAX calculations may be made more effective. Use the CALCULATE and FILTER methods to deal with fewer rows and columns. Use SUMX, AVERAGEX, and MAXX methods instead of SUM, AVERAGE, and MAX functions when working with large data sets. (Russo, 2016)

7. By just refreshing the data that has changed since the last refresh, incremental refresh can increase performance. This is useful particularly for huge data sets that take a while to update. (Smith, et al., 2023)

8. Use Direct Query or Live Connection: By running queries on data that already exists in the source database, Direct Query or Live Connection may be used to boost performance instead of importing data into Power BI. This works well for large data sets or frequently updated data. (Rad, 2022)

9. To identify performance issues with a report or data model, use the Power BI Desktop Performance Analyzer. It can help identify slow queries, heavy data loads, and other performance issues. (Iseminger, et al., 2023)

10. Test and improve: To make sure the FSA dashboard keeps working effectively, it is crucial to continually test and improve it. It is necessary to keep track of query and report performance, as well as to spot bottlenecks and implement the necessary changes to enhance it.

By following these recommendations, the client may keep the FSA dashboard optimised and ensure sure it continues to run efficiently.

In order to facilitate more efficient installation and usage activities, it is necessary to take into account extra procedures for consumers and analysts using the dataset. These actions can aid in lowering mistakes and raising process quality all around.

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# Appendix

|  |  |
| --- | --- |
| Name | Role |
| Kenil Gadhiya | Developer: Writing SQL code and performing task to create visualization by analyzing data. |
| Nidhi Mehta | BI Developer: Creating visualization for dashboard in PowerBI. |
| Jay Shah | Research and Documentation: Preparing the report, presentation, and conducting research for analysis. |
| Mohit Lingayat | QA Tester: Testing the code, analysis, and assuring the project meet standards and quality. |
| Manali Shah | Researcher: Conducting research and gathering information. |
| Avany Joshy | Researcher: Conducting research and gathering information. |