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Chapter-5: Data Visualization Using Power BI

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Content

1. Introduction to PowerBI

- Power BI, developed by **Microsoft**, is a powerful business analytics tool that helps organizations aggregate, visualize, analyze and share their data.
- It is self-service BI platform for both on-premise and cloud-based data.
- Main use of PowerBI is to build **Reports** and **Dashboards.**

2. Building Blocks of PowerBI

1. Visualizations
2. Datasets
3. Tiles
4. Reports
5. Dashboards

Building Blocks of PowerBI…

1. Visualizations-

- Visualizations, also known as visuals, in Microsoft Power BI are graphical tools that help users turn raw data into visually compelling business information.
- They can be used to display insights discovered in the data, such as trends, outliers, and patterns, and to make data more comprehensible.
- Visualizations can also be used to communicate performance, show relationships, and understand the impact of new strategies.

Building Blocks of PowerBI…

2. Datasets-

- A Power BI dataset is a collection of data that can be imported or connected to, and used for reporting and visualizations.
- Datasets are made up of tables that have relationships between them and calculated metrics.

Building Blocks of PowerBI…

3. Tiles-

- A single visualization found in a report.
- A tile is a snapshot of your data, pinned to the dashboard.

Building Blocks of PowerBI…

4. Reports-

- A collection of visualizations arranged in a specific manner to represent different findings and insights from data is known as a Report.
- Visuals could be any kind of charts or graphs.
- Power BI reports are comprehensive and detailed pages that provide in-depth analysis and insights. They offer more advanced functionalities compared to dashboards.

Building Blocks of PowerBI…

5. Dashboards-

- Single page interface that uses the most important elements of a report to tell a story.
- It is also known as **Canvas**.
- Dashboards, in the context of Power BI, are visual displays that provide a consolidated view of data.
- They allow users to monitor key metrics, track performance, and gain high-level insights at a glance.

Building Blocks of PowerBI…

Dashboards vs Reports-

- **Purpose**: Dashboards are used for high-level monitoring, often in real-time or near-real-time, providing a consolidated view of business performance. Reports, on the other hand, are used for in-depth analysis and exploration of data to answer complex business questions.
- **Interactivity**: While dashboards offer limited interactivity to keep things simple, reports provide a variety of interactive features. These include drill-through, filtering, and highlighting that enable users to delve deeper into the data

Building Blocks of PowerBI…

Dashboards vs Reports-

- **Structure**: Dashboards are typically single-page, with multiple visualizations available at a glance. Reports, however, may be multi-page, with different visualizations and data tables split across multiple pages or tabs.
- **Data updates**: Dashboards are designed for real-time or near-real-time data updates, making them ideal for monitoring live data. Reports typically focus on historical data and require periodic updates, with Power BI offering scheduled refresh capabilities.

Building Blocks of PowerBI…

Dashboards vs Reports-

- **Use case**: Dashboards are often used for quickly sharing key insights across an organization, while reports are more suited for detailed analysis, allowing users to explore specific aspects of the data.
- **Page Layout in Reporting and Dashboarding**: Dashboards are single-page layouts, whereas reports are multi-page.

Building Blocks of PowerBI…

Dashboards vs Reports…

- **Power BI Reports and Dashboard Visuals**: For visuals, dashboards and reports differ.
- In reports, you're focused on creating summary pages rather than visuals.
- However, dashboards are more about visualization as you tell a story through charts, graphs, etc.

3. PowerBI Architecture Components

- **Power Query**: The key element that transforms how data is extracted, transformed, and loaded (ETL) is Power Query. With Power Query, you can quickly join several data sources, synchronize and purify data, and apply transformations using a user-friendly interface or sophisticated programming.

- **Power Pivot**: Power Pivot is a data modelling technique that uses the Data Analysis Expression (DAX) language to create data models.

- **Power View**: Power View creates graphs, maps, charts, and other visuals with drag-and-drop features. Power View can connect and filter different data sources to make a report on a single device.

PowerBI Architecture Components…

- **Power Map**: Power Map allows you to base on the country, longitude, and latitude, Bing Maps shows the exact geospatial visuals of complex business information.

- **Power BI service**: Power BI Service connects Power View, Power Pivot, Power BI Report Server, Power Q&A, and other components with the Workspace and allows you to connect with the data.

- **Power Q&A**: Power Q&A uses Natural Language Processing and integrates it with Cortana (Microsoft's virtual assistant) to get the answers to your query.

4. Types of PowerBI Platforms

- PowerBI Desktop
- PowerBI Web Services
- PowerBI Mobile

Types of PowerBI Platforms…

- **PowerBI Desktop** is a free application for PCs that lets you gather, transform, and visualize your data.
- It resides on the local system and used to build and publish reports.
- **PowerBI Web Service** resides on web as a form of website and used to build reports, make dashboards and share reports and dashboard with other users.

Types of PowerBI Platforms…

- **PowerBI Mobile** is an mobile application version of PowerBI which is used to view and share the reports and dashboard.
- You can create your reports and dashboards in Power BI Desktop, and then publish them to the Power BI Service for others to consume.

Types of PowerBI Platforms…

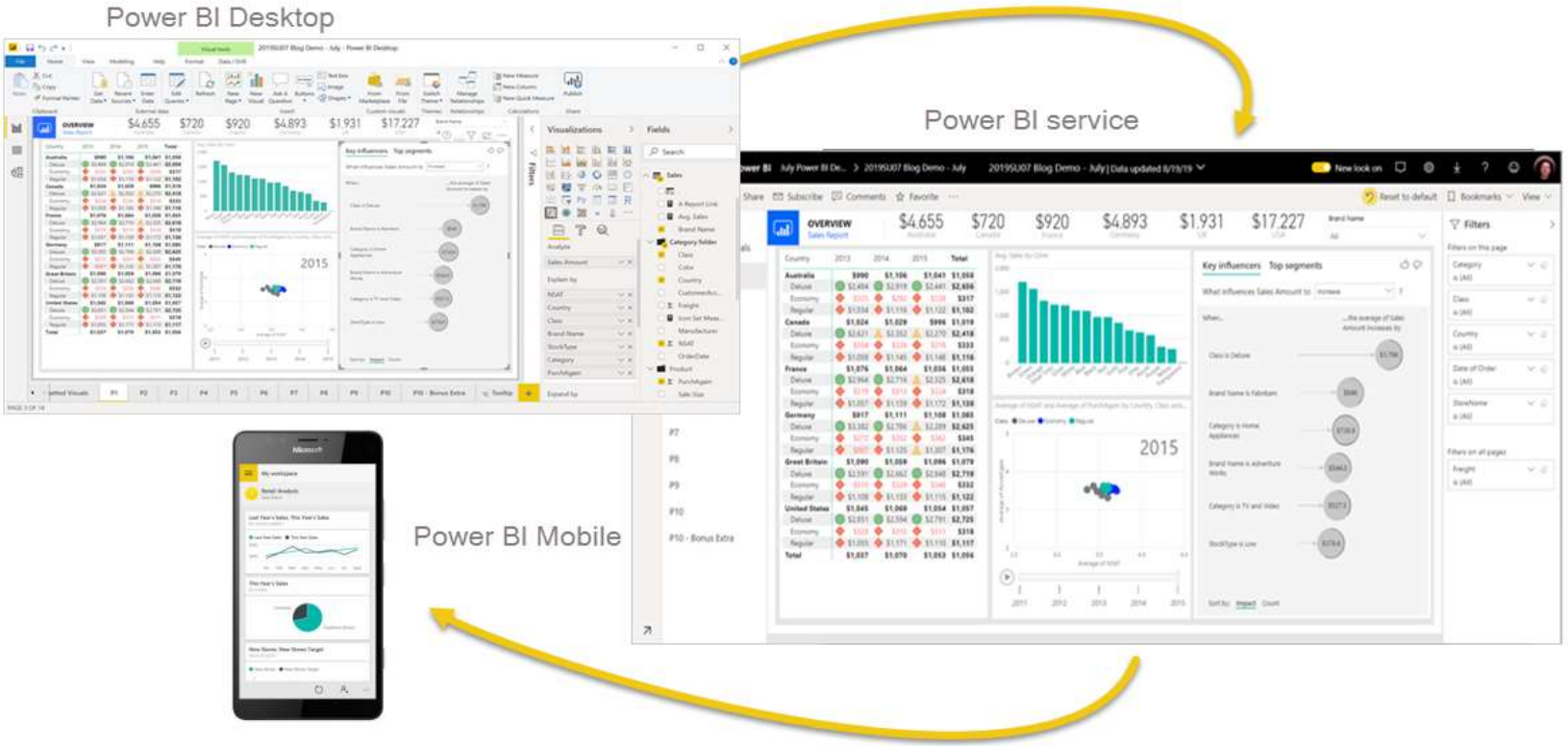

Fig. 4.1: PowerBI Platforms

Types of PowerBI Platforms…

Difference Between PowerBI Desktop and PowerBI Web Services

PowerBI Desktop	PowerBI Web Services
• You cannot share the reports or dashboards. • You can write DAX(Data Analysis Expressions) Queries to create Calculated columns and measures. • You can apply relationships between multiple sources of data	• You can share the reports and dashboards with others. • You cannot write DAX queries. • You cannot apply relationships.

Steps For Creating Dashboard

5. Steps For Creating Dashboard…

1) Load and Extract the data.

2) Transform the data as required and change the relationship between the tables using a power query.

3) Use DAX to perform the calculation on your data.
4) After getting your data ready, you can jump to your visualizations.

5) Add the graphs, charts, cards, etc., and create edits within them to make your report look more understandable.

6) Upload your dashboard to the cloud enabling others to access the dashboard and report.

6. Exploring PowerBI Desktop

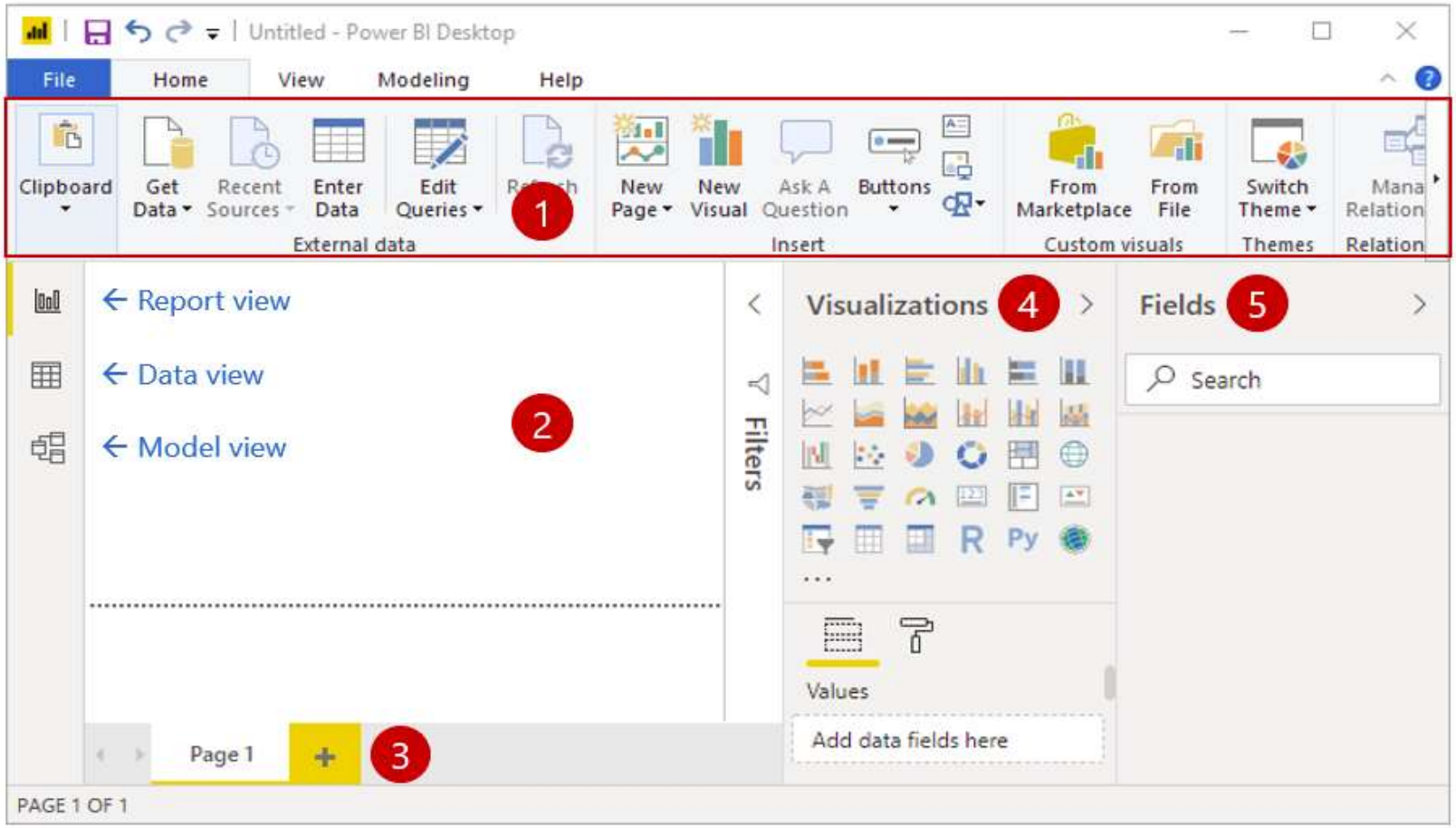

Fig. 6.1: Creating Dashboard

Exploring PowerBI Desktop…

1. **Ribbon** - Displays common tasks that are associated with reports and visualizations.
2. **Report view, or canvas** - Where visualizations are created and arranged. You can switch between Report, Data, and Model views by selecting the icons in the left column.
3. **Pages tab** - Located along the bottom of the page, this area is where you would select or add a report page.
4. **Visualizations pane** - Where you can change visualizations, customize colours or axes, apply filters, drag fields, and more.
5. **Fields pane** - Where query elements and filters can be dragged onto the Report view or dragged to the Filters area of the Visualizations pane.

Exploring PowerBI Desktop…

Power BI Desktop has three views:

- **Report view** – You can use queries that you create to build compelling visualizations, arranged as you want them to appear, and with multiple pages, that you can share with others.
- **Data view** – See the data in your report in data model format, where you can add measures, create new columns, and manage relationships.
- **Model view** – Get a graphical representation of the relationships that are established in your data model, and manage or modify them as needed.

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Exploring PowerBI Desktop…

Power BI Desktop has three views…

- Power BI Desktop also comes with **Power Query Editor**.
- Use Power Query Editor to connect to one or many data sources, shape and transform the data to meet your needs, then load that model into Power BI Desktop

Exploring PowerBI Desktop…

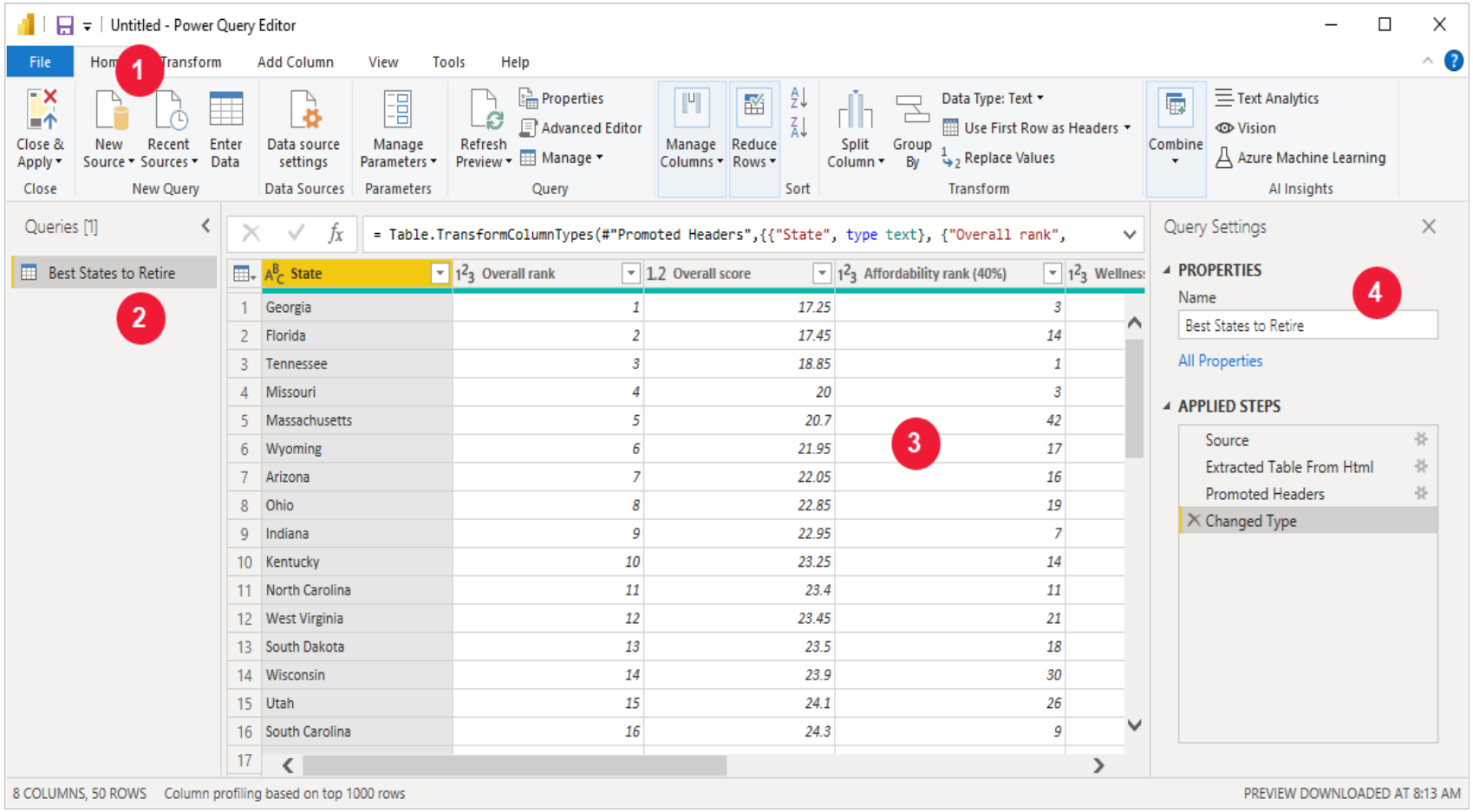


Fig. 6.2: View of PowerBI

Exploring PowerBI Desktop…

1. In the ribbon, many buttons are now active to interact with the data in the query.
2. In the left pane, queries are listed and available for selection, viewing, and shaping.
3. In the center pane, data from the selected query is displayed and available for shaping.
4. The Query Settings pane appears, listing the query's properties and applied steps.

7. Importing Datasets

- Power BI can connect to a whole range of data sources from Excel sheets and local databases to several Cloud services.
- Currently, over 60 different cloud services have specific connectors to help you connect with generic sources through XML, CSV, text, and ODBC.

Importing Datasets…

Files: Power BI can import statistics from Excel, CSV, and other record formats.

Databases: It can connect to several databases, which include MySQL, Oracle, and SQL Server.

Direct Query: It can retrieve the desired dataset by connecting to a data source without importing it beforehand.

Online Services: It can connect to various online services for example Google Analytics, Salesforce, and SharePoint.

Live Connection: An up-to-date live connection with a data source in real-time allows users to retrieve up-to-date data.

Importing Datasets…

- As our first step to import the dataset/file into Power BI, we click on the **Get Data** icon on the ribbon of **Home** tab.

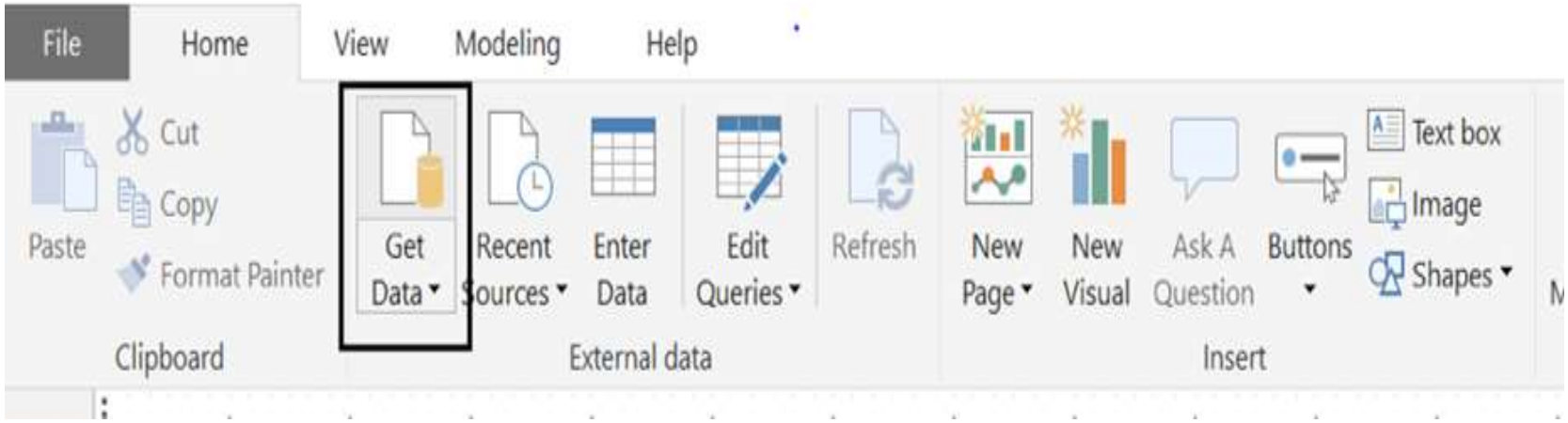
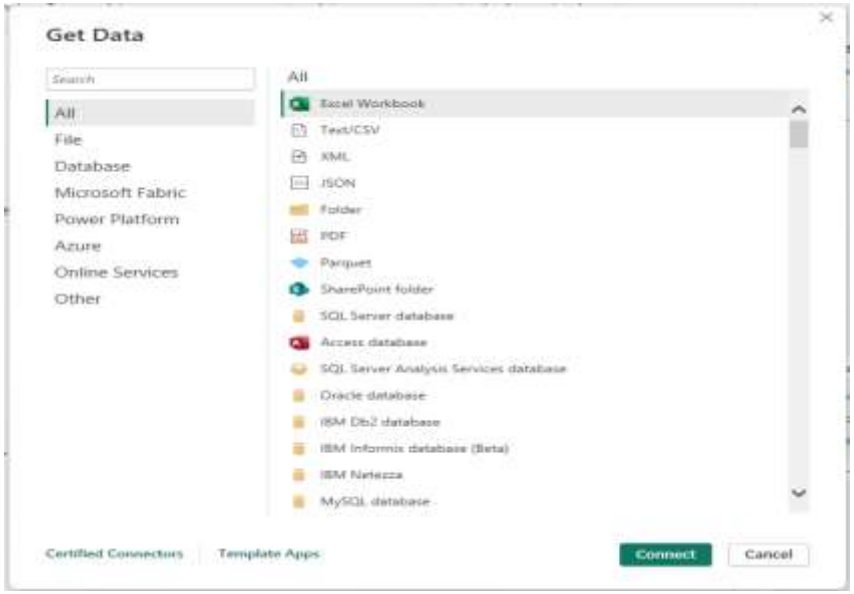


Fig. 7.1: Import the Dataset on PowerBI

Importing Datasets…

- We go Ahead and we can see different data sources including excel files, CSVs , JSON etc. Let's select Excel File for this moment.

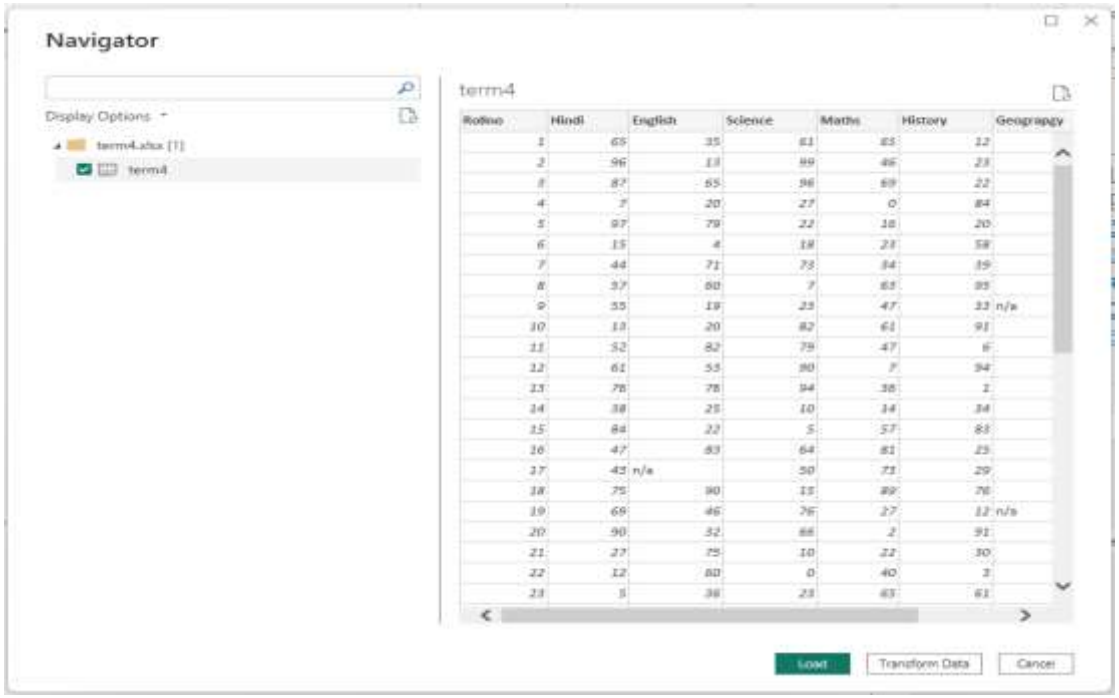


Importing Datasets…

- Click on **Connect** button below to have a quick preview of the file.

Importing Datasets…

- Once we click on **Load**, Power BI will successfully import the file. Any errors will then pop up ready to be analysed and fixed.



8. Data Transformation and Modelling

- **Data transformation** can be defined as manipulating raw data to form a dataset which can be used to form insights.
- These manipulations may include removing null values, or removing unnecessary attributes.
- In other words, data transformation is the process of changing the format, structure, or values of your variables.
- The aim of structuring and reformatting data is to transform it into a data model from which you can learn insights and derive **business intelligence**.
- Data transformation can be done in **Power Query Editor** mode in PowerBI Desktop.

Data Transformation and Modelling…

There are various advantages to transforming data:

- **Better organization**: Transformed data is easier to process for both people and computers.
- **Data quality**: Raw data usually has low quality: missing values, empty rows, and poorly formatted variables. Transforming data to enhance its quality makes life easier for data users, helping them be more productive and gain better insights from their data.
- **Usability**: Too many organizations sit on a bunch of unusable, unanalysed data. Standardizing data and organizing it properly enables your data team to create business value from it.

Data Transformation and Modelling…

- **Data Modelling** is one of the features used to connect multiple data sources in BI tool using a **Relationship**.
- A relationship defines how data sources are connected with each other and you can create interesting data visualizations on multiple data sources.
- With the modelling feature, you can build custom calculations on the existing tables and these columns can be directly presented into Power BI visualizations.
- This allows businesses to define new metrics and to perform custom calculations for those metrics.

Data Transformation and Modelling…

- When you add multiple data sources to Power BI visualization, the tool automatically tries to detect the relationship between the columns.
- When you navigate to the **Relationship** tab, you can view the relationship.
- You can also create a Relationship between the columns using **Create Relationships** option.

- Joining (link data together), Merging (consolidate data from multiple sources) and integrating (reconcile name and values for the same data elements across different sources) can be termed as **Data Modelling**.

Data Transformation and Modelling…

- **Power Query** is used to transform data by performing tasks such as filtering, grouping, and pivoting.
- It helps to create calculated columns and measures by using the formula bar and functions.
- After the cleaning and transformation of your data, you can move on to your visualizations.

9. Visualizing Data in PowerBI

- Data can be visualized using Visualization Pane in PowerBI Desktop.

- The different kind of visualizations available in PowerBI are Stacked Bar Chart, Stacked Column Chart, Line Chart, Area Chart, Ribbon Chart, Waterfall Chart, Funnel Chart, Scatter Chart, Pie Chart, Donut Chart, Tree map, Filled map, Card, Multirow Card, Slicer, KPI, Table, Matrix etc.

Fig. 9.1: Visualizing of Data

Visualizing Data in PowerBI…

Bar Chart-

- Bar Charts are a summary of categorical data and display data using several bars, each representing a particular category.
- The height of each bar is equal to the sum of the values in the category it represents.
- There are mainly two variations of Bar Chats. Depending on the situation charts are used: **Clustered Bar Charts** and **Stacked Bar Charts**.

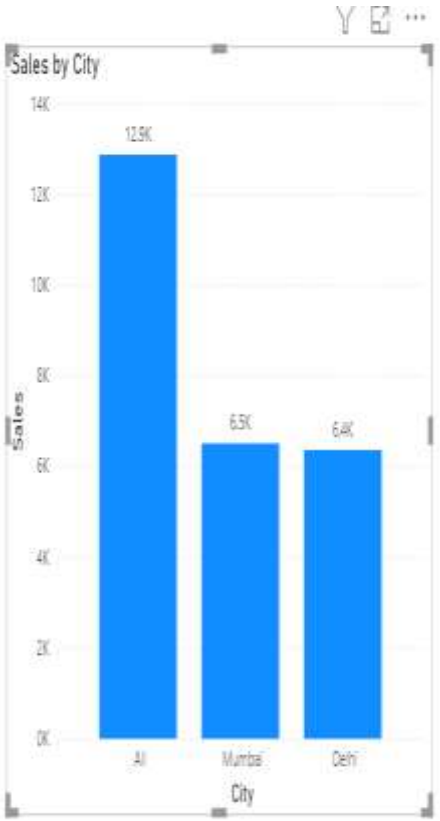


Fig. 9.2: Visualizing of Dat's through Bar Chart

Visualizing Data in PowerBI…

Bar Chart

Main Parts of Stacked Bar Charts

- **Title**: It denotes the information about the chart
- **X-axis**: It is the individual entry for the category to be presented
- **Legend**: It is the different category that will contribute to the charts
- **Y-axis**: It is for the value against each type of category
- **Bars**: These heights represent the total value of all the legend

Visualizing Data in PowerBI…

Slicer-

- Slicers are the interactive filters used to format and analyse the parts of the data more effectively.
- We have various options to format slicers, we can change the value of the alt text, title, etc.
- We can also add various options like slicer headings, hierarchy distribution, and multi-select slicers.

Visualizing Data in PowerBI…

Slicer-

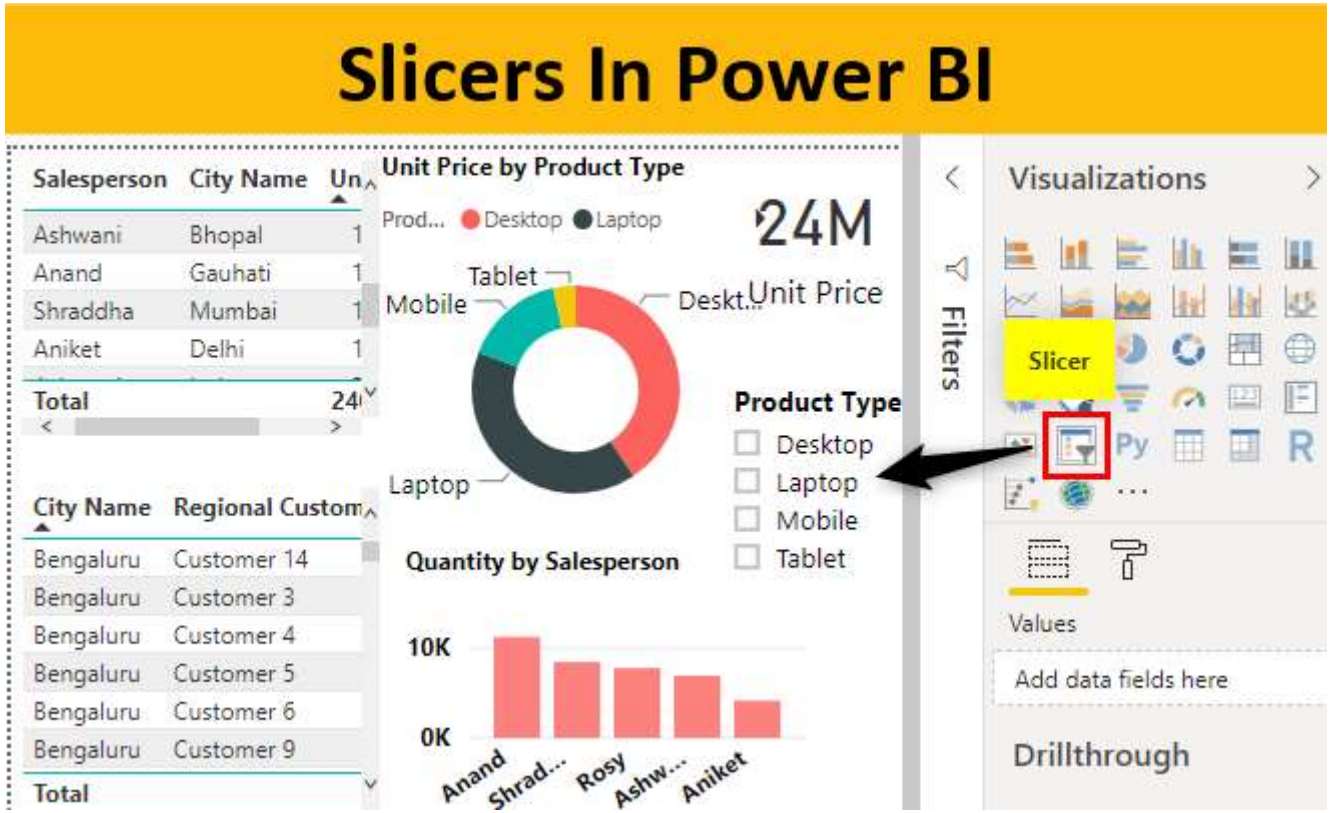


Fig. 9.3: Visualizing of Data's through Slicer

Visualizing Data in PowerBI…

Pie Chart-

- Pie charts show the proportion of each category in the total.
- Use cases include budget expense distribution, market share by product, and consumer demographic composition.

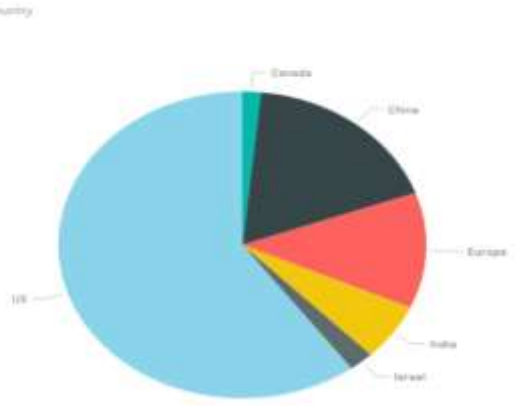


Fig. 9.4: Visualizing of Data's through Pie Chart

Visualizing Data in PowerBI…

Line Graph-

- Line charts are effective for visualizing data with continuous values because they reveal trends across time.
- Used Cases can be Stock price swings over months, website traffic fluctuations over a year, and temperature fluctuations over a day.

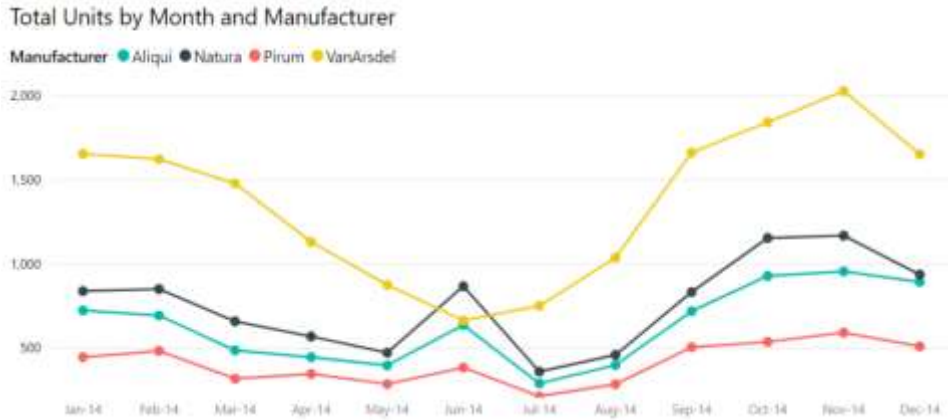


Fig. 9.5: Visualizing of Data's through Line Chart

Visualizing Data in PowerBI…

Area Charts-

- Area charts are useful for displaying data distributions because they emphasize cumulative total.
- An area chart, for example, can be used by a project manager to depict the cumulative progress of tasks accomplished within a project.

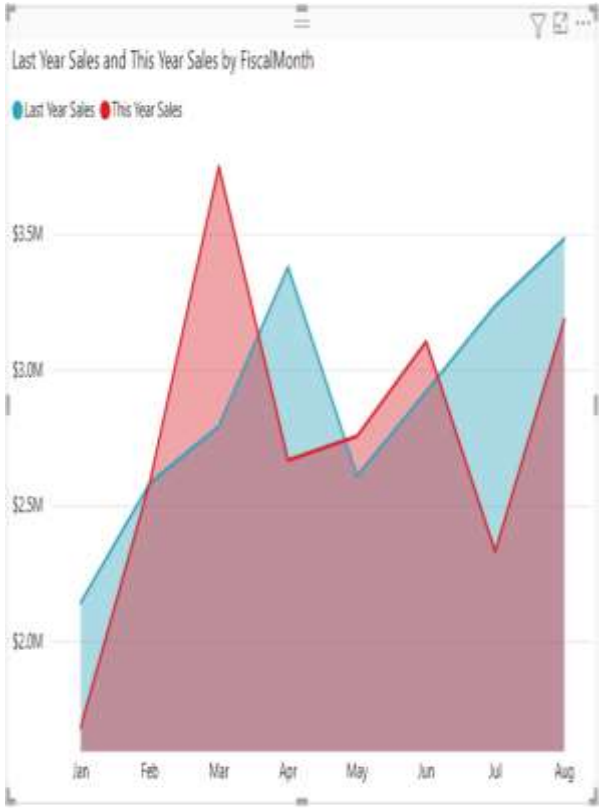


Fig. 9.6: Visualizing of Data's through Area Chart

Visualizing Data in PowerBI…

Waterfall Chart-

- Waterfall charts demonstrate the cumulative influence of positive and negative values on a starting point.
- Financial statement adjustments, budget allocation breakdown, and project cost breakdown are examples of use cases.

Visualizing Data in PowerBI…

Waterfall Chart-

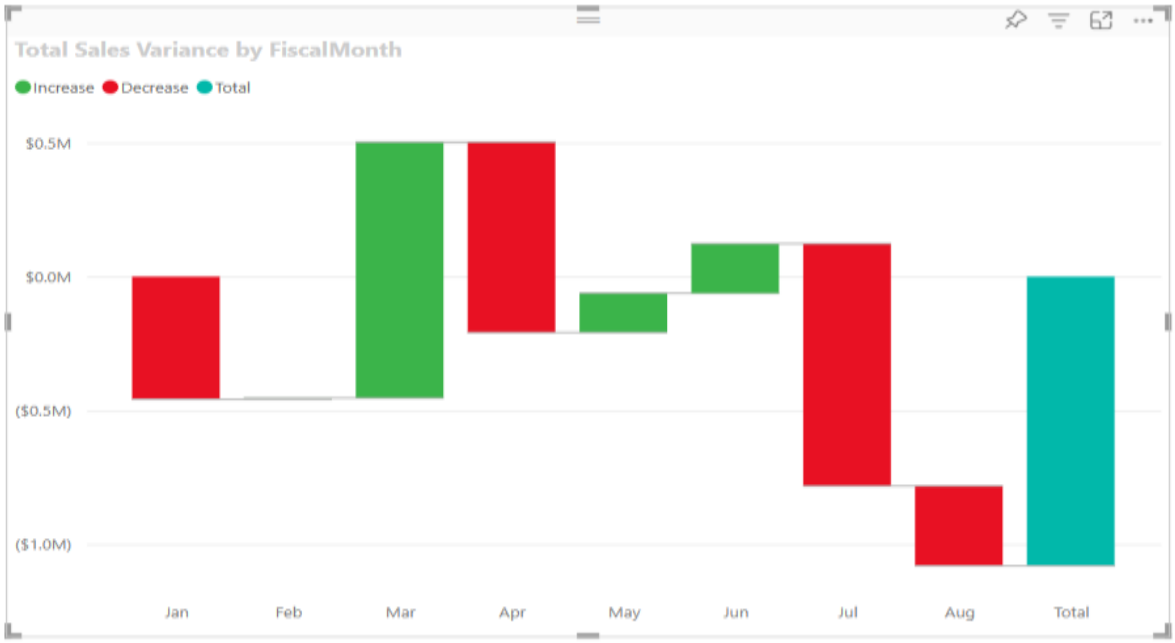


Fig. 9.7: Visualizing of Data's through Waterfall Chart

Visualizing Data in PowerBI…

Funnel Chart-

- Funnel charts are used to visualize the sequential steps of a process, highlighting the drop-off at each level.
- A sales conversion funnel, stages of the recruitment process, and website visitor trip.

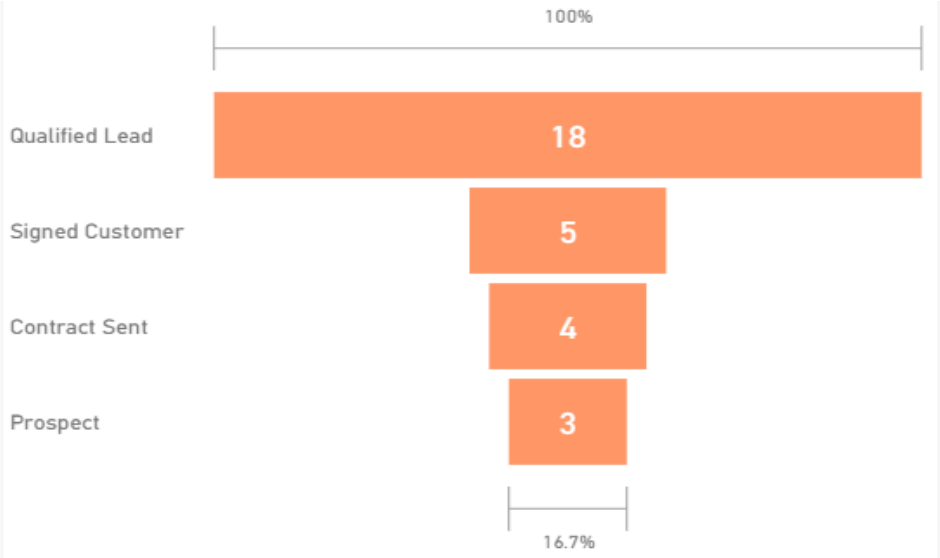


Fig. 9.8: Visualizing of Data's through Waterfall Chart

Visualizing Data in PowerBI…

Treemaps and Sunbursts-

- Treemaps and sunbursts are hierarchical visualizations that show nested data structures.
- Distribution of folder sizes on a hard drive, organizational structure, and product sales breakdown by category and subcategory can be a used case for treemap visualization.

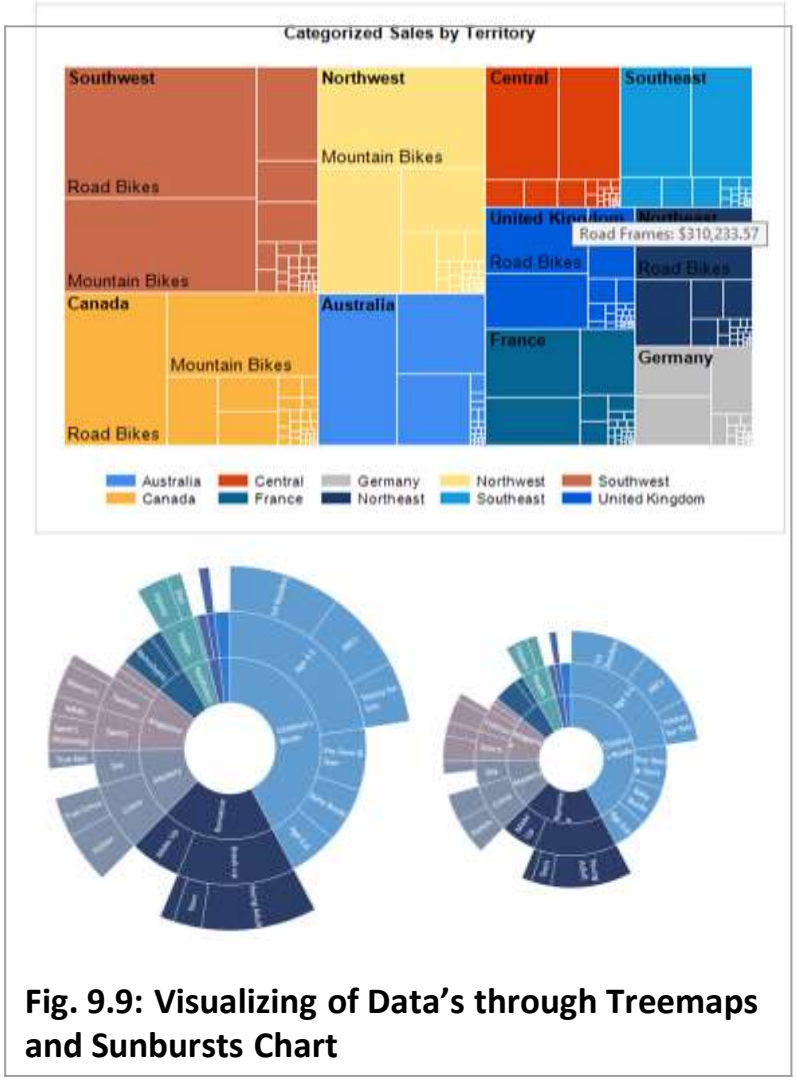


Fig. 9.9: Visualizing of Data's through Treemaps and Sunbursts Chart

Visualizing Data in PowerBI…

Column Diagram-

- Column charts are used to compare data values across various categories.
- Sales by product category, monthly expenses by department, and website traffic by source are all examples of use cases.

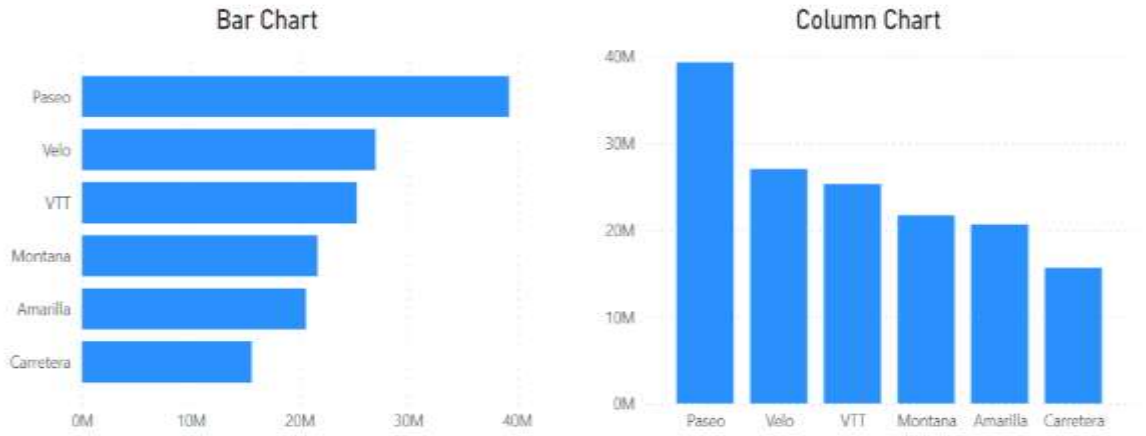


Fig. 9.10: Visualizing of Data's through Column Chart

Visualizing Data in PowerBI…

Box Plot-

- Box plots show the distribution of a dataset and emphasize crucial statistics such as the median, quartiles, and outliers.
- Exam score distributions, wage ranges by job position, and customer purchase amount distributions are all examples of use cases.

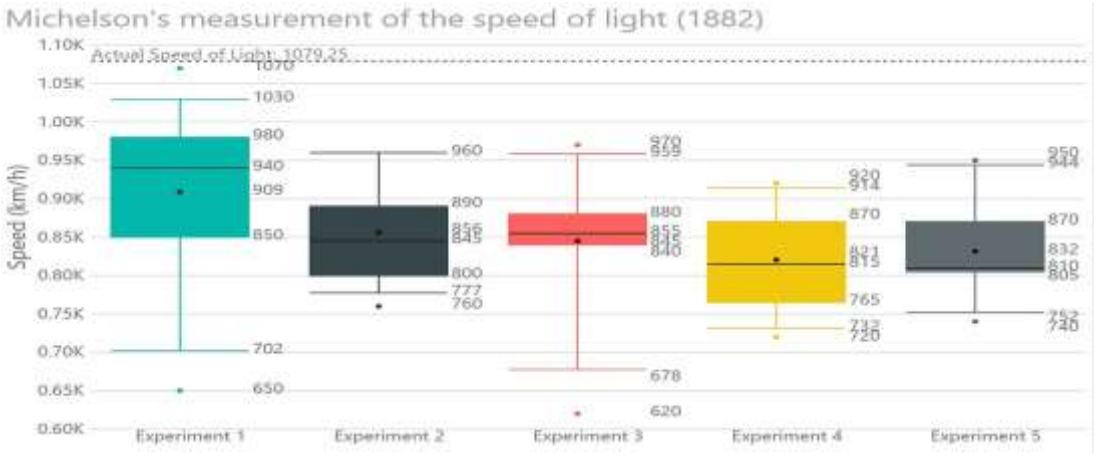


Fig. 9.11: Visualizing of Data's through Box Plot Chart

Visualizing Data in PowerBI…

Scatter Plot-

- Scatter plots represent relationships between two numerical variables, assisting in the identification of correlations and outliers.
- Use cases include the correlation between advertising spend and sales, the association between height and weight, and the relationship between client age and purchase quantity.
- A marketing team, for example, can generate a scatter plot to investigate the relationship between ad spend and sales income.

Visualizing Data in PowerBI…

Scatter Plot-

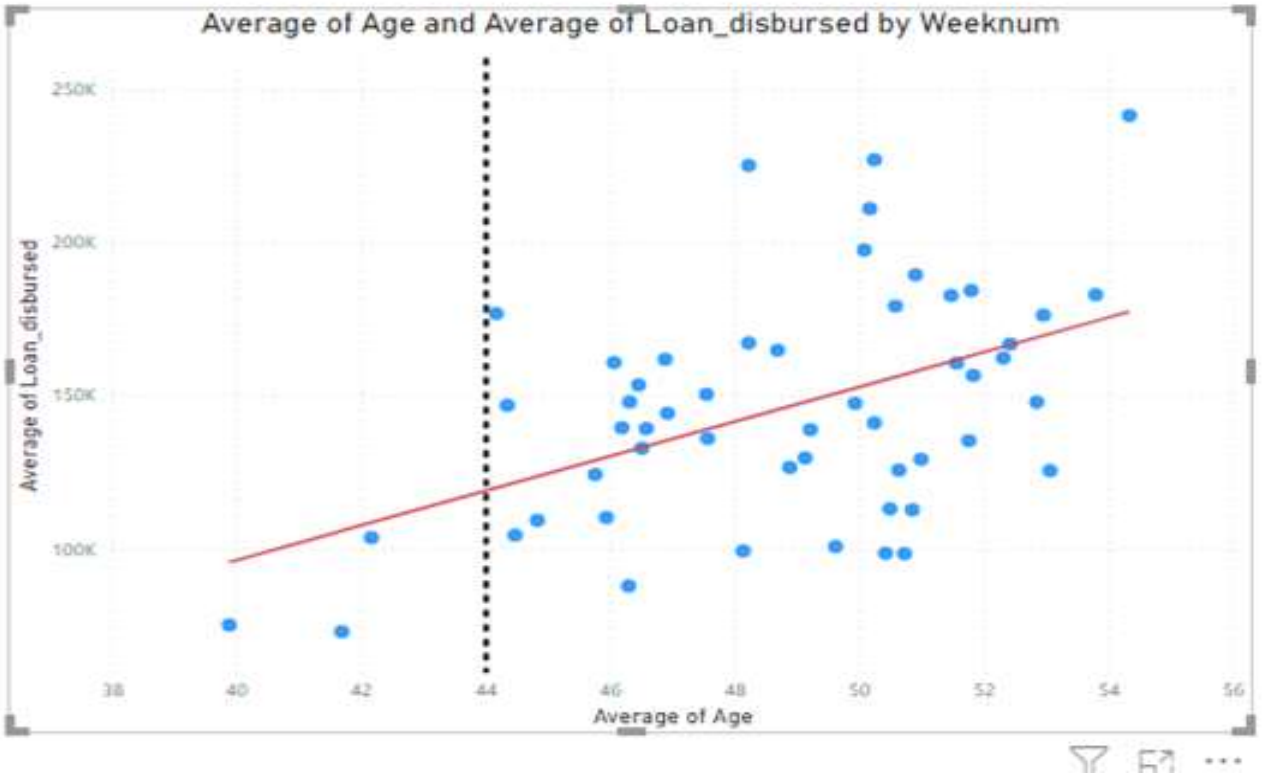


Fig. 9.12: Visualizing of Data's through Scatter Plot Chart

Visualizing Data in PowerBI…

Histogram

- Histograms are used to illustrate the distribution of numerical data and to find patterns or trends.
- Age distribution in a population, economic distribution in an area, and time spent on a website are all examples of use cases.

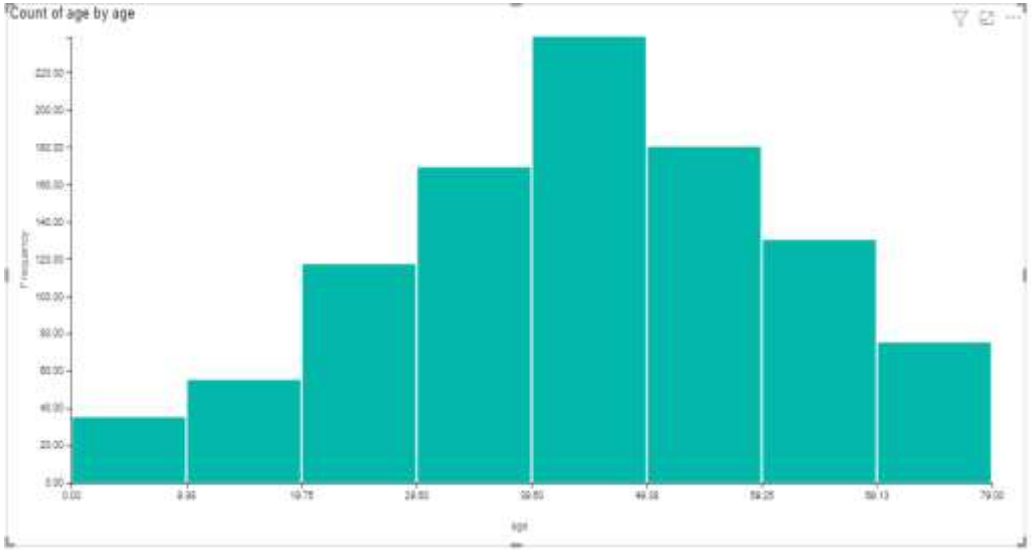
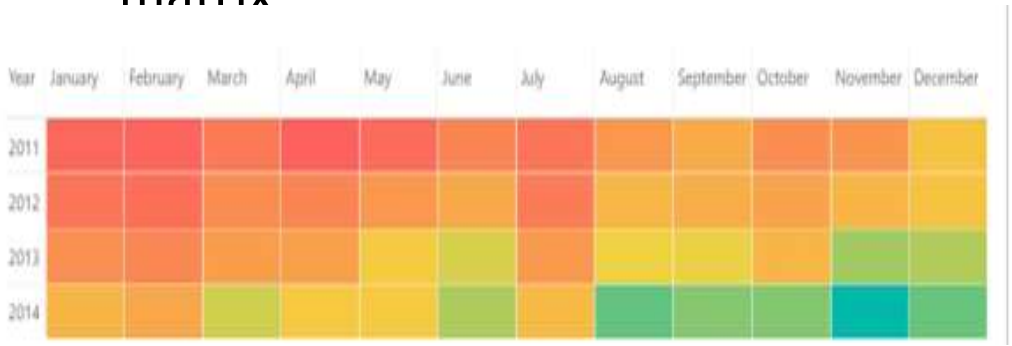


Fig. 9.13: Visualizing of Data's through Histogram Chart

Visualizing Data in PowerBI…

The Heat Map

- Heat maps employ color to represent data values in a matrix, making it simple to spot patterns and relationships.
- Use cases include employee performance across multiple months, website traffic by the hour of the day, and a correlation matrix



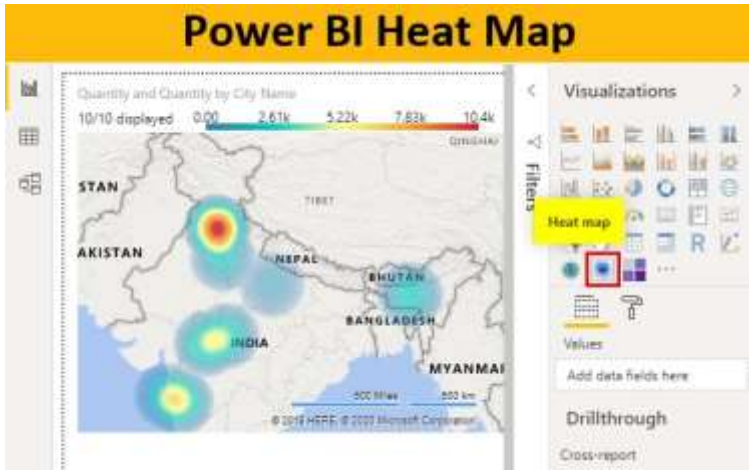


Fig. 9.14: Visualizing of Data's through Heat Map

Visualizing Data in PowerBI…

Key Performance Indicator (KPI)

- KPIs present a single value, as well as a goal value and a trend indication, to provide a snapshot of performance.
- Use cases may include Monthly revenue vs target, website conversion rate, and employee attrition rate.
- For example, an HR manager can develop a KPI to track employee turnover and compare it to the organization's aim.

Visualizing Data in PowerBI…

Key Performance Indicator (KPI)

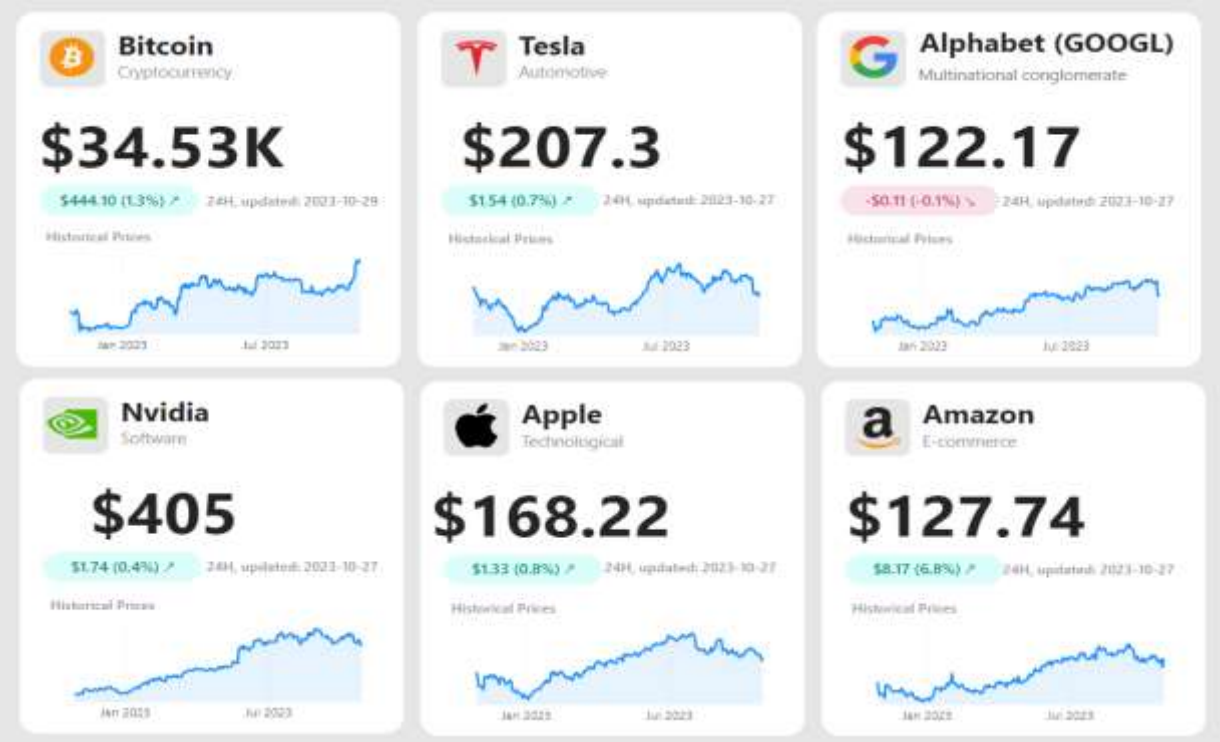


Fig. 9.15: Visualizing of Data's through KPI

Visualizing Data in PowerBI…

Gauge Chart-

- Gauge charts display a single value within a defined range and are frequently used to illustrate performance measures.
- Used cases may include Project completion rates, client satisfaction scores, and project progress.
- As an example, a project manager can use a gauge chart to visually express a project's completion.

Visualizing Data in PowerBI…

Gauge Chart-

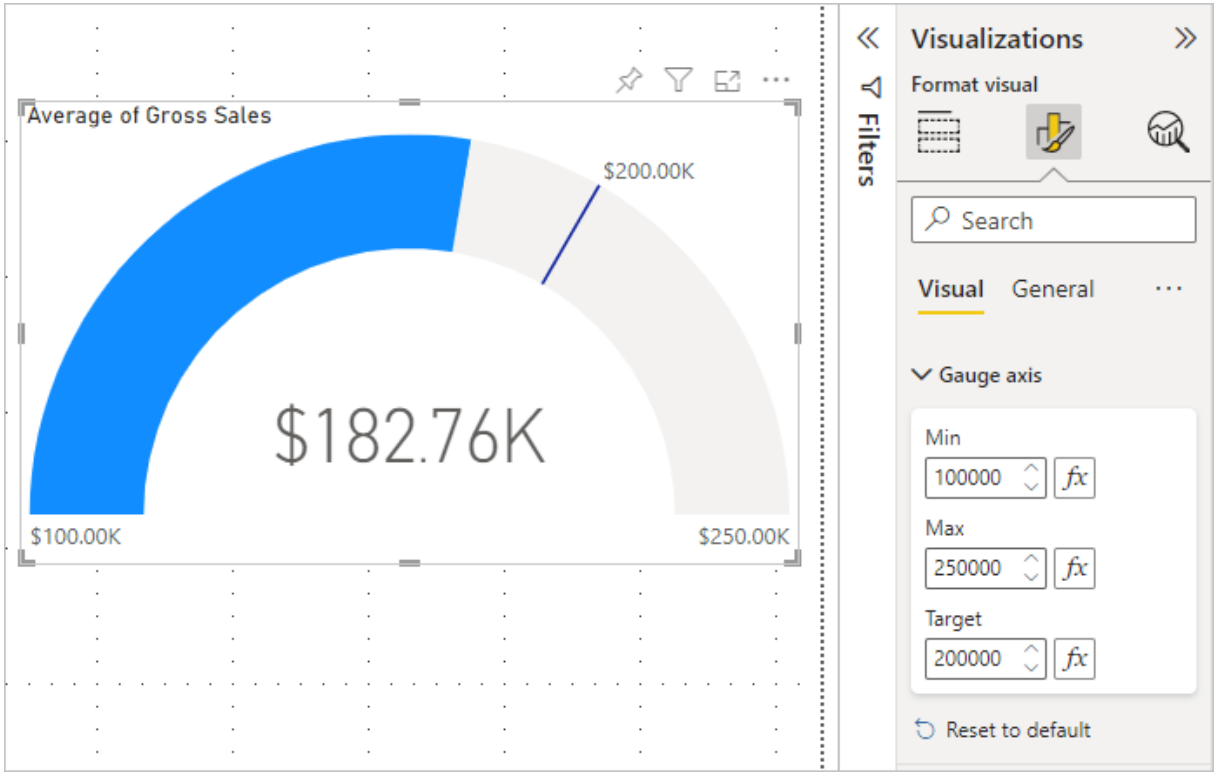


Fig. 9.16: Visualizing of Data's through Gauge Chart

Visualizing Data in PowerBI…

Radar Diagram-

- Radar charts are used to reveal patterns among numerous variables by displaying data points on a circular plot.
- Use cases include evaluating performance across multiple dimensions, comparing product features, and assessing expertise.
- A sports coach, for example, can use a radar chart to evaluate an athlete's performance in multiple skill areas such as speed, endurance, and accuracy.

Visualizing Data in PowerBI…

Radar Diagram-

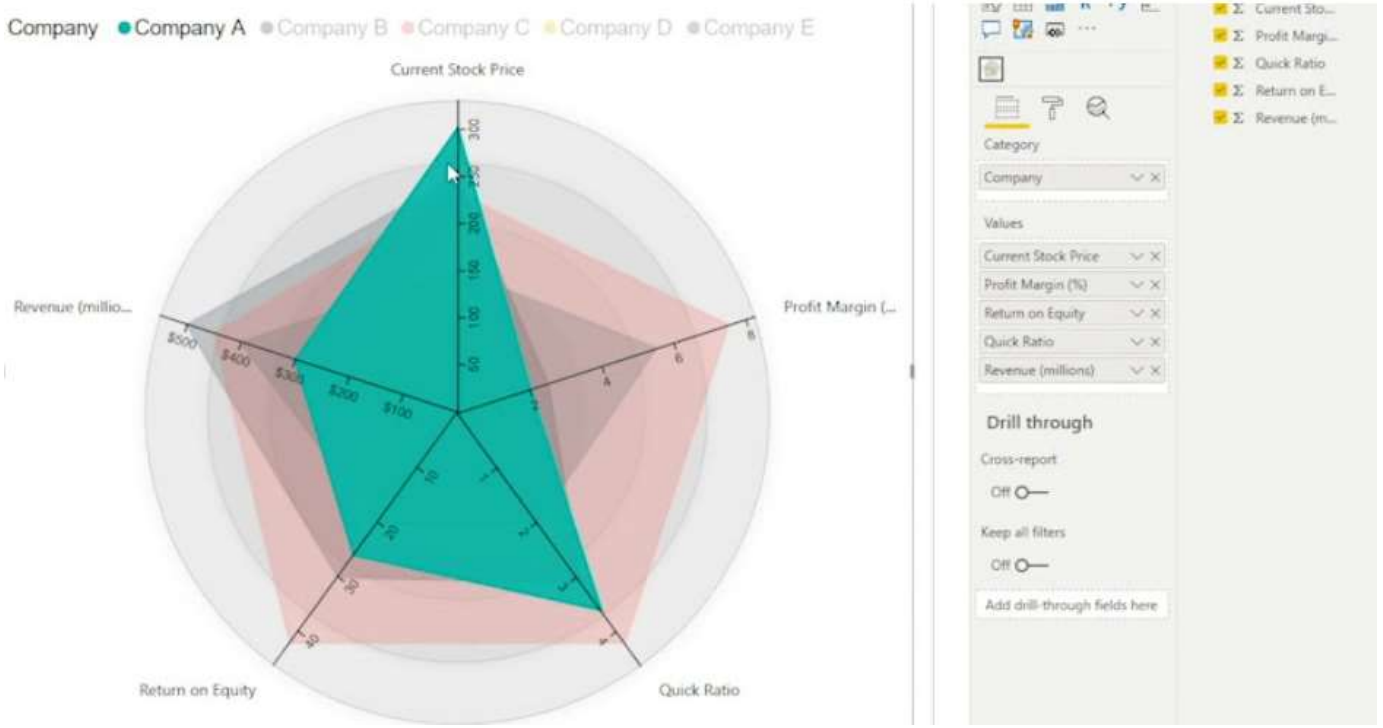


Fig. 9.17: Visualizing of Data's through Radar

Visualizing Data in PowerBI…

Matrix-

- A matrix is a type of visualization that's analogous to a table in that it's made up of rows and columns.
- To fill the values in the matrix, there are three fields: Row, Column, and Values.

Region / Sales Stage	Central Opportunity Count	Central Revenue	East Opportunity Count	East Revenue	West Opportunity Count	West Revenue
Lead	**91**	**$441,033,315**	**101**	**$419,536,437**	**47**	**$234,397,428**
Qualify						
Small	10	$11,550,016	19	$23,925,214	5	$5,695,989
Medium	12	$48,820,525	19	$71,617,016	8	$33,018,968
Large	7	$51,344,920	12	$100,149,924	2	$13,727,406
Solution	**29**	**$100,743,789**	**30**	**$134,347,170**	**15**	**$53,441,501**
Proposal						
Small	8	$13,095,186	3	$4,770,862	3	$3,720,287
Medium	4	$15,283,161	6	$25,607,581	5	$21,456,937
Large	2	$18,344,522	4	$29,592,481	2	$17,855,445
Finalize	**5**	**$23,302,246**	**5**	**$30,696,428**	**4**	**$21,176,185**

Visualizing Data in PowerBI…

Card-

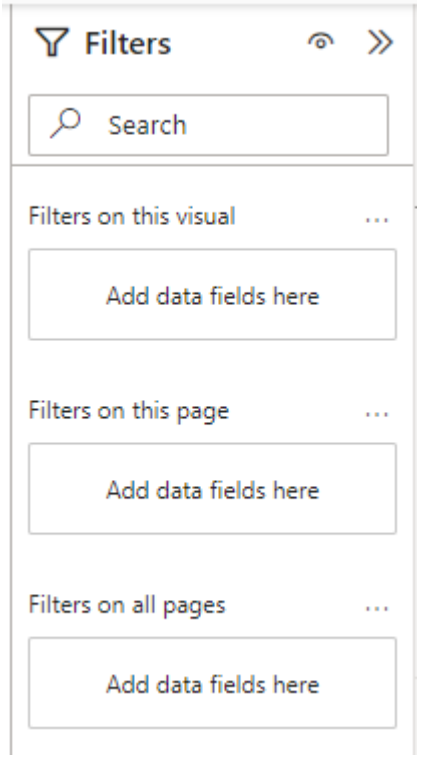
- Cards in Power BI help us display a certain value, corresponding to different dynamic scenarios.
- After the successful, creation of a card in Power BI. We have multiple options to format it.
- For example, adding the title to a card, changing the color, and position of a card, adding tooltips, and callout value in a card.

Fig. 9.18: Visualizing of Data's through Card

10. Filtering Data in PowerBI

In PowerBI filtering can be done using **Filter Pane**

- Visual Filter
- Page-level Filter
- Report-level Filter
- Drill Through Filter



11. Publishing and Sharing Reports

Publishing and Sharing reports can be done using the **Publish** Button in Home ribbon.

Sign in to Power BI if you aren't already signed in.

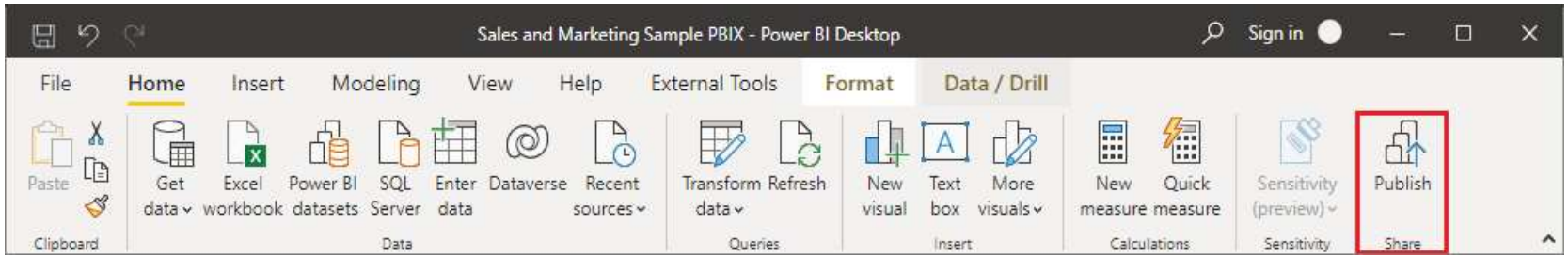
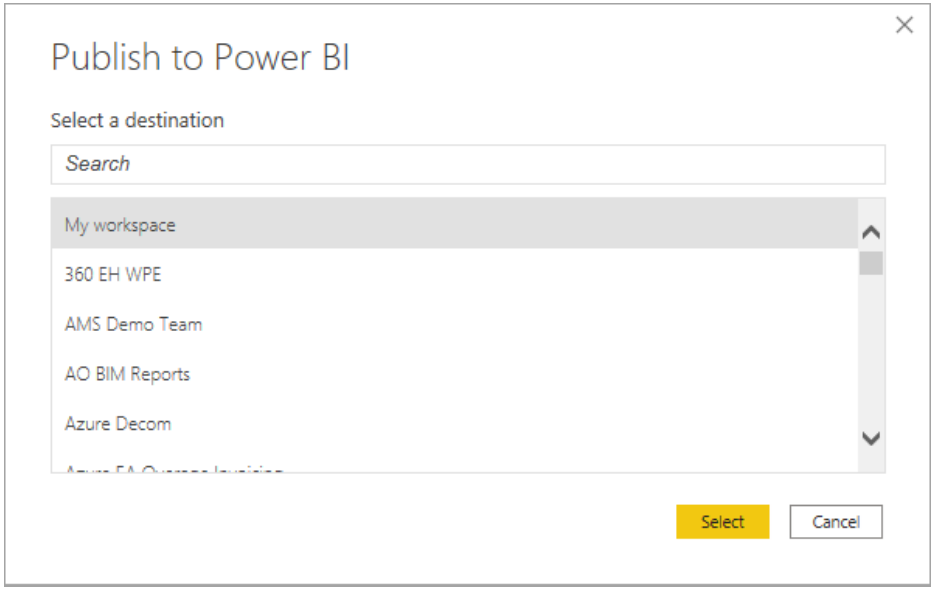


Fig. 11.1: Publishing and Sharing Reports

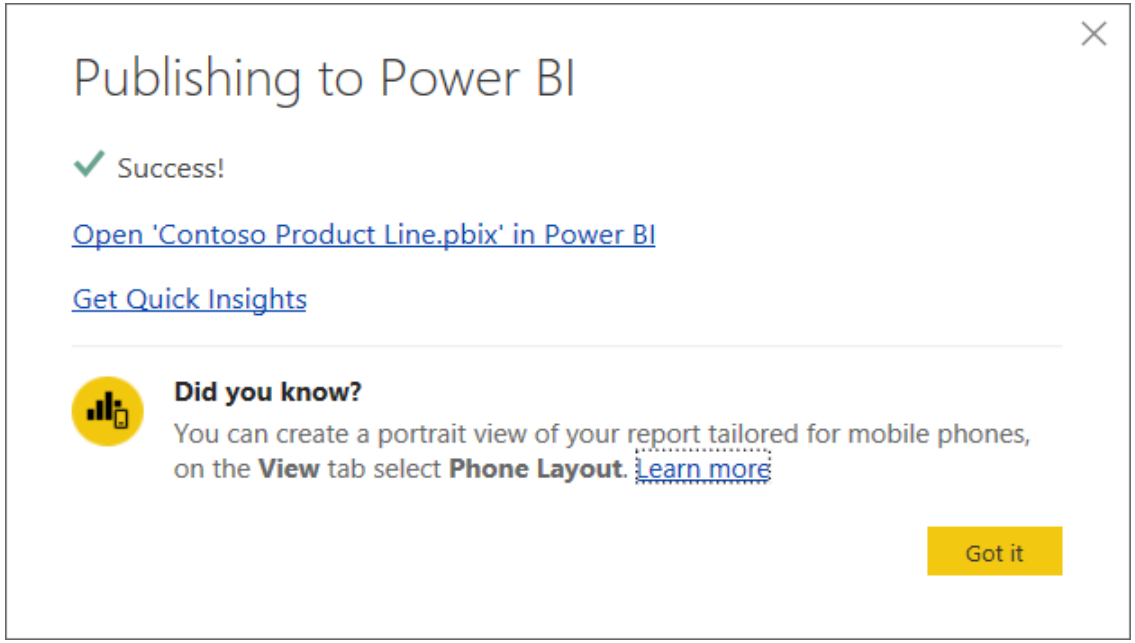
Publishing and Sharing Reports…

- Select the destination.
- You can search your list of available workspaces to find the workspace into which you want to publish.
- The search box lets you filter your workspaces. Select the workspace, and then click the **Select** button to publish.



Publishing and Sharing Reports…

- When publishing is complete, you receive a link to your report. Select the link to open the report in your Power BI site.



12. Dashboard in PowerBI

Microsoft Power BI Dashboards Use Cases:

- Finance Industry
- Healthcare
- Retail and eCommerce
- Government and Public Sector
- Engineering and Construction
- Manufacturing and Supply Chain
- Marketing and Advertising

Dashboard in PowerBI…

Microsoft Power BI Dashboards Examples:

- Custom Segmentation Dashboard
- Sales Scorecard Dashboard
- Sales Analysis Dashboard
- Email Engagement Analytics Dashboard
- Marketing Campaign Dashboard
- Ad Display Campaign Dashboard
- Financial Analytics Dashboard
- Quarterly Financial Performance Dashboard

Dashboard in PowerBI…

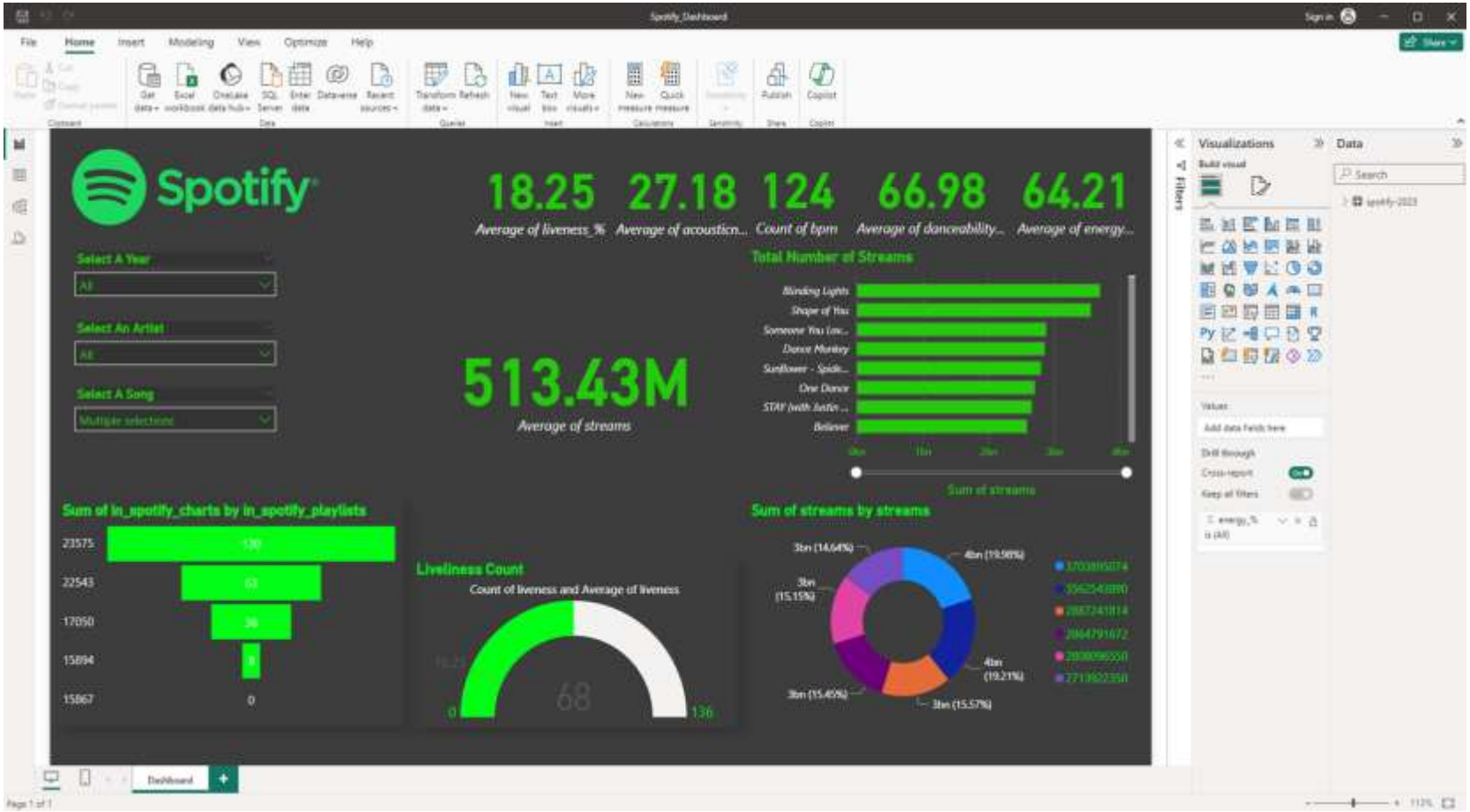


Fig. 12.1 Dashboard

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