IS EXCEL ENOUGH?

INTRODUCTION

Students or professionals, we are using Excel as long as we remember. Whether it's conducting experiments in a lab or analyzing data in an office, the principles of science guide our actions and decisions. Our knowledge of scientific concepts helps us solve problems and make informed choices in our respective fields. In the field of data science and data analytics, we use Excel as our trusted companion.

We have been using Microsoft Excel for a long time. Many of us have advanced skills, if not more than a basic understanding of Excel. From small business organizations to larger ones, Excel is being used to store data, format it, and generate reports. In many organizations, Microsoft Excel is being used as a database system to extract, load, and transform their data.

Introduced in 1985, it is primarily used as a spreadsheet editor for Windows, MacOS, Android, and iOS. It uses a grid of cells arranged in rows and columns to organize data. Excel is a tool for modernizing data storage and management that helps to increase efficacy. It is easy to use and consists of many features that serve as a digital canvas where rows and columns of data transform into accessible insights.

If utilized properly, it is one of the best tools for data storage, analysis, and report generation, offering a user-friendly interface with powerful functionalities to trim tasks and increase efficiency. With each click, we can generate trustworthy, unraveling patterns, pivot tables, charts, and precise data. While providing efficiency and effectiveness in many fields, it lacks functionality in processing large data sets, compiling advanced formulas, and more. Then the question arises: "Is Excel best suited for advanced statistical analysis or complex data visualization tasks?"

In this document, I am delivering an overview of the history of Excel, how it is being used in the modern technological era, how everyone of us, as well as business organizations, is using it, and how it is being useful in different contexts as a database system, a report generator, or as a visualization tool.

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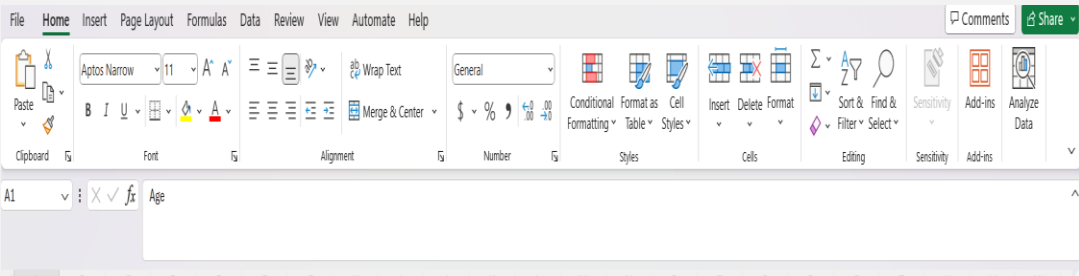
1. History and Introduction of Excel

As I mentioned above excel is introduced in 1985 as a spreadsheet editor for Windows, MacOS, Android, and iOS. As its increased performance and usability Microsoft Excel became an essential resource for professionals, companies, and students. Over the period of time the usability, functionality and performance evolved for the better.

Let us first review Excel's brief introduction and its current applications before delving into its historical background.

Microsoft created Microsoft Excel as a spreadsheet editor. It is utilized not only on Windows but also on other operating systems, including iOS, Android, and macOS. Microsoft Excel serves as a database system, a reporting tool, a data storage device, and a visualization tool.

A wide range of industries and fields, including real estate, science and technology, engineering, medicine, and human resources, use Excel.

Let's run down through the history and evolution of Excel.

1982	Microsoft first began selling a spreadsheet program named Multiplan in 1982. With the Control Program Monitor (CP/M) technology, the Multiplan has gained a lot of popularity.
1985	The initiation of Microsoft Excel started as spreadsheet applications that used graphical interfaces as pull-down menus alongside point and click with a mouse. It mainly focused on Apple Macintosh computers.
1987– early 1990	Excel rebranding, enhanced user interface, VBA integration, and Windows compatibility were made. In the early 1990s, Excel was integrated with Windows, and pivot tables and pivot charts were also introduced.
1993	VBA is introduced for automation, creating macros, and advanced data analysis.
2003	The XML support system is built for seamless data exchange and interoperability.
2007	The Ribbon Interface is introduced in Excel. Figure 1: Ribbon Interface
2010	Excel 2010 supports data modeling capabilities through the use of Power Pivot and Slicer.
2013	For faster data calculation and analysis, an in-memory procedure is implemented.
2016	In Excel 2016, real time co-authoring is introduced through cloud-based Office 365.
Present Time	As of right now, financial modeling, data visualization, project management, and database management can all be accomplished with the broad and flexible toolkit that modern Excel provides.

Excel has come a long way, from a basic spreadsheet to a data processing tool. With time, Excel has developed to include more sophisticated features like pivot tables, tools for data

visualization, and automation capabilities. Because of its adaptability and user-friendly layout, it is a useful tool for both individuals and organizations. Excel has many capabilities that can help you be more efficient and streamline procedures, whether you're managing budgets, making charts, or analyzing data. Excel is still an essential tool in the field of data analysis and management because of its capacity to handle massive volumes of data and carry out intricate computations.

2. USABILITY and FUNCTIONALITY of EXCEL

As professionals or students, we use Excel in our studies, work, or even in the management of personal finances. Excel is a versatile tool that allows for data organization, analysis, and visualization, making it an essential skill in various fields. Excel is not just limited to basic data storage functionalities; rather, it expands its wings in data analysis, visualization, and automation tasks. With features like pivot tables, formulas, and macros, Excel is a powerful tool for businesses to make informed decisions and streamline processes.

2.1 Lists of Excels Functions.

- **Basic Math Functions:**
The Excel math functions are very efficient and easy to use. The math functions provide us with reliable and accurate results based on our query. We can use functions like SUM, COUNT, AVERAGE, MIN, MAX, and more.
Let's say we have a series of data points in column B, and we want to take the average of the entire column. Then we can use the **"=AVERAGE (B: B)"** formula or function to execute the average value in column B.
- **Logical Functions:**
Excel also provides logical functions, which allow us to make decisions based on conditions and automate tasks. These functions return values based on the conditions we applied. For example, the IF function allows us to specify a condition and return one value if the condition is true and another value if it is false. This can be particularly useful for creating dynamic spreadsheets that respond to changing data.
For instance, we can use the query **"=IF(B2>=65, "Pass", "Fail")"** to retrieve student marks for those who received more than 65 marks as passed and fewer than that as failed if we have a column b2 containing the marks of a student.
- **Text Function**
Microsoft Excel can be used to organize and modify text that is saved in the spreadsheet. We can change our text appropriately by using a variety of text functions, such as TRIM, CONCAT, and FIND. It may be quite useful and efficient when utilized properly. For instance, the CONCAT function can combine text from several cells into one, whereas the FIND function can assist in finding specific text within a cell. For better organization and analysis, these features can expedite the text manipulation process in Excel.
For example, if we have columns filled with first and last names and we want to combine the first and last names, we can use the CONCAT function. **"=CONCAT (A2, " ", B2)"** is used to combine the first name and last name that are in columns A2 and B2 with a space in between.
- **Lookup and Reference Function**
To reference another column, to find a specific value, and to return the value into a specific cell range, we use the lookup and reference functions. Different lookup functions, such as

VLOOKUP, HLOOKUP, and XLOOKUP, are used to search for and return specific values. We can also use INDEX and MATCH functions to choose or match values from different cells and tables.

For example, the **"=MATCH ("Y", A1, 0)"** formula searches for the letter "Y" in cell A1 and returns the position where it first appears.

2.2 Charts and Visualization in Excel

Along with the above functionalities, Excel also uses charts and graphs for visualization, report generation, and data analysis. These visual representations help users easily interpret and understand complex data sets, making them a powerful tool for decision-making and presenting findings to stakeholders. While providing the functions for formatting the data, adding the visualization will enhance the overall presentation and make it more engaging for the audience. Additionally, Excel allows users to customize the charts and graphs to suit their specific needs and preferences, further improving the effectiveness of data analysis and reporting.

Some of the Charts and Visualization techniques we can use in excel are listed below.

- **Bar Charts**

Bar charts are one of the most common and popular charts used in Excel. The bar chart can be used for quick comparisons between categorical data. The chart displays categorical values on the y axis and numerical values on the x axis. Bar charts are effective for illustrating trends over time or comparing data across different categories. They are easy to create and customize in Excel, making them a versatile tool for data visualization.

SAHARE MARKET

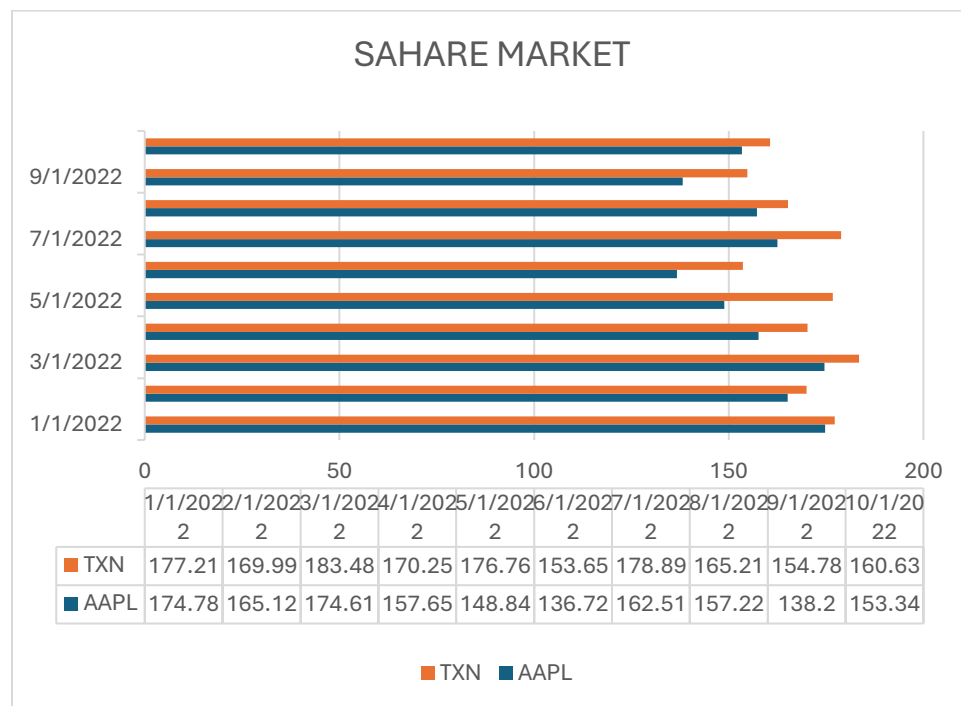|	1/1/2022	2/1/2022	3/1/2022	4/1/2022	5/1/2022	6/1/2022	7/1/2022	8/1/2022	9/1/2022	10/1/2022
TXN	177.21	169.99	183.48	170.25	176.76	153.65	178.89	165.21	154.78	160.63
AAPL	174.78	165.12	174.61	157.65	148.84	136.72	162.51	157.22	138.2	153.34

TXN   AAPL

Figure 2: Bar Chart

In the above chart, we can see the share market value of APPL and TXN from January 1, 2022, to January 9, 2022. We can manipulate the color, title, and gridlines of the above chart with just a single tab.

- **Pie Chart**

A pie chart is another most used chart in Excel, used to represent data in the form of slices. The pie charts are used to show some proportions of different categorical data. Pie charts are effective in displaying data with a clear visual representation of the percentage each category represents. They are particularly useful for illustrating comparisons between different categories or highlighting the distribution of a single variable.

Apple vs Banana
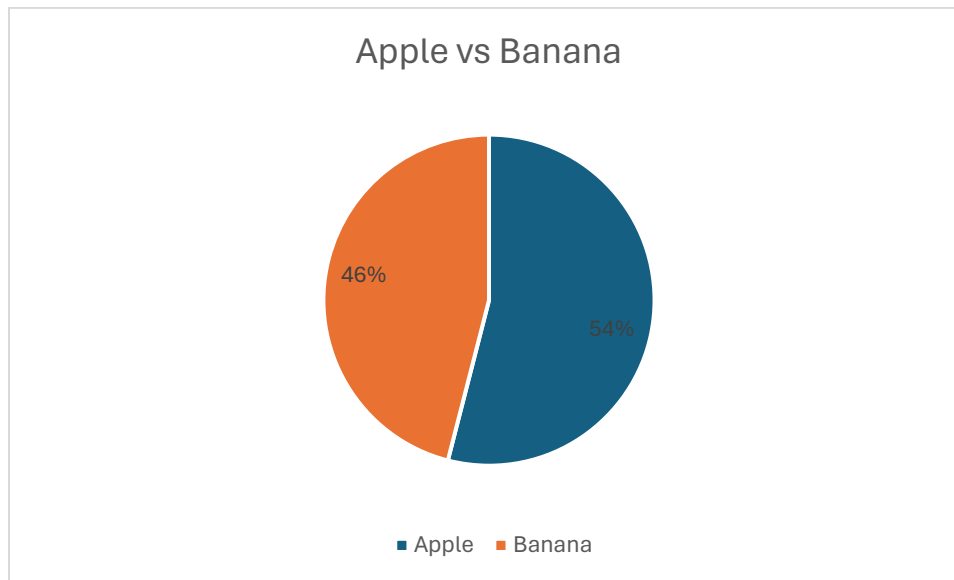
46%

54%

■ Apple ■ Banana

Figure 3:Pie Chart

- **Line Chart and Area Chart**

The line chart is one of the most popular types of charts because it can easily be used to visualize changes and patterns by displaying trends over time. When displaying data with a distinct progression or fluctuation, it works very well. Transactional data can be represented using a line chart. Finding patterns, continuous progression, and periodic trends may all be done with a line chart.

- **Scatter Chart**

The scatter plot is used to show relationships between two numeric variables. It is mainly used to identify correlations between two or more categories. The data points on the scatter plot are represented by dots, with each dot indicating a single observation. By analyzing the pattern of the dots, one can determine if there is a positive, negative, or no correlation between the variables being compared.

In the below example we can see the share market value of APPL and TXN are highly corelated. While the value of TXN rises the AAPL also rises.
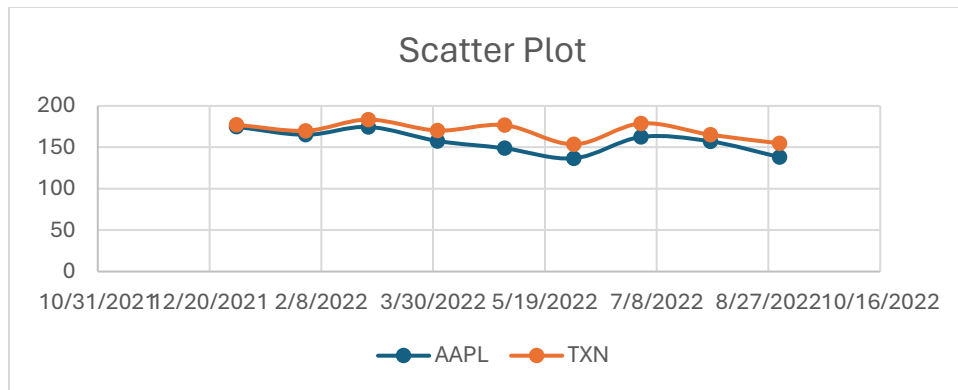
Figure 4:Scatter Plot

Along with these charts here are some other Chart that are being used in Excel.

- Column Charts,
- Stacked bar chart,
- Bubble chart,
- Surface chart
- Radar chart and more.

We may utilize the charts and make them visually appealing to the audience based on our data, demands, and appropriate visualization. The charts demonstrate the expression "a picture is worth a thousand words."

2.3 Pivot Table and Regression Analysis

A pivot table is very useful when summarizing, filtering, and analyzing a large dataset efficiently. By using the pivot table, we can group and aggregate data dynamically and create customized reports that are highly usable to understand the patterns, trends, and relationships between our data. Pivot tables can also help identify outliers or anomalies in the data, making it easier to spot potential errors or inconsistencies. Additionally, pivot tables allow for easy comparison of different subsets of data, providing valuable insights for decision-making purposes.

On the other hand, regression analysis helps us understand the relationship between variables. It calculates the coefficients, which represent the relationship between the variables, and allows predictions based on historical data. Regression analysis is particularly useful for predicting future trends or outcomes based on past data. By analyzing the strength and direction of relationships between variables, regression analysis can provide valuable insights for making informed decisions.

Regression analysis and pivot tables are both effective methods for analyzing data that can assist companies in making strategic decisions based on patterns and relationships found in their data. While regression analysis focuses on comprehending the relationship between variables to generate future predictions, pivot tables group, filter, and analyze data points collectively. When combined, these techniques can offer a thorough comprehension of dense datasets as well as initiate decision-making procedures.

3. ALTERNATIVE OF EXCEL in DATA ANALYSIS

In the data analysis field, Excel has been used for a long time. Excel functionalities like pivot tables, regression analysis, and charts are being used in the analysis and visualization processes. But for large datasets, advanced tools like SQL, Python, and Power Query are being highly used. For automation, manipulation, and visualization, these tools provide a more robust and compatible platform.

Platforms like IBM SPSS can be used for advanced data manipulation, statistical modeling, and predictive analytics. Whereas business intelligence tools like Power BI, Tableau, and IBM Cognos can be specifically used in the data analysis and visualization process. These tools offer a wide range of features, such as interactive dashboards, data blending, and real-time analytics, to help businesses make informed decisions based on their data. They also provide user-friendly interfaces and customizable reporting options for easier data interpretation and sharing within organizations.

Let's go through some of the commonly used alternatives for Microsoft Excel.

3.1   IBM SPSS vs. Excel

IBM SPSS is a powerful statistical software that plays a crucial role in statistics and data analytics. IBM SPSS works as a batch processing tool, whereas Excel works as a data manipulation tool. Some of the reasons why we should use IBM SPSS over Excel for data analysis.

- IBM SPSS provides more sophisticated visualization: bar chart, line chart, histogram, scatter plot, box plot, and more.
- Provide advanced data preparation and data transformation functionalities: automation in data preparation, data validation, and optimal binning.
- SPSS provides automation and reproducibility with tools like syntax editors, scripting with Python and R, Control Language for Expression Manipulation (CLEM), batch processing, and more.
- Room for predictive analytics and modeling
- Better handling techniques for large data sets

3.2 Python in Data Analytics

Python is one of the most advanced programming languages, highly used in data analytics. Python provides a wide range of scripts, queries, and libraries for data cleaning, observing, manipulation, and visualization. Some of the features we can use while doing data analysis in Python are:

- Python Libraries: Python provides an ecosystem of libraries such as Pandas for data manipulation, NumPy for numerical computing, Matplotlib, and Seaborn for data visualization.
- Data Handling: Python libraries can provide an easier way to handle large data sets, with ease in loading them and ease in formatting.
- Ease in Data Cleansing: A single piece of code can get rid of unwanted data, missing data, duplicate data, and poorly formatted data.
- By using Python, we can perform descriptive analysis, diagnostic analysis, predictive analysis, and predictive analysis.

- Visualizations like scatter plots, heat maps, contour plots, bubble charts, tree maps, histograms, and more can be used for visualization.

3.3 SQL in Data Analytics

SQL is typically not used in visualization, but in the analytical field, SQL has a higher value. Some of the values provided by SQL are:

- Data retrieval: We can easily access specific data in an easy manner by using SQL.
- Data Manipulation: By using SQL, we can aggregate, join tables, merge data, and do sophisticated calculations.
- Data Integration: The join functions provided by SQL allow us to join data from multiple databases or tables.
- Data Cleaning and Transformation: Data cleaning methods like deleting duplicates, dealing with missing values, and standardizing data formats are highly valuable.
- Performance Optimization: SQL enables optimization in the SQL queries. Techniques like query optimization, indexing, and caching help in optimization.

3.4 Business Analysis Tools

The business analytics tools include a variety of applications and software that help in the collection, processing, formatting, and analysis of data to support enhanced business decision-making. These tools enable organizations to gain insights from their data, identify trends, and make informed decisions. Some of the most popular tools are:

1. KNIME
2. Microsoft PowerBI
3. Apache Spark
4. BOARD
5. SAS Business Analytics

The above-mentioned tools have their own unique features and usability. Some of the common features provided by these tools are as follows:

- Data Aggregation: These tools help to combine data from various data sources, such as Excel, CSV, and PDF, into a single integrated view.
- Data Mining: Help to explore complex data sets to find patterns and relationships.
- Forecasting: These tools also provide tools and techniques for forecasting and future prediction.
- Visualization: Each of these tools is highly valuable in visualization. Each tool provides a wide range of visually appealing graphs, maps, charts, and tables.
- Modeling: To connect our table and provide optimization on each point, these tools can be used.

6. CONCLUSION

Microsoft Excel remains an essential tool for students and professionals alike, offering a user-friendly interface and powerful functionalities for data storage, analysis, and report generation. Whether you are creating simple spreadsheets or complex financial models, Excel's versatility and wide range of features make it an asset for anyone looking to streamline their work processes and increase productivity. Its ability to handle large amounts of data and perform calculations efficiently sets it apart as a top choice for organizing and presenting information effectively. Despite its longevity and widespread use, Excel does have limitations, particularly in handling large datasets and performing advanced statistical analysis or complex data visualization tasks. Many other tools like IBM SPSS, Python programming, SQL, and business analysis tools, offer more robust capabilities in these areas, making them better suited for data analysis tasks that require more advanced features. However, its adaptability and enduring relevance in various contexts, such as database management, report generation, and visualization, underscore its importance in the modern technological era.

If we want to make effective use of Microsoft Excel, we can use Excel along with advanced analytics tools. This allows us to leverage Excel's user-friendly interface for data entry and basic analysis while utilizing the specialized capabilities of other tools for more complex tasks. By combining Excel with these advanced analytics tools, we can maximize efficiency and accuracy in our data analysis processes.

By using Excel with other analytics tools, we can increase automation, decrease redundancy, improve data management, provide enhanced visualization, scale, and collaborate. It is always best to tag with another tool rather than focusing just on Excel. It's true that Excel provides fundamental value, but integrating Excel with other tools can provide more accuracy and freedom in workability. This integration allows for more advanced analysis, data manipulation, and reporting capabilities that may not be possible with Excel alone. By leveraging the strengths of multiple tools, users can achieve more comprehensive insights and make more informed decisions.

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