



Power BI Manager Guide

Explore how Power BI can help you get the right decision at right time .

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Feb
2025

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Introduction:

This is my Fifth Book Training material in the series of learning Power BI. The first one was "**Extracting and Transforming Data in Power BI**", the Second was "**Data Modeling in Power BI**", the Third was "**Data Visualization in Power BI**" and the Fourth was "**Power BI Quick Start**".

They were training material about fundamentals of ETL (Extract, Transfer, Load) processes in Power BI, how to create a robust and well-structured data model for your data and use the DAX language making your data ready for analyzing and creating insightful reports, and Creating interactive reports and share them on lin. The 4th book was a quick journey in the process of creating reports in Power BI for those who need not to go deeper in the details of the program.

You can download all my books with the training materials from my profile repositories on **github**:

<https://github.com/saidfawzy>

You can also visit my channel on YouTube to watch the complete training of my courses in channel lists.

www.youtube.com/saidfawzy

This book is a guide for the manager to know what is Power BI and what can Power BI gives him to help handling his business.

It will walk you through the process and life of the data analyst to understand the nature of his work and what should you offer him/her to complete their jobs.

It has activities to consolidate the concepts explained in the book in accompanied book "Power BI Manger Guide Activity Book". With both books and training you will get to know how to participate with the data analyst to get a very useful reports and dashboards to support your business.

Feel free to contact me through my Linked in: www.linkedin.com/in/saidfawzy.

You can also join my channels of Power BI:

[Facebook Group](#) [WhatsApp Group](#) [LinkedIn Group](#) [Telegram Group](#)

This Book is free and feel free to share with anyone with the accompanied material. And never hesitate to contact me if you need any help.

Said Fawzy
Manager of Information Center
Arab Contractors
27 Feb. 2025

Objective of The Book and Training

By the end of this two-day training, participants will:

1. Understand Power BI Fundamentals

- Define **Power BI** and its role in **data-driven decision-making**.
- Recognize the **key components** of Power BI: **Power Query, Data Model, Reports, and Dashboards**.

2. Explore the Data Analysis Life Cycle in Power BI

- Understand the process of **data collection, transformation, modeling, visualization, and sharing**.
- Learn about the roles of **Data Analysts, Data Engineers, and Project Managers** in the Power BI ecosystem.

3. Recognize the Types of Reports & Visuals in Power BI

- Explore different **chart types** and their applications in project management.
- Identify **key performance indicators (KPIs)** and how to visualize them effectively.

4. Contribute to Report Design & Dashboard Creation

- Learn how to **collaborate with Data Analysts & Engineers** in designing reports.
- Understand which **data fields are essential** for project management dashboards.

5. Apply Power BI to Project Management Scenarios

- Discuss **real-world examples** of how Power BI enhances **project tracking and reporting**.
- Learn how to ensure **data accuracy, consistency, and relevance** for decision-making.

Power BI Benefits for Any Business (Brief Overview)

Power BI is a **powerful business intelligence tool** that helps organizations make **data-driven decisions**. Its key benefits include:

- **Data Integration** – Connects to multiple data sources (Excel, databases, cloud services, etc.).
- **Data Visualization** – Creates interactive reports and dashboards with real-time insights.
- **Automation & Efficiency** – Reduces manual reporting, saving time and effort.
- **Better Decision-Making** – Provides clear insights for faster and smarter business decisions.
- **Collaboration & Sharing** – Enables secure sharing of reports across teams and devices.
- **Scalability** – Works for small businesses to large enterprises with cloud-based solutions.
- **Cost-Effective** – Affordable compared to other BI tools, with **Power BI Desktop free to use**.

Power BI in Manufacturing

- Manufacturing today is driven by data. With Microsoft Power BI you can turn raw unprocessed data from disparate sources into actionable insights impacting your entire production process.
- Power BI gives you the ability to monitor **production lines**, track **machine performance** during downtime and overall equipment efficiency all in real time.
- **Quality** is everything in manufacturing, Power BI integrates data from quality control test and product inspections. It analyzes it to identify Trends and detect areas for improvement
- **Inventory management** is complex, you can simplify it with Power BI. Visualize stock levels, predict shortages well before time and get insights to improve supply chain performance.
- You can reduce the chances of **equipment failures**, combine Power BI with your **IOT** network and your sensor data to predict when machines need to be repaired.
- Say goodbye to unplanned downtimes **utilizing the power of AI driven analytics** in Power BI to identify the top performers in your team. Identify skill gaps and training needs to build a truly efficient Workforce.
- Get more visibility into your supply chain. Integrate Power BI to track shipments lead times and monitor several suppliers from one single platform.
- Do your bit for the environment? with Power BI, you can track your energy usage and Emissions helping you to **reduce environmental impact** and meet relevant compliance standards
- Not only production but Power BI can also Aid in fiscal management, consolidate various financial performance reports, analyze costs and cash flows to find areas to increase efficiency.

Construction and Power BI

- The construction industry shapes our world, from towering skyscrapers to building roads, ports and other infrastructure.
- Managing these projects is challenging to say the least. Juggling **budgets**, resources and **timelines**, is a struggle.
- Inability to effectively manage projects results in:
 - Data silos.
 - Miss deadlines.
 - Cost overruns.
- If you are looking to grow your construction business, it is time to adapt to Innovative technology Like Power BI helps you to analyze the data generated and discover avenues for better project management.
- Power BI is a tool that can:
 - Transform your data into actionable insights.
 - Making your projects run smoother
 - Drive efficiency and power organizational growth.
 -
- The Capability of Power BI Can assist you improve the overall project management through:

Intuitive Project Dashboard:

- Visualizing your project data like never before from Project times to Resource Allocation, the customized Power BI reports put the information you need right at your fingertips.

Better budget management:

- Managing costs is crucial.
- With Power BI Financial Insights you can track expenses, monitor costs and optimize fiscal management of your project.

Optimal use of resources:

- Efficiently allocating Resources with Power BI.
- Optimize Workforce distribution, monitor equipment usage and ensure every aspect of your project is operating at its best.

Smarter bidding:

- Analyzes historical project data market trends to predict competitor bids to make informed and competitive bids of your own.

higher safety:

- With Power BI you can radically transform the way you approach safety.
- Monitor incident reports and address potential hazards on time.

You can reach all that using:

- Comprehensive need assessment.
- Custom dashboards

- Connection with the right data sources
- Accurate data modeling
- Complete training and support.

Chapter 1: Introduction to Power BI

What is Power BI?

Power BI is software to create & publish reports and data stories from your datasets. You can make highly interactive, engaging and powerful reports, dashboards or visuals with Power BI. You can connect to any data (Excel files, SQL databases, BI warehouses, Cloud data, APIs, web pages and more), mashup the data, link one table with others, create *clickable* visualizations and then share them with your audience securely through Power BI.

How is Power BI different from Excel?

- **Power BI allows rich, immersive and interactive experiences** out-of-box. You can click on a bar in bar chart & other visuals respond to the event and highlight or filter relevant data. You can show graphs & visuals that are very tricky (or impossible) to reproduce in Excel like maps, pictures and custom visuals.
- **Power BI works with large data sets. There** is no artificial limit of 1mn rows in Power BI. You can hookup to a business data set and analyze any volume of data. The limit depends on what your computer (or Power BI server) can process.
- **Share and read reports easily. You** can create reports in Power BI and share them in formats that are universal (*i.e.* browser pages or apps). This means your boss need not have Excel or Power BI installed to enjoy the beautiful reports you create.
- **Power BI is for story telling** while Excel is for *almost anything*. We can use Excel to simulate pendulum motion, calculate Venus's orbit, model a start-up business plan or many other things. Power BI is mainly for data analysis & story telling. If you try to replicate a large, intricate financial model or optimization problem with Power BI, you will either fail or suffer miserably. On the other hand, if you use Power BI for making reports, running cool analysis algorithms (clustering, outlier detection, geo-spatial patterns etc.) you will wow your colleagues and bosses.

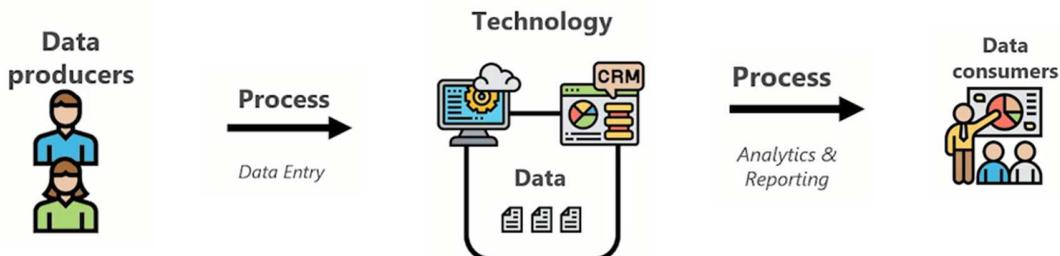
Data Life Cycle

Business Process

Some examples of business processes are things like sales inventory management and payroll. So, payroll has processes around it like time sheet entry and then invoicing. But a lot of it really starts around the time sheets that people enter and all the different tracking you're doing and all the downstream processes that end up coming out of it.

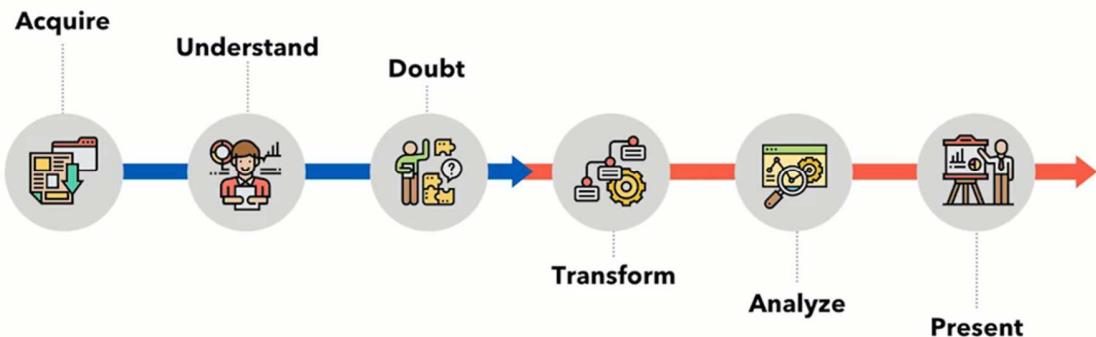
- Pick one of those or a business process that you have in your organization and frame it around this data lifecycle.

Data Cycle in your organization



- Typically, there's **some type of technology** that we have in our organization that is used to help manage our business process. So, we may have **spreadsheets, CRM**, we may have an **ERP** all depending on how large our organization is and how complex the business process is.
- We have **data producers**; these are people that are in our organization that help manage that business process. And then those people end up having some type of **process** around that where they do data entry. So at the end of the day, we have data producers that are in our organization and they're using some type of process to enter data into our systems.
- So after that process is followed and hopefully we have a standard and consistent and ultimately simple process because when we have those things in place we typically find that organizations end up with higher quality data. So, if the process is understood and is followed then the result in data that gets stored in our technologies is usually of a higher degree of quality. And you may have heard the term **garbage in garbage out**.
- The next thing that happens is we have **data consumers** on the other side that say Hey we'd like to know how well we're doing in terms of sales? What are our inventory levels? Do we need to replenish our inventory? What are our time sheets looking like? Are we logging as many hours in a month as we thought we might be to hit our revenue targets?
- So, there's all kinds of **business questions** that come out of any one of these processes here.
- So, the data consumers are typically the ones that are asking those questions. And sometimes the data producers and data consumers are the same people. And then the data consumers want to use some type of process around analytics and reporting to actually go ahead and measure that business process so we can see how well it's actually performing. Okay.

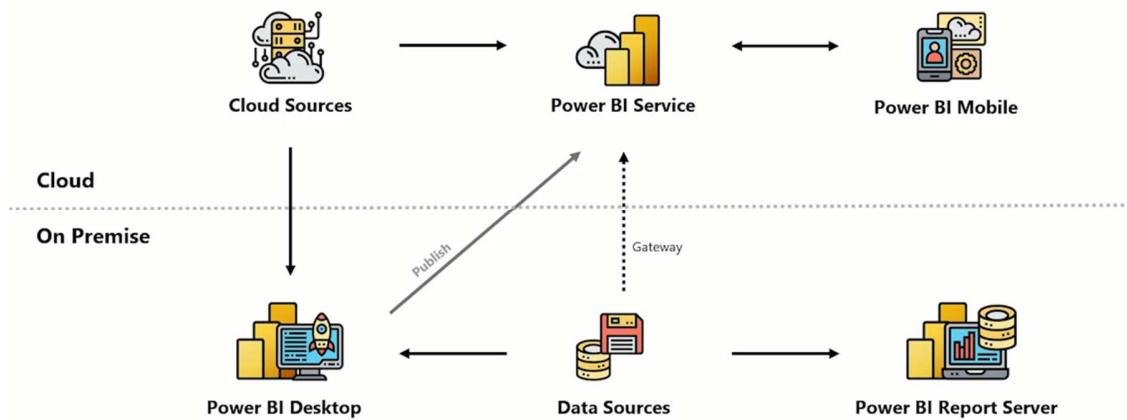
Analytics process flow



- It is the general stages of answering a business question.
 - **step number one when a business question is asked**, you are trying to understand where the data might be in an organization that supports that. So, you must go through some type of **acquisition step**. Maybe you understand that data, maybe you don't.
 - The second step is to go ahead and try **to understand** what that data is telling us.
 - Then often we run into a phase of **doubt**. So, we get the data we start working with and it doesn't quite seem to be adding up to what we'd expect. So, there's some doubting that will happen. And ultimately, we end up going back and working with those subject matter experts to really understand what's happening.
 - Next what ends up happening is we go through some type of **transformation** process. So maybe that data's not quite in the form that we want for reporting or maybe there are some quality issues that are found in that data. We want to go ahead and do some cleansing on that.
 - Then we go through after our data in a report ready state, and we start doing some **analysis** on it to ultimately try and answer that business question.
 - Once we have our findings in place then we're ready to go off and start **presenting** the findings of our business questions to our business users.
- It's highly iterative. We're moving back and forth between these different circles all the time as we learn new things, new business questions are being asked and we learn different things about our data.

Power Bi Environment

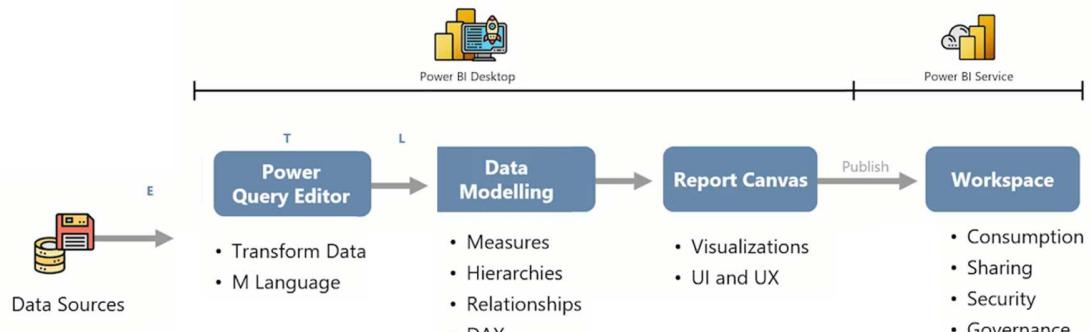
Power BI Architecture



There are separate **two key areas of our services:**

- **On premise:**
 - things installed on a desktop or a server room maybe in your organization.
 - Power BI desktops first connect into data sources and ingest them into the Power BI desktop.
 - We then bring that data in, go through some transformations and get it into a report ready state.
 - And finally building some reports that we can use for consumption.
- **On cloud:**
 - Once that's complete, we want to go through a **publishing** process.
 - We take our work that we've done on the power BI desktop and publish it into the **power BI service** that resides in the cloud.
 - At this point in time the work that you've published will be available through a **mobile device** and almost instantaneously it will be available to you in power BI mobile. And if you have access to the power BI mobile app on your preferred mobile device then you can access your content through there as well.
 - The next one is a **gateway** up is we somehow need a way to get our refresh data daily or whatever your schedule happens to be from our sources on premise up into the cloud.
 - So, the gateway is essentially going to be that transportation highway that allows the Power BI service to connect back down into your on-premises data sources. And bring the new data into the service on your scheduled refresh basis.
 - If you have **data in the cloud**, you don't need the data gateway. You can just connect directly to those cloud-based sources.
- **Power BI report server:**
 - if you actually want to do Power BI work and build things up but never publish it in the cloud and take advantage of some of the features in Power BI you can utilize the Power BI report server.

Power BI End to End Service



- In the **Power BI desktop**, we will work with the power query editor. doing some data modeling, end up building some reporting.
- And ultimately when we're done with those processes, we will take our work and publish it into the **Power BI service** and put our work into a **workspace** in that service.
- we first need to go in and find our **data sources** that's answer our business question we will connect then go ahead and **extract** that data from that data source.
- Once we bring it into the power query editor from an extract perspective then go through a **transformation** step and transform data, using the **M language** that is inside the power query editor.
- Once we go through that step of transforming our data and getting it ready for reporting we will then **load** that data over into the data model.
- Once our data is loaded into the data model and we have data that is almost ready for reporting we will go through a process of adding extra value to that data model. We will build relationships between our tables. Will perhaps add hierarchies to our data model which we'll do in this course. We will then go through and build some **DAX** expressions building some measures.
- Once we have our data model ready for reporting then we will go ahead to the **report canvas** and start doing some **visualizations**. And take those visualizations and craft stories. And hopefully stories that are compelling, easy to understand and satisfy our business questions.
- Once we have put stuff on the report canvas, we will then **publish** our work into the **Power BI service**. Because that is where people will go ahead and consume our data. We will work on sharing our data out.

Power BI Licenses

	Not in Premium capacity	Premium capacity
Free	Use as a personal sandbox where you create content for yourself and interact with that content. A free license is a great way to try out the Power BI service. You can't consume content from anyone else or share your content with others	Interact with content assigned to Premium capacity and shared with you. Free, Premium per-user, and Pro users can collaborate without requiring the free users to have Pro accounts.
Pro	Collaborate with Premium per-user and Pro users by creating and sharing content.	Collaborate with free, Premium per user, and Pro users by creating and sharing content.

Source: <https://docs.microsoft.com/en-us/power-bi/consumer/end-user-license>

Download Power BI Desktop

1. You can download directly from Power BI Site:
 - o <https://powerbi.microsoft.com/en-us/downloads/>
 - o Advantage: You can apply to many computers.
2. You Can Install form **Microsoft Store**.
Advantage: Automatic update.

Power BI Components

- Power BI Desktop,
- Power BI Apps,
- and Power BI Service.

Power BI Desktop

- is a Windows-based desktop application that is mainly used by data analysts or report designers to clean, transform, and load data, create a data model, design reports, and publish these reports. Power BI Desktop uses Power BI connector to access various data types and data sources.
- **Connectors** allow you to read data from various sources. This includes resources located in the local file system, such as Microsoft Excel, or PDF documents. Conventional database systems hosted on internal servers called on-premises databases, Cloud-based databases, and even external enterprise applications, and application programming interfaces, or API's.

Power BI service

- is the Cloud-based BI service or Software as a service part of Power BI. It is used by report users and administrators. Power BI apps is the native mobile application of Power BI.

- It's available on iOS, android, and Windows. With these components and interfaces, Microsoft's Power BI enables users from various disciplines, such as Report Designers, administrators, and business users, to use a product according to their roles.

Power BI Workflow

- the order in which you use these components is known as a workflow.
- A Power BI workflow can be described as the steps taken with data to create, publish, and share.
 1. A typical workflow in Power BI often starts with **the creation of a report** in **Power BI Desktop**. Report designers and developers are primarily responsible for this task.
 2. Once the report is ready, you **publish** it to the **Power BI service**, where administrators can assign permissions, and specific users can consume the reports.

Now, let's examine each step of the workflow in more detail.

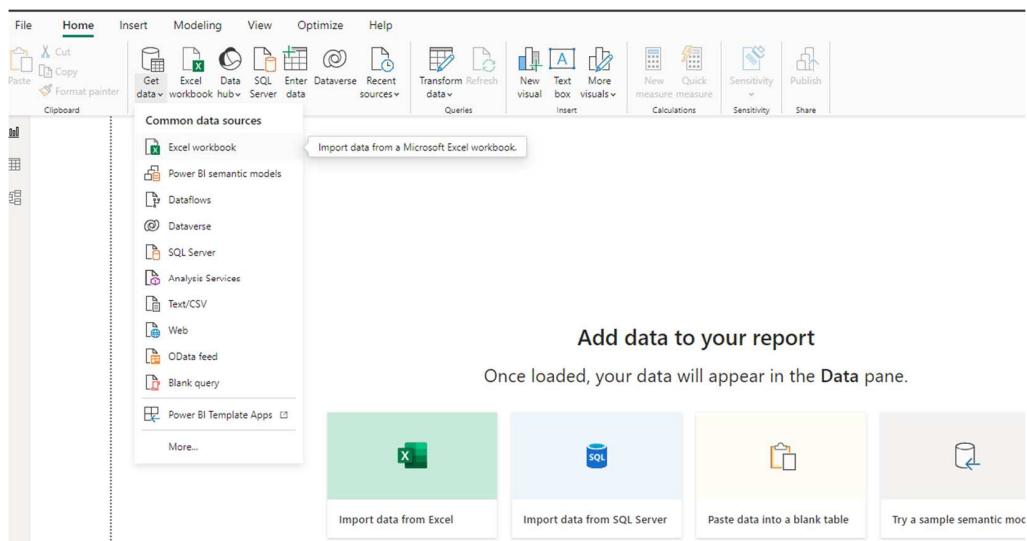
- **Create** is about importing data and creating a report. This step is when you import your data sources into **Power BI Desktop**, clean, transform, and load your data to have targeted data for your reports. Use your filter data to create a report and analyze and present your data using various visualizations and charts in your reports.
- Then you move on to the **publish** step of the workflow, where you publish reports and create dashboards. That means you publish a report to the Power BI service and share your data with others by creating dashboards and use different visualizations and filters to make your data more understandable in your dashboard.
- The final step of this workflow is **sharing**. In this step, you share dashboards with users and manage access to your data. Share your dashboards with the users needed to make it easier to collaborate on projects. Manage access to your data by ensuring that dashboard's have different user permission levels.
- This is also where you consider **mobile usage**. For instance, using Power BI mobile apps, you can view and interact with reports and dashboards that have content pinned from reports anytime and anywhere. You can use different features of the mobile apps to explore and share your data from different perspectives.

In summary, a typical Microsoft Power BI workflow sequences the requirements needed to choose data sources and types in step 1 and then step 2 is used to visualize the data. The third and final workflow presents the resulting reports and dashboards to cater to different user types and their requirements. Using such a workflow, you combine different types of data from many sources using various components, such as Power BI Desktop, Power BI service, and Power BI apps.

Demo 1: Power BI Mini Project

A: Getting Data

1. Use the Excel file: **Employees.xlsx** in Demos folder.
2. Explore the data in the workbook and.
3. Notice you have a worksheet with the Name **HR** and a table with name **table1**.
4. Explore columns you have.
5. Open Power BI.
6. Close the **splash** screen.
7. From **Home** Ribbon in **Data** Group Select **Get Data**.



8. Select Excel Workbook.
9. Browse to your Employees workbook to open.
10. In the **Navigation Pane** notice that on the left you have the tables that are available in the source and when you click a table you get a preview on the right side.
11. You have a sheet and a table with the same date.
12. Select **table1**.

Navigator

The screenshot shows the Microsoft Power BI Navigator window. A file named "Employees.xlsx [2]" is open, and within it, a table named "Table1" is selected. The table preview on the right displays the following data:

Name	Gender	Department	Age	Date Joined	Salary
Barr Faughny	Female	Procurement	39	2/6/2018	68810
Dennison Crosswaite	Male	Website	26	9/16/2017	86400
Gunar Cockshoot	Male	Website	31	5/11/2017	49950
Wilone O'Kiel	Female	Website	43	10/29/2017	11470
Gigi Bohling	Male	Sales	33	1/8/2017	74550
Curtice Advani	Male	Finance	30	8/5/2017	59810
Kaine Padly	Male	Website	20	3/20/2017	58300
Ches Bonnell	Male	Website	37	11/22/2016	71300
Andria Kimpton	Male	Website	30	9/18/2016	58300
Briem Boise	Female	Website	31	10/12/2017	67200
Husein Augar	Female	Finance	30	1/12/2017	58300
Karlen McCaffrey	Female	Finance	34	3/20/2017	71300
Jan Morforth	Male	Finance	28	1/29/2016	58300
Dotty Strutley	Female	Website	31	5/10/2016	58300
Kelci Walkden	Male	Procurement	21	1/20/2018	58300
Marney O'Brien	Female	Finance	21	11/1/2016	58300
Rafaelita Blaksland	Female	Sales	38	12/30/2016	71300
Madelene Uppott	Male	Procurement	25	12/14/2017	58300
Beverie Moffet	Female	Finance	28	6/20/2016	58300
Oby Sorrel	Female	Finance	34	10/2/2017	58300
Mallorie Waber	Male	Procurement	30	10/15/2017	58300
Jehu Rudeforth	Female	Finance	34	8/20/2017	58300
Van Tuxwell	Female	Website	25	11/13/2017	58300

Buttons at the bottom of the Navigator window include "Load", "Transform Data", and "Cancel".

13. You can select Load to **load** to your data model directly.

14. But select **Transform** to go to power query

Load **Transform Data** **Cancel**

The screenshot shows the Microsoft Power Query Editor window. The main area displays the data from "Table1". The ribbon tabs are visible at the top. On the right side, there are two panes: "Applied Steps" and "Query Settings".

Applied Steps: Shows a single step named "Changed Type".

Query Settings: Shows the query name as "Employees".

15. The Power Query is opened in a separate window.

16. Explore Power Query.

17. You have your table in the middle of the screen.

18. You have Ribbons to help you to transform data.

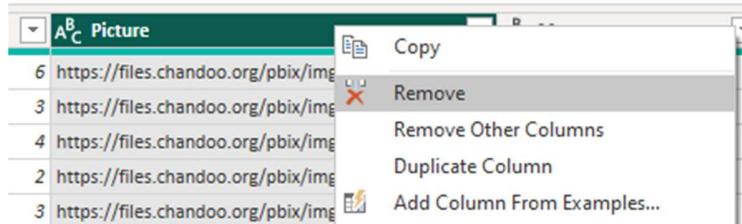
19. On the left you have Queries Pane.

20. In right you have Query settings with Properties and the Applied Steps.

21. Change the name of your Query to **Employees**.

22. We do not need the Picture column.

23. Right click then choose to remove.

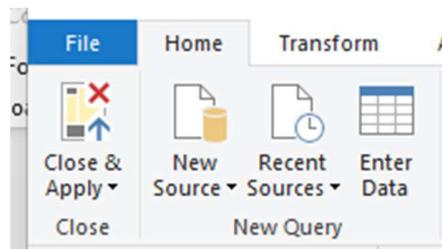


24. Notice that you have the step added to the **Applied steps**.

25. You can undo what you have done by just deleting the step from the Applied steps.

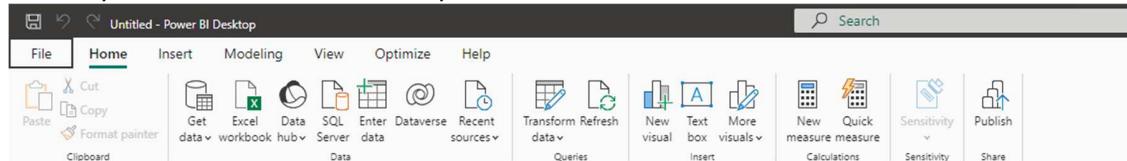
26. Do and redo your removing column.

27. You can now click close and Apply in the Home tab to close power query and get back to the Power BI.



28. You get back to your Power BI File.

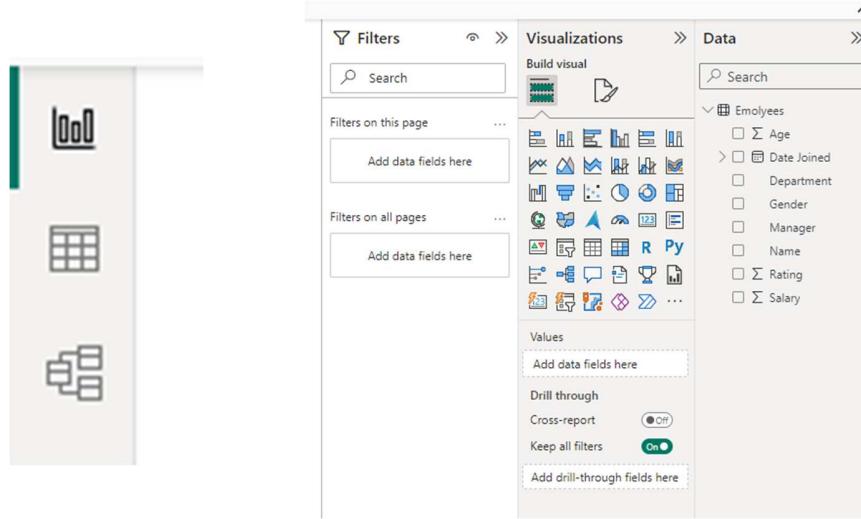
29. Notice you have ribbon on the top .



30. You have Pans on the right : Data, Visualization , and Filter.

31. And on the left you have the three icons of the 3 view of power BI which are :

Report View ,table View and Model view.



32. Report view is where you do your visualization.

33. Click on table view to see the actual data you work with.

34. Click

is
of one table this time.

36. Go back to Report View.

37. Notice that is an old View of Power BI.

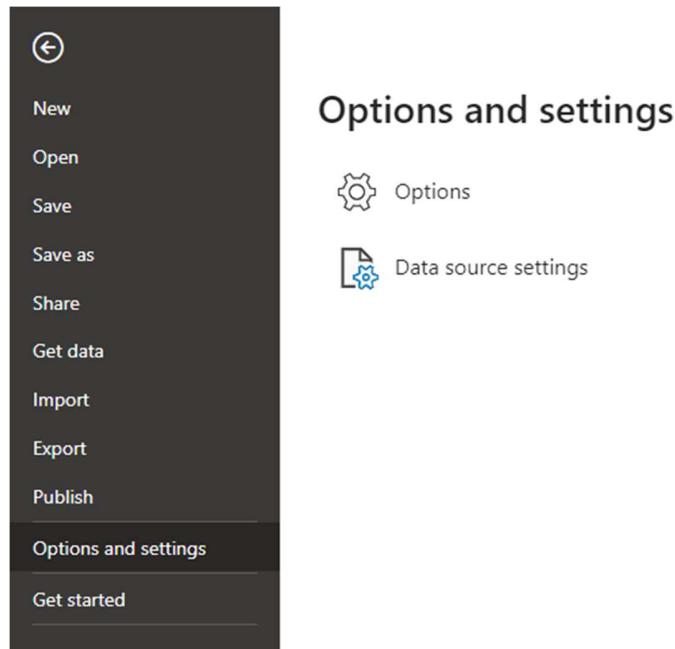
on **Model view** to see data model
35. Notice

B: Change Power BI Settings to on Object Interaction

38. Let us move our view to On Object Interaction View.

39. First Save your File as My First Power BI Report.pbix.

40. Go to File → Option and settings → Options.

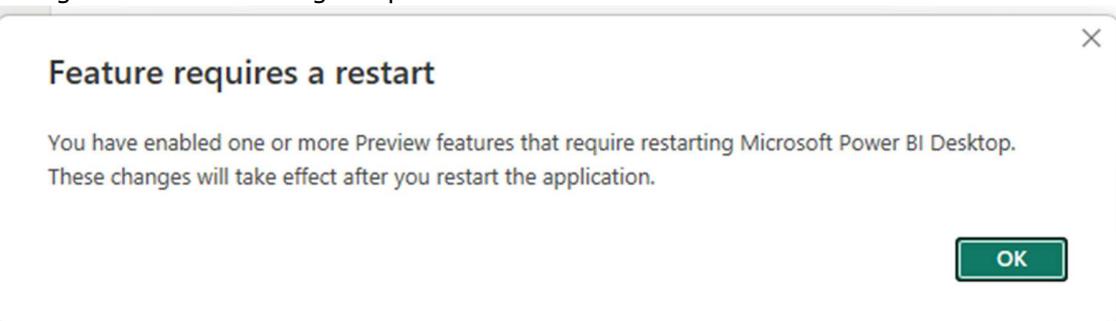


41. In Google → Preview Features → select **On-Object Interaction**

Options

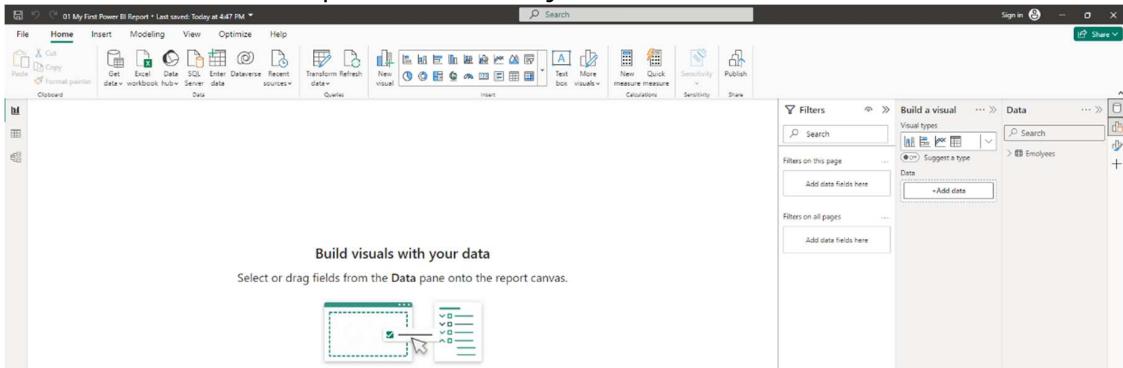
The 'Options' dialog box is shown with the 'Preview features' section expanded. On the left, there's a list of global preview features: Data Load, Power Query Editor, DirectQuery, R scripting, Python scripting, Security, Privacy, Regional Settings, Updates, Usage Data, Diagnostics, and 'Preview features' (which is highlighted with a green border). On the right, under 'Preview features', a list of available features is provided with checkboxes. Some checkboxes are checked (e.g., Sparklines, Metrics visual, Quick measure suggestions, Field parameters), while others are unchecked (e.g., Shape map visual, Spanish language support, Q&A for live connected Analysis Services databases, Connect to external semantic models shared with me, Modern visual tooltips, Enhanced row-level security editor, On-object interaction, Power BI Home in Desktop). Each feature has a 'Learn more' link and a 'Share feedback' link.

42. You got a restart message requirement.



43. Close and reopen Power BI.

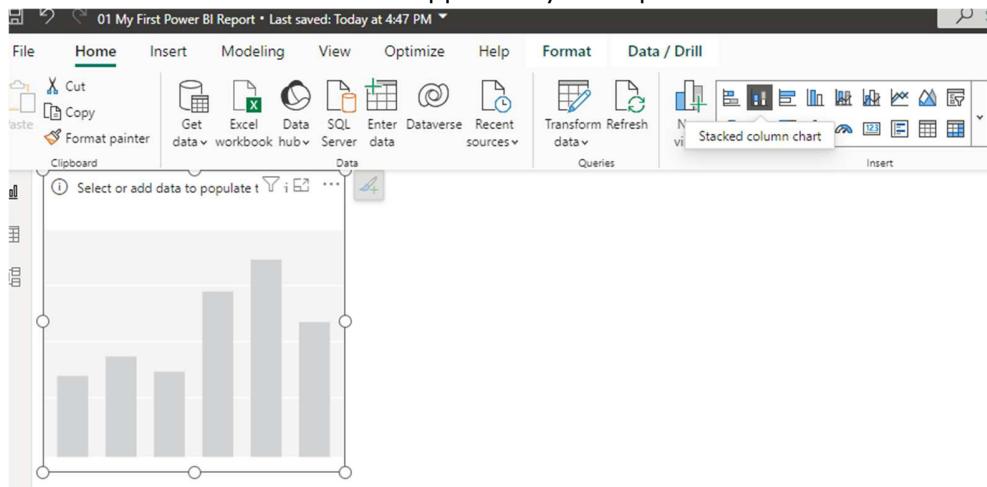
44. You are now in the new preview of on-Object interaction



45. Notice that Visuals are now on the top and you have a new interface.

C: Creating Bar Chart

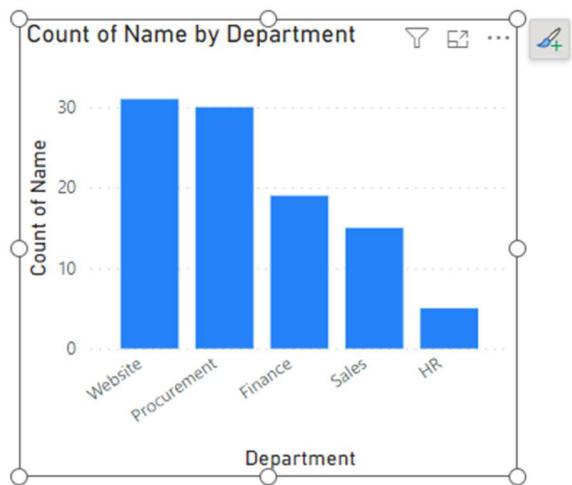
46. Select Stacked column visual to appear in your report Canvas.



47. Your boss wants to know How many employees in each department.

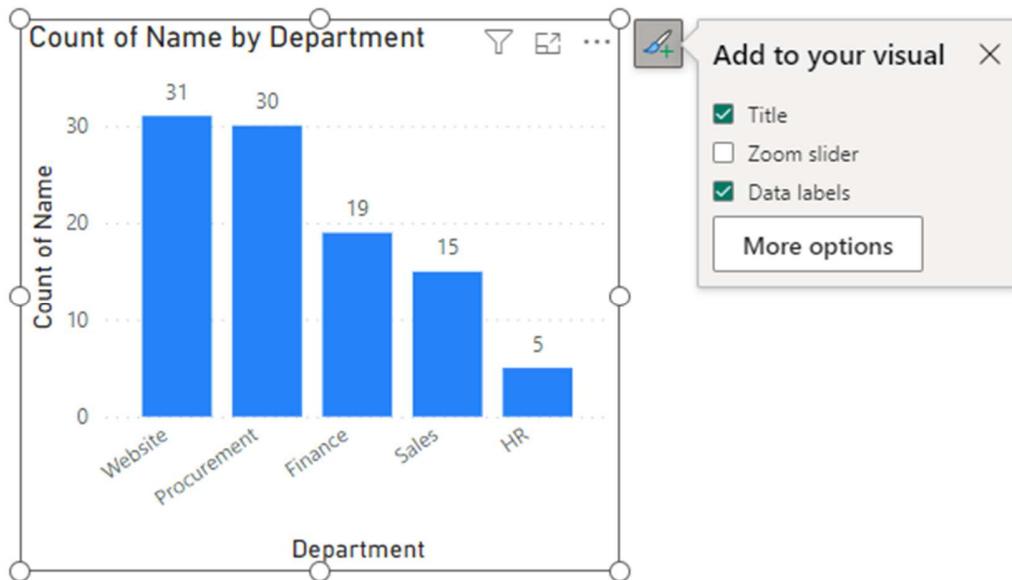
48. Drag Department from data pane to X-axis in Build pane , and drag name to Y-axis (it will then count).

49. You have now the count of employees in each department.



50. Click on the icon on the right of the Visual (add and remove to your visual) and select Data Labels.

51. The Number of employees is now Appear on top of each column.



D: Create Pie Chart

52. We want to what is the ratio between men and women in the company

53. The suitable visual here is Pie Chart.

54. First Click on a free space in Canvas.

55. Then click on Pie from the visual so it is in your Report.

56. Drag Gender to legend and Names to Values, so Power BI count them.



57. Notice you have 3 Gender in the legend **Male, female and Blank**.

58. That means you have a missing value in this column.

59. Go to **table view** and check the **Gender** column.

A screenshot of the Power BI table view showing a list of names and their corresponding gender. The table includes columns for Name, Gender, Department, Age, and Date Joined. A context menu is open over the Gender column, showing options like Sort ascending, Sort descending, Clear sort, Clear filter, Clear all filters, and Text filters. The Text filters dropdown shows checkboxes for (Select all), (Blank), Female, and Male, with (Blank) and Female checked. The OK button is highlighted.

60. Notice you have blank value.

61. You can filter the view to see them.

62. Try to change the value of those two rows, you cannot.

63. To transform the data, you must use power query editor.

64. From the **home** tab in data ribbon chose **Transform data** to open power query again.

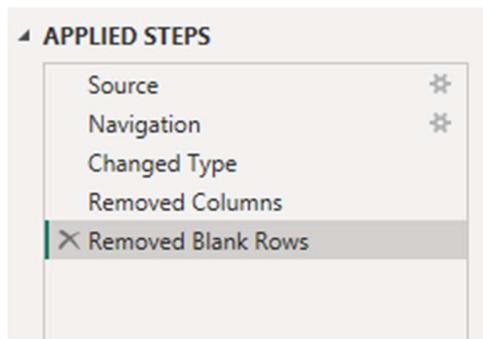
65. Notice you have two null values in the column.
 66. Also, if you go to **view** tab → **Data Preview** → check **column quality**.
 67. You get the % of **valid**, **error** and **empty** values.

	A ^B Name	A ^B Gender	A ^B Department
12	Karlen McCaffrey	Female	Finance
13	Jan Morforth	Male	Finance
14	Dotty Strutley	Female	Website
15	Kelci Walkden	Male	Procurement
16	Marney O'Brien	Female	Finance
17	Rafaelita Blaksland	Female	Sales
18	Madelene Upcott	Male	Procurement
19	Beverine Moffet	Female	Finance
20	Oby Sorrel	Female	Finance
21	Mallorie Waber	Male	Procurement
22	Jehu Rudeforth	Female	Finance
23	Van Tuxwell	Female	Website
24	Roddy Speechley	Male	Procurement
25	Camilla Castle	Female	Website
26	Janene Hairsine	Female	Procurement
27	Niall Selesnick	Female	Website
28	Ebonee Roxburgh	Male	Procurement
29	Zach Polon	Male	Procurement
30	Orton Livick	Male	Procurement
31	Gray Seamon	Female	Sales
32	Benny Karolovsky	null	Finance
33	Dyna Doucette	Male	Procurement
34	Erin Androsik	Male	Procurement
35	Madge McCloughen	null	Website
36	Esmaria Denecamp	Male	Finance
37	Hogan Iles	Female	Procurement

68. You must decide now.
 69. You can delete those rows.
 70. Click Home → Remove Rows → Remove Blank Rows.

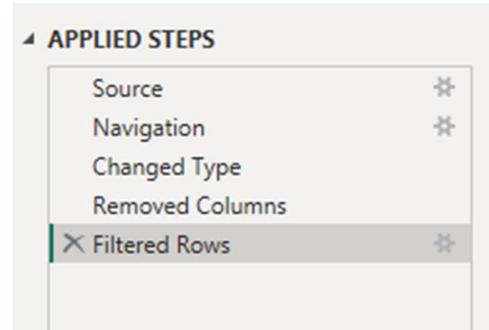
	A ^B Gender	A ^B Department	
	Female	Finance	123
	Male	Finance	
	Female	Website	31
	Male	Procurement	21
	Female	Finance	21
	Female	Sales	38

71. It is not a good decision.
 72. Go and delete that step from applied steps pan in the right.



73. You can do the same thing by filtering the value in the Gender column.

A screenshot of the Power BI 'Filter' dialog for the 'Gender' column. The dialog shows a list of gender values: (Select All), (null), Female, and Male. The 'Female' and 'Male' options are checked. At the bottom are 'OK' and 'Cancel' buttons.



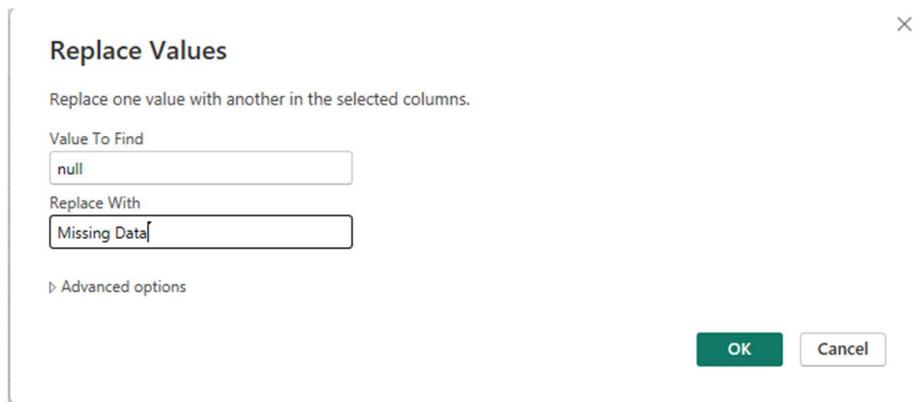
74. Also, it is not a good decision, go and delete this step too.

75. The best thing is to put value in this blank like "**missing data**".

76. Right click the Gender column and choose Replace Value.

A screenshot of the Power BI desktop interface. A context menu is open over a column named 'Gender'. The menu options include: Copy, Remove, Remove Other Columns, Duplicate Column, Add Column From Examples..., Remove Duplicates, Remove Errors, Change Type, Transform, Replace Values..., Replace Errors..., Split Column, Group By..., Fill, Unpivot Columns, Unpivot Other Columns, Unpivot Only Selected Columns, Rename..., Move, Drill Down, and Add as New Query. The 'Replace Values...' option is highlighted with a grey background.

77. In the replace value dialogue box replace null with missing data.



78. It is a chance to see the applied step pan.

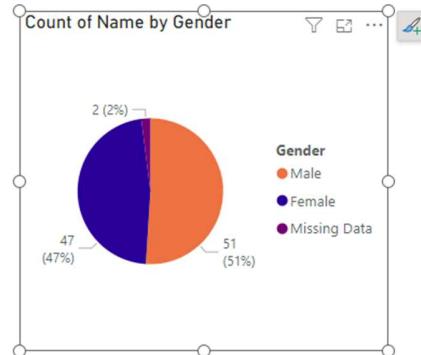
79. Click every step and watch the corresponding **M language** line in the formula bar.

80. You can also go to **Home tab** → **Query Group** → **advanced editor**.

A screenshot of the Power BI interface showing the 'Applied Steps' pane and the formula bar. The 'Applied Steps' pane lists the following steps: Source, Navigation, Changed Type, Removed Columns, and Replaced Value. The 'Replaced Value' step is currently selected. The formula bar shows the M language code: = Table.ReplaceValue(#"Removed Columns", null, "Missing Data", Replacer.ReplaceValue, {"Gender"}).

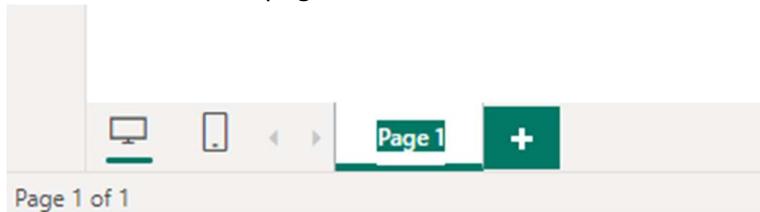
81. You can here see and edit the steps manually in **M language**.
 82. From **home** tab click **Close & Apply** to go back to power BI.
 83. Notice now it appears in **table view** and **report view** in the Pie chart.

Niall Selesnick	Female	Website
Ebonee Roxburgh	Male	Procurement
Zach Polon	Male	Procurement
Orton Livick	Male	Procurement
Gray Seamon	Female	Sales
Benny Karolovsky	Missing Data	Finance
Dyna Doucette	Male	Procurement
Erin Androsik	Male	Procurement
Madge McCloughen	Missing Data	Website
Esmaria Denecamp	Male	Finance

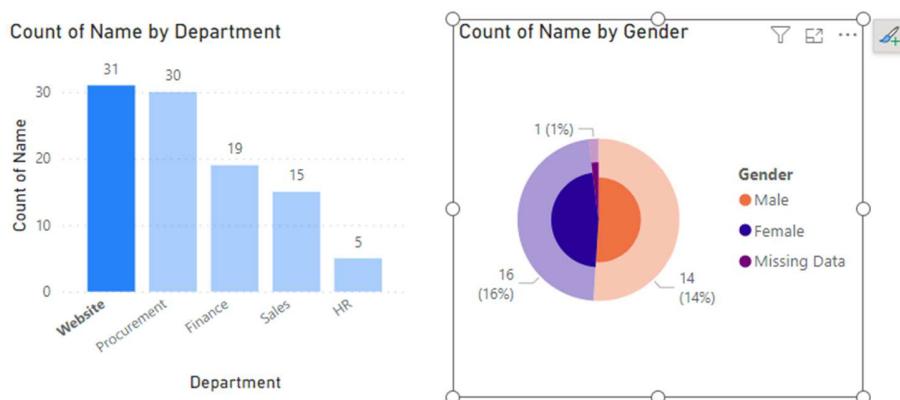


E: Visuals interactivity

84. Now you have two visuals in your report.
 85. It is Page one of your report.
 86. Double click on the page 1 in bottom and rename it to **Employees**.

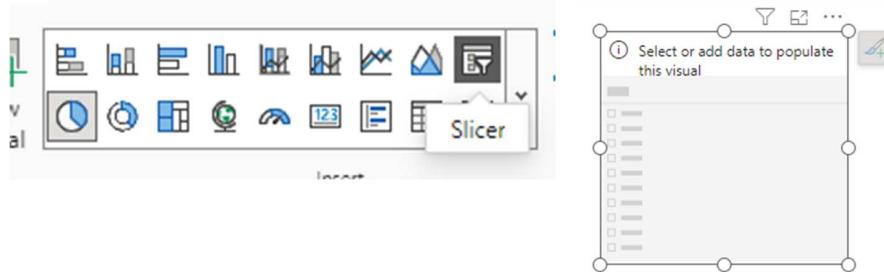


87. You can also click on + button and add a new page.
 88. Click on Column Website department in the column chart.
 89. You will see that pie chart reflects that and show only value of that department only.
 90. Go and click on every department to see their values in pie chart.



91. Now we want to filter by manager

92. You can add visual slicer and add manager to it.



93. Make sure you always click on empty part of canvas before you add any new visual.

94. Now you can filter the two visuals with your new slicer.

A screenshot of the Microsoft Power BI interface. On the left, the 'Data' pane shows a hierarchy of fields: 'Employees' (selected), 'Age', 'Date Joined', 'Department', 'Gender', 'Manager' (checked), 'Name', 'Rating', and 'Salary'. Below the Data pane is a bar chart titled 'Count of Name by Department'. The chart shows four bars: Procurement (9), Website (6), Sales (4), and Fin' (4). The x-axis is labeled 'Department' and the y-axis is labeled 'Count of Name'. A legend on the right lists managers: Carla (dark blue square), Cynthia (light blue square), Fred (light blue square), Ian (light blue square), and Ram (light blue square). On the right side of the screen is a Slicer visual titled 'Manager'. It lists five names: Carla, Cynthia, Fred, Ian, and Ram, each with a small square checkbox next to it. The first checkbox for 'Carla' is checked. Below the Slicer is a 'Filters' pane. It has sections for 'Filters on this page' and 'Filters on all pages', each with a 'Add data fields here' button. A red arrow points from the 'Filters' pane towards the Slicer, indicating the relationship between them.

95. Notice you can do that by using filter pane to save space, but slicers are so intuitive for the users of your report.

F: Creating table and format results

1. Your boss liked your report, but it asked you to see the employees of each manager.
2. Add a table to your report
3. In Data pane click on Name, age, rating and salary.

4. You must now have your table like this.

Name	Sum of Age	Sum of Salary
Agnes Collicott	27	83750
Alta Kaszper	27	54970
Cherlyn Barter	28	104120
Dell Molloy	26	47360
Gigi Bohling	33	74550
Halimeda Kuscha	30	112570
Kissiah Maydway	23	106460
Mollie Hanway	34	112650
Shayne Stegel	42	70270
Vic Radolf	24	62780
Total	294	829480

5. Go to icon in right of table (format) → More Options → Visual tab → Totals → Values and make it off.

The screenshot shows a table visualization in Power BI. The table has columns: Name, Sum of Age, and Sum of Salary. A row for 'Halimeda Kuscha' is selected, highlighted in blue. To the right of the table is a context menu with the title 'Add to your visual'. This menu includes options like 'Title' (unchecked), 'More options' (selected), 'Ian' (unchecked), and 'Ram' (checked). To the right of the context menu is the 'Format' pane. The 'Visual' tab is selected. Under the 'Totals' section, the 'Values' option is expanded, showing 'Text color' (black) and 'Background color' (white). A radio button next to 'Values' is labeled 'Off', indicating it is turned off. Other tabs in the Format pane include 'Properties', 'Size and style', 'Style presets', 'Grid', 'Values', 'Column headers', and 'Totals'.

- Notice you have search bar in format pane you can search for what you want.
- Your boss is happy now he can see every manager employee.
- He asked you to see which employees have low ratings.
- He wanted to having conditional formatting for rating column.
- Go to Format pan → Visual → Cell elements → Apply setting to → choose rating → Make back ground color **on** and thin click the fx icon.

11. In conditional formatting dialogue box change color for min and max.

Background color - Background color

Format style: Gradient

Apply to: Values only

What field should we base this on?: Sum of Rating

Summarization: Sum

How should we format empty values?: As zero

Minimum: Lowest value (dark purple)

Maximum: Highest value (light purple)

Add a middle color:

Learn more about conditional formatting

OK Cancel

12. You can also format font color

Name	Sum of Age	Sum of Rating	Sum of Salary
Agnes Collicott	27	5	83750
Alta Kaszper	27	2	54970
Cherlyn Barter	28	5	104120
Dell Molloy	26	5	47360
Gigi Bohling	33	3	74550
Halimeda Kuscha	30	2	112570
Kissiah Maydway	23	2	106460
Mollie Hanway	34	5	112650
Shayne Stegel	42	5	70270
Vic Radolf	24	4	62780

13. Your boss wanted to highlight the high salary.

14. Chose salary this time and use the data bars options and make it on.

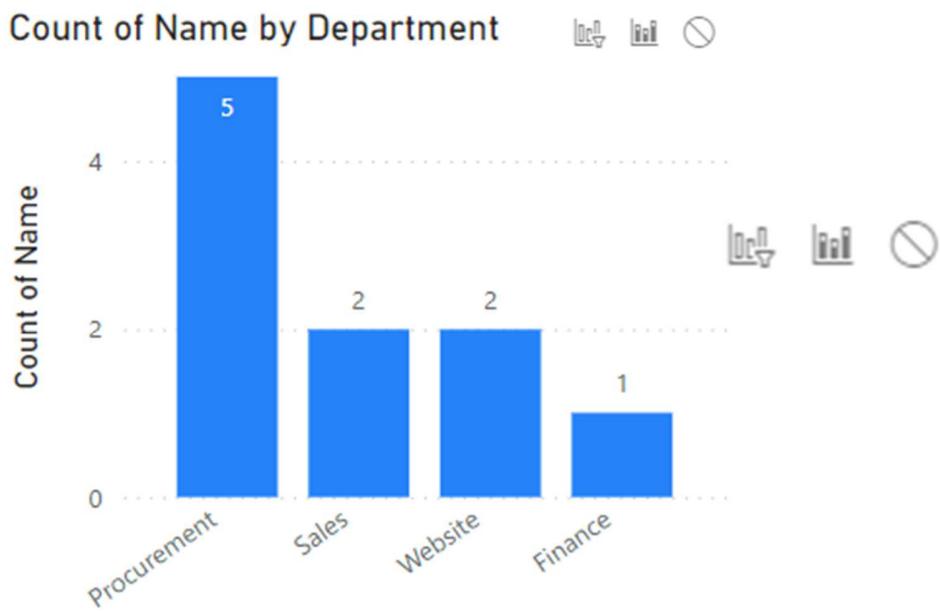
15. You must have your table now like this

Name	Sum of Age	Sum of Rating	Sum of Salary
Agnes Collicott	27	5	83750
Alta Kaszper	27	2	54970
Cherlyn Barter	28	5	104120
Dell Molloy	26	5	47360
Gigi Bohling	33	3	74550
Halimeda Kuscha	30	2	112570
Kissiah Maydway	23	2	106460
Mollie Hanway	34	5	112650
Shayne Stegel	42	5	70270
Vic Radolf	24	4	62780

16. Notice that table also when you click on an employee it filters the other two charts which has no meaning.

17. Stop that as follow as you select the table chart:

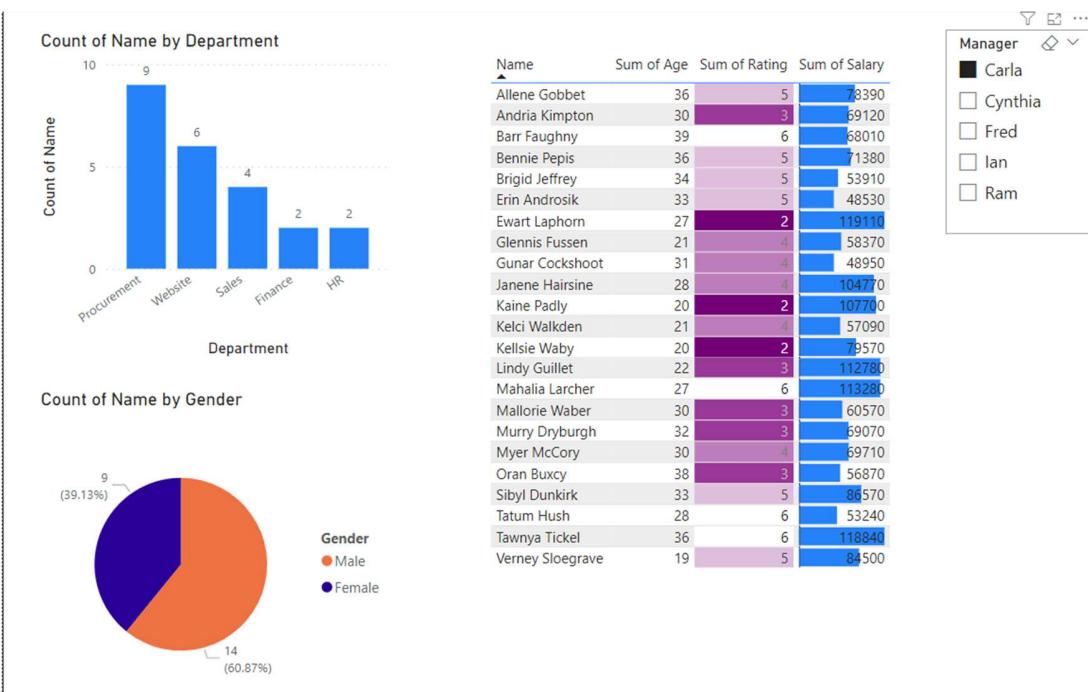
- o Go to Format tab → Indicators group → edit indicators.



Department

- o This shows new icons on top right of other visuals.
- o They are Filter, Highlight, **non**.
- o Chose non for all other visuals.
- o Click edit indicators again to remove these icons.

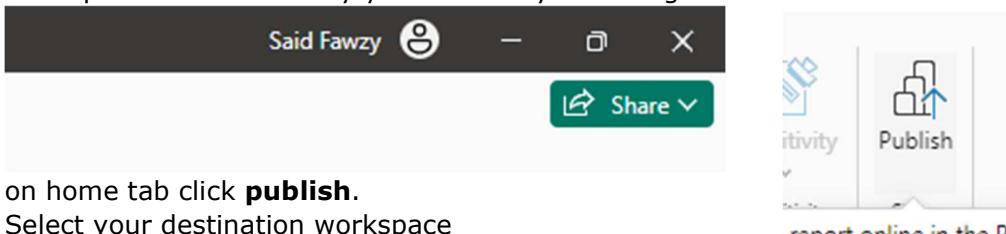
18. Now your final report like this:



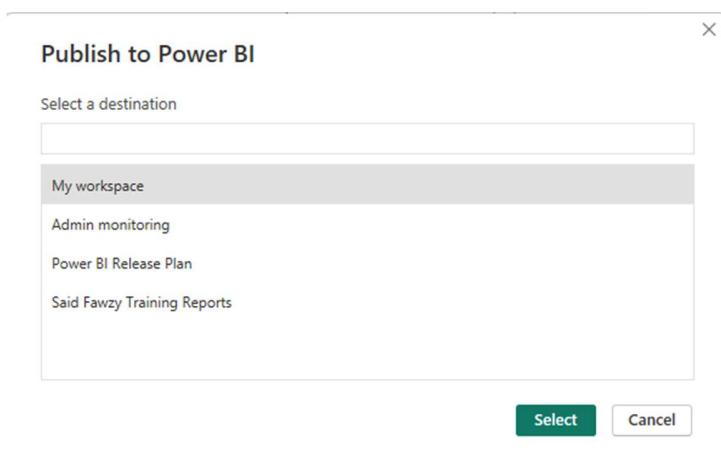
19. You can click any column Header to sort.
20. Save your work.

G: Publish and share your report.

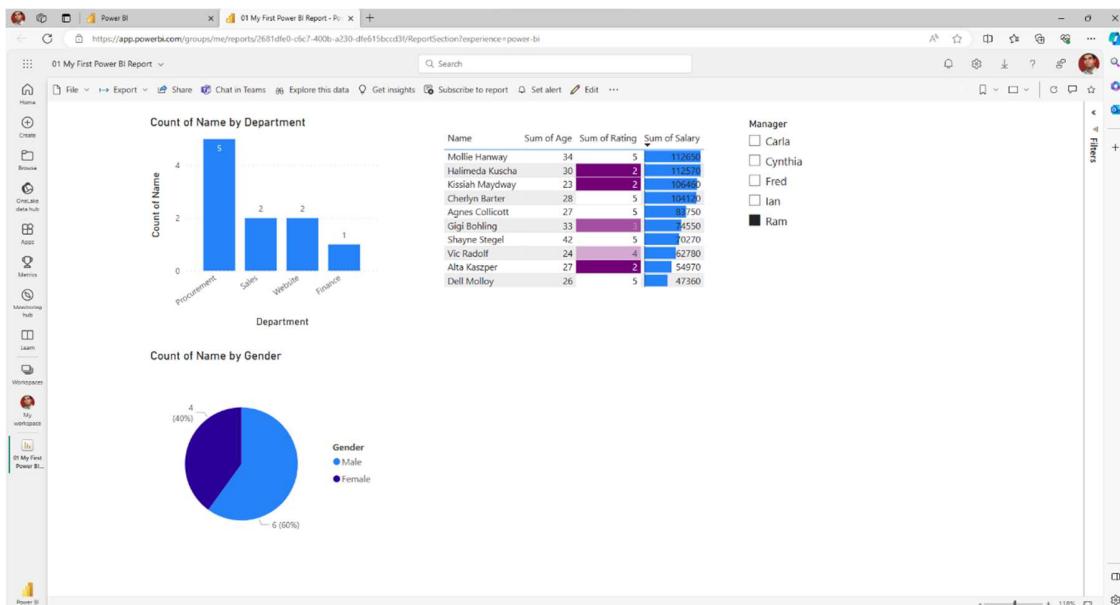
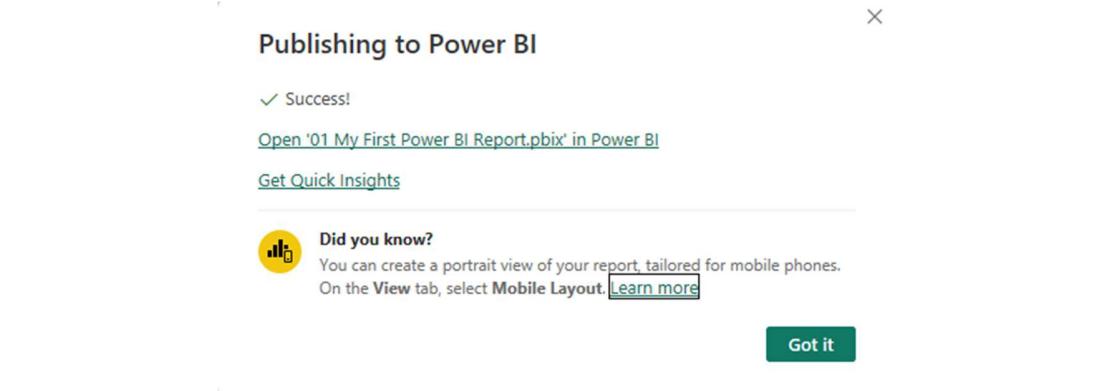
21. Click sign in in top right of the screen.
22. Enter your business mail or developer mail and press continue.
23. Enter pass word and verify your mail so you are signed in



24. on home tab click **publish**.
25. Select your destination workspace



26. Then click the link to go to your report



27. Now your report is published in your workspace, and you can share it if you have pro account

Chapter 2: Preparing Data for Analysis

What is Data?

- Data is **raw facts, numbers, or information** collected for analysis.
- It becomes meaningful when processed into **useful insights**.

People Working in Data

In the world of **data and Power BI**, different professionals play key roles in handling, analyzing, and presenting data. Here's how you can explain these roles to your trainees:

Data Engineer

- **What they do:** Collect, clean, and prepare data for analysis.
- **Key Responsibilities:**
 - Build **data pipelines** to move data from sources to databases.
 - Ensure **data quality and accuracy**.
 - Work with **databases and cloud storage**.
- **Tools Used:** SQL, Python, ETL tools, Azure Data Factory.

Data Analyst

- **What they do:** Analyze data and create reports to help businesses make decisions.
- **Key Responsibilities:**
 - Clean and transform raw data into insights.
 - Use **Power BI** to create dashboards and reports.
 - Find trends and patterns in the data.
- **Tools Used:** Power BI, Excel, SQL, Tableau.

Business Intelligence (BI) Developer

- **What they do:** Design and maintain data reporting solutions.
- **Key Responsibilities:**
 - Develop **interactive dashboards** in Power BI.
 - Optimize **data models** for better performance.
 - Work with IT teams to integrate business systems.
- **Tools Used:** Power BI, DAX, SQL Server.

Data Scientist

- **What they do:** Use advanced analytics, statistics, and machine learning to predict future trends.
- **Key Responsibilities:**
 - Develop **predictive models** for forecasting.
 - Use AI and machine learning for data analysis.
 - Work on **big data** projects.
- **Tools Used:** Python, R, Power BI, AI/ML frameworks.

Chief Data Officer (CDO) / Data Governance Manager

- **What they do:** Oversee data strategy and ensure data security and compliance.
- **Key Responsibilities:**

- Ensure data meets **compliance and privacy laws**.
 - Define **data policies and governance frameworks**.
 - Lead data-related strategies for business growth.
-

How This Relates to Project Managers

As a **Project Manager**, you will not be working directly in data, but you will **collaborate** with these professionals. You need to:

- Understand what data is available.
- Know **who** is responsible for creating reports.
- Communicate **business needs** to data teams.
- Use **Power BI dashboards** for decision-making.

Connecting to Data Sources

The ETL (Extract, Transform, Load) process

- Have you ever tried to solve a jigsaw puzzle when the pieces are scattered everywhere, and you don't even know if those pieces belong to the same puzzle?
- That's what it can feel like as a data analyst tasked with extracting insights from data that spread across multiple sources, formats, and structures.
- Not to worry, there's a way to solve this problem. The **Extract, Transform, Load**, or **ETL** process.

ETL Components

- **ETL** stands for extract, transform and load, the names given to the three main steps in the ETL process.
- This process involves taking raw data from various sources, preparing it for analysis, and loading it into a repository or data storage and management system.

Extract

- **Extract** is the first step in the ETL process, which involves retrieving and extracting raw data from different sources, such as databases, files, or other data storage systems. For example:
 - Customer Relationship Management, or **CRM**.
 - Enterprise resource planning system, or **ERP**
 - Spreadsheets.
- The extraction process involves pulling the data from these different sources.
- Then, you consolidate it into an easily accessible central location, often a temporary intermediate storage location known as the **staging area** and prepare it for further processing in the next step.

Transforming

- Once the data is extracted, the second step is to transform it.

- Transforming the data involves cleaning, structuring, and enriching the data to make it more suitable for analysis.
- This may involve:
 - removing duplicates,
 - handling missing values,
 - creating new calculated fields,
 - converting data types, and
 - standardizing measurement units. let's say that the sales and marketing data is in US dollars. But the manufacturing and purchasing data is in different currencies, depending on where in the world the sales or purchase take place. As part of transforming the data, you may need to convert all the currency values into a standard unit of measurement, in this case US dollars, to ensure consistency.

Load

- The third and last step involves loading the transformed data into the final storage system, typically a data warehouse. Where it can be readily accessed and analyzed, for example, using tools like Power BI.
- Depending on the organization's needs, the loading process can be a one-time event or scheduled to run regularly.

ETL Benefits

- The ETL process ensures that the data analyzed is **accurate**, **clean**, and **consistent**, which in turn **supports informed decision making**.
- This process offers many benefits, including:
 - **Data integration:** ETL helps integrate data from different sources, providing a unified view of an organization's data, making it easier for analysts to perform analysis and derive insights.
 - **Data Quality:** ETL processes involve data cleansing and validation, which significantly improve data quality.
 - **Data consistency:** By transforming data into a standardized format, ETL ensures consistency across various datasets, enabling analysts to easily compare and analyze data from different sources.
 - **Enhanced performance:** By aggregating, summarizing, or indexing data during the transformation process, ETL can improve query performance and reduce the load on data analysis systems.
 - **Data governance:** ETL can support data governance initiatives by helping organizations maintain a single source for their data, ensuring that everyone has access to the same accurate information.
 -

ETL With Power BI

- Power BI is just one tool that comes equipped with built in ETL capabilities, enabling you to connect to many different data sources, transform your data using Microsoft Power Query, and load it into the Power BI data model.
- Power Query is a powerful ETL tool within Power BI, providing a graphical interface and formula language, called **M**, to perform various data transformation tasks.

- With Power Query, you can extract data from multiple sources, clean and structure it, and load it into Power BI for creating reports and visualizations.

Data sources that you can connect to in Power BI.

- Flat files:** are a common type of data source that can be used for ETL or extract, load, and transform in Power BI.
 - Examples of flat files include **CSV**, **TXT**, and Microsoft **Excel** files.

Relational data sources

- such as **SQL Server**, **MySQL**, and **Oracle** Databases.
- commonly used by large organizations because they provide a high level of reliability, data integrity, and security.
- NoSQL databases:**
 - such as **MongoDB** and **Cassandra**
 - becoming increasingly popular for ETL in Power BI.
 - These databases are designed to store and manage large volumes of **unstructured** or **semi-structured** data, making them ideal for use in a wide range of applications.

Combining Data Sources

- Power BI has the flexibility to connect to a wide range of data sources.
- By combining data from various sources such as sales figures, inventory, production, and supplier information, your department could gain valuable insights into customer behavior, product performance, and supplier performance.
- Combining data sources can benefit different stakeholders in a business by providing valuable insights into customer behavior, product performance, and supplier performance.
- This information can be used to make **informed decisions**, leading to improved supply chain management, reduced costs, and increased customer satisfaction.
- Data integration can be a daunting task, especially when you are working with multiple data sources that have varying formats, structures, and quality levels.
- The combination of these sources can often lead to inconsistencies and errors, making it difficult to derive meaningful insights and make informed decisions.
- But you don't need to worry. Tools like Power BI simplify the process of
 - combining data from different sources,
 - reducing the time and effort required to create a comprehensive view of your data.
- It is designed to be user friendly and accessible even for non-technical users, with
 - an intuitive interface and
 - drag and drop functionality that makes it easy to create reports and visualizations.
- Power BI also allows you to customize your reports and visualizations to suit your company's specific needs.
- You can choose from a wide range of pre-built templates and visualizations or create your own custom designs.
- This flexibility makes it easy to create reports that are tailored to the unique needs of your business.
- It also enables collaboration by allowing you to **share** your reports and visualizations with colleagues, clients, or stakeholders by sharing reports or embedding them in websites or apps.
- This collaborative approach can improve communication and ensure that everyone is working with the same data, ultimately driving business success.

- Combining data sources is a great method of providing valuable information that can lead to improved supply chain management, reduced costs, increased customer satisfaction, and ultimately drive business success.
- Tools like Power BI, with its built-in data connections, can simplify the process of combining data from different sources, reducing the time and effort required to create a comprehensive view of your business.

Connecting to flat data source

- Every day, businesses generate large amounts of data. But where do they store it all?
- many organizations store and export data as files, such as flat files.

what is a flat file?

- A flat file is a file type that contains a single data table, with a uniform structure for every row of data, and does not have hierarchies.
- Some examples of flat files include:
 - comma separated value or CSV files,
 - delimited text or TXT files and
 - fixed width files. Additionally, output files from various applications such as Microsoft Excel Workbooks, can also be classified as flat files.

Transforming Data

Why data needs to be transformed

- Data transformation can involve different activities, such as cleaning, merging, and profiling data.

components of data transformation

- Before you can start working with that data, you need to clean and transform the raw data to ensure its accuracy and consistency.
- You learned that data may come from different sources. However, the data from these sources may contain inconsistencies that make accurate analysis difficult.
- Data from different sources can be untidy, incomplete, and inconsistent, making it difficult to draw meaningful insights.
- That's why data transformation is a crucial step. It helps you prepare data for analysis.

Some of the inconsistencies you may find in data

- let's say you are working on an analysis related to products in an e-commerce database. For this task, you need some relevant fields for your report.
- However, the table has hundreds of fields, making designing the report difficult. A data transformation would be when you **include certain columns** from the data and **exclude others** before loading for analysis and reporting.
- Another transform example would be selecting fields and transforming by **merging** them, such as in the customer table with fields for the first and last name. You want to display them as a single full name field by merging fields with a space between.

What is data cleaning?

- Data that is not structured is more flexible in terms of rules and therefore more likely to be disorganized and require cleaning.
- You may not encounter as clean data as you would expect in Excel data or in data organized using delimiter symbols such as angle brackets or commerce. In such cases, the data should have a preliminary examination to identify **incorrect** data or **separate rows** where content refers to the **same values**.
- like **warehouse** how it's written as two words and **warehouse** has in one word.
- You can resolve these inconsistencies by passing them through filters with specific rules.
- This examination is referred to as **data cleaning**.
Another data issue you may encounter is the need to **merge** or append multiple data sources.

Introduction to Power Query and its interface

- Power Query is part of Power BI Desktop, allowing for seamless data preparation within the Power BI environment.
- Power Query is a data transformation and data preparation tool allowing you to connect, clean, and transform data from a wide range of sources.
- It ensures that your data is ready for analysis, enabling you to create insightful visualizations and reports.

Exploring Power Query

- Features that Power Query can help with:
 - **Data connectivity**, Power Query connects to various data sources both on-premises and the Cloud directly within Power BI Desktop. You can access data from traditional databases as well as file-based sources.
 - **Data extraction and transformation**: Power Query interface allows you to extract and transform data with ease. During the extraction process, you can filter, sort, and apply custom transformations, ensuring that you import only the required data.
 - **Power Query Editor**: in Power BI within Power BI Desktop, which provides a graphical user interface or GUI for designing and managing queries.
 - Tabs such as **Home**, **Transform**, **Add Column**, and **View** have data manipulation tools.
 - **Applied steps**: Power Query records each transformation as an applied step allowing you to review, modify, or delete any step. This ensures that your data transformations are transparent and easily modifiable.
 - **Performance and scalability**: Power Query handles large datasets efficiently using various techniques that optimize performance and reduce memory usage.

Data types Groups

Number types

- **Decimal number**: This data type can handle numbers with fractional values as well as whole numbers. The maximum precision (number of digits in a number after the decimal point) that the decimal number type can represent is 15 digits. The decimal separator can be anywhere

in the number. For example, 99, 99.50, and 99.20930 are all valid decimal numbers. One example could be the price of a watch, \$99.99. In another example, you could use the 15 digits of the decimal number data type to store the first 15 digits of the mathematical constant pi, which is 3.141592653589793.

- **Fixed decimal number:** The decimal separator always has four digits to its right and allows for 19 digits of significance. This data type is useful in cases where rounding might introduce errors. For instance, 99.0000, 99.5000, and 99.2093 are all valid fixed decimal numbers.
- **Whole number:** This is an integer type that has no digits to the right of the decimal place. It has 19 digits of positive or negative whole numbers, such as -10, 0, and 103. Its range is between $-2^{63}+1$ and $2^{63}-2$.

Date and Time types

- **Date/time:** Represents both a date and a time value. Dates between the years 1900 and 9999 are supported. This data type is useful for keeping date and time data together. For example, a spreadsheet with Purchase Date or Order Date columns.
- **Date:** This data type represents just a date with no time portion. This data type is useful when you need only the date element of your records, such as birth date or contract date.
- **Time:** This represents just time data with no date portion. This data type is useful when you need only the time part of your dataset, such as an activity start hour or end hour.
- **Date/time/time zone:** This represents a UTC Date/Time with a time-zone offset. UTC, or Coordinated Universal Time, is the primary time standard by which the world regulates clocks and time.
- **Duration:** This data type represents the length of time. This data type is useful when measuring or calculating the time difference, such as Activity Duration or Sleep Time.

Other data types

- **Text:** This is a Unicode character data string. This can be strings, numbers, or dates represented in a text format. The maximum length of this data type can be 536,870,912 bytes. Or 268,435,456 Unicode characters. Unicode is an international character encoding standard that assigns a unique number to every character across languages and scripts.
- **True/false:** This is also known as Boolean data type, which has either a True or a False value.
- **Binary:** This represents any data with a binary format. For example, a non-human readable format is represented by ones and zeros. Binary files can contain diverse types of data. For instance, image or video files serve as binary files that are intended for computer systems to interpret.

Working With Columns

Benefits of working with Columns

- A common data manipulation you'll encounter is working with columns. Working with columns in Power Query in Power BI is an essential skill for data analysts and professionals who regularly deal with data.
- One of the main benefits of learning to work with columns is efficient data preparation.
- **Eliminating** unimportant or repetitive columns allows you to concentrate on the most crucial data for your analysis. Minimizing the data set size and streamlining the data structure for easier manipulation and quicker processing.

- Another benefit of working with columns is **improved data readability** and interpretation. Removing unnecessary columns helps declutter your dataset, making it easier to read and understand.
- **Renaming** columns with more descriptive names helps you quickly identify the purpose and content of each column.
- One other benefit of working with columns is that it **allows for enhanced data analysis and reporting**. By focusing on the most relevant columns, you can produce more accurate and meaningful analysis. This allows you to deliver actionable insights to your team and organization, leading to better decision making.
- Finally, working with columns means **time and resource savings**. Efficiently removing and renaming columns in Power Query can save you a significant amount of time during the data preparation stage. This means you can devote more time to analyzing the data and generating insights.
- By streamlining your data preparation process, you also **reduce the computational resources required** to process your data. This can lead to **faster analysis** and in some cases, **cost savings**, particularly when working with cloud-based services that charge based on resource usage.

Remove columns:

- In the Power Query Editor locate the column you want to remove. To select a single column, select its header. If you need to select multiple columns, hold down the keyboard control key and click on multiple column headers to remove.
- With the columns you want selected, you're ready to proceed. Right click any of the selected column headers. In the context menu that appears, select **Remove Columns**. The selected columns are removed from your dataset.
- You will notice a new step, **Removed columns** appears in the **applied steps list** on the right pane reflecting the updated data state.

Rename columns

- In the Power Query Editor, select the header of the column to rename, right click the header of the selected column. In the context menu, select **Rename**. A text box appears. Type in a new column name. Press Enter to save the change.
- Again, you'll notice the new step in the applied steps list.

Promote header rows

- The first thing is to identify which row in your dataset contains the headers. In most cases, this is the first row. If your dataset has additional information or metadata above the headers, you may need to scroll down to find the appropriate row.
- Now you can promote the header row. Once you've identified the header row on the ribbon, use the **Home** tab to locate the **transform group**. Select **use first row as headers**. This promotes the first row to be used as column headers replacing the existing headers.
- Note, if the header row isn't the first row, you'll need to **remove any rows above** the header row before promoting it. To do this, **select the rows you want to remove** by selecting the row numbers on the left side of the editor. Then, on the ribbon in the Home tab, select **remove rows**.
- You will notice a new step removed rows in the applied steps list on the right pane reflecting the updated data state.

Common data errors

- Before you begin to transform data in Power BI, you must first make sure that your dataset is accurate and reliable. Otherwise, you risk producing data analysis results that are incorrect.
- There are several types of errors that commonly occur in data sets.

Scenario

You Company recently produced a large dataset containing data on customers and sales. The marketing department plans to use this dataset to generate insights into the business and to help the business grow.

	A ^B _C Product	ABC 123 Discount Band	ABC 123 Units Sold	ABC 123 Manufacturing Price	A ^B _C Sale Price	ABC 123 Sales
1	TrailBlazer 1000	None	958	5 300		287400
2	TrailBlazer 2000	Low	53,4	10 7		17525,97
3	SpeedMaster 1000	Low	918	10 300		269892
4	SpeedMaster 2000	Low	1774	10 125		215097,5
5	Explorer 1000	Low	866	250 \$345		9976,32
6	Explorer 2000	Medium	null fifty	15		7908,75
7	GravityMaster 1000	2	1679	260 350		552391
8	GravityMaster 2000	Medium	588	120 20		10936,8
9	Pathfinder 1000	Medium	1366	260 20		25134,4
10	Pathfinder 2000	Medium	973	10 20		2013-10-01
11	Voyager 1000	High	2072	260 15		27972
12	Voyager 2000	High	six hundred	5 15		8936,4
13	Adventurer 1000	High	2641	10 20		45953,4
14	Adventurer 2000	High	1727	5 7		10396,54
15	EnduroMaster 1000	High	663	120 125		70443,75
16	EnduroMaster 2000	None	2146	5 7		15022
17	FatTrail 1000	Low	703,75	3 12		17166,6
18	FatTrail 2000	1	1728	10 300		508032
19	CrossRider 1000	Low	1901	10 12		22127,64
20	CrossRider 2000	Low	349	250 350		117264
21	DuoExplorer 1000	Medium	2861	120 15		40769,25
22	DuoExplorer 2000	Medium	727	260 350		239183
23	E-Mountain 1000	Medium	3244,5	250 null		36208,62

However, one of the data analysts believes that there are errors in the data set. These are common errors Adventure Works must identify and remedy before analysis.

Common errors

There are three main types of errors that you'll encounter as a data analyst. These are:

- Missing or null values
- Duplicate rows
- Inconsistent data types.

You must be able to identify instances of these errors in your datasets. If the errors are not identified, then their inclusion will lead to inaccurate, skewed, and inflated results. They can also give rise to extra, unnecessary storage and processing requirements.

Missing or null values

- A missing or null value occurs when data is absent or unavailable for certain cells or records within a dataset.
- For example, in the following datasheet, for the **Sale Price** column, the cell content on row 6 states **NULL**, indicating that there is no value in this location.

The screenshot shows the Microsoft Power BI Data Editor interface. The top ribbon has tabs like File, Home, Transform, Add Column, View, Tools, and Help. The Home tab is selected. Below the ribbon is a toolbar with various icons for data management. The main area is a grid-based table with columns labeled Product, Discount Band, Units Sold, Manufacturing Price, Sale Price, Sales, and Profit. Row 6, which corresponds to the row mentioned in the text, has a value of "null" in the Sale Price column. This cell is highlighted with a red rectangular box. The table has 9 columns and 51 rows. At the bottom left, it says "9 COLUMNS, 51 ROWS Column profiling based on top 1000 rows". At the bottom right, it says "PREVIEW DOWNLOADED AT 05:31 PM".

Product	Discount Band	Units Sold	Manufacturing Price	Sale Price	Sales	Profit
TrailBlazer 1000	None	958	\$ 300		287400	47900
TrailBlazer 2000	Low	53,4	10 57		17525,97	4880,97
SpeedMaster 1000	Low	918	10 300		269892	40392
SpeedMaster 2000	Low	1774	10 125		215097,5	2217,5
Explorer 1000	Low	856	250 \$345		9976,32	7378,32
Explorer 2000	Medium	1679	15		7908,75	2358,75
GravityMaster 1000		588	260 350		552391	115851
GravityMaster 2000	Medium	1366	120 20		10986,8	5056,8
Pathfinder 1000	Medium	973	10 20		25134,4	11474,4
Pathfinder 2000	Medium	2072	260 15		2013-10-01	7978,6
Voyager 1000	High	six hundred	5 15		27972	7252
Voyager 2000	High	2541	10 20		8936,4	2166,4
Adventurer 1000	High	1727	5 7		45953,4	19543,4
Adventurer 2000	High	663	120 125		10986,54	1761,54
EnduroMaster 1000	High	2146	5 7		70443,75	-9116,25
EnduroMaster 2000	None	703,75	3 12		15022	125
FatTrail 1000	Low	1728	10 300		17166,6	12831,6
FatTrail 2000		1901	10 12		508032	76032
CrossRider 1000	Low	349	250 350		22127,64	16424,64
CrossRider 2000	Low	2861	120 15		117264	26524
DuoExplorer 1000	Medium	727	260 350		40769,25	12159,25
DuoExplorer 2000	Medium	3244,5	250	null	239183	50163
E-Mountain 1000	Medium				36208,62	26475,12

It's important to scan your dataset for missing or null values before you perform data analysis. The inclusion of these values can lead to incorrect calculations, skew statistical results, or generate misleading insights.

Duplicate rows

- Duplicate rows are instances in a dataset when two or more rows have identical values across all columns. This error often occurs because of data entry errors, glitches within the system, or data that's been merged from multiple sources.
- For example, the dataset contains identical records in rows 13 and 14. Most likely, this occurred because the dataset was created by merging two different spreadsheets that contained an overlap of data. Both instances of this data have now merged into one spreadsheet leading to duplication.

The screenshot shows the Microsoft Power BI Data Editor interface. The top ribbon has tabs like File, Home, Transform, Add Column, View, Tools, and Help. The Home tab is selected. Below the ribbon is a toolbar with various icons for data management. The main area shows a table with columns: Product, Discount Band, Units Sold, Manufacturing Price, Sale Price, Sales, and Profit. Row 12, which contains mixed data in the 'Units Sold' column, is highlighted with a red box. The status bar at the bottom indicates "9 COLUMNS, 51 ROWS" and "PREVIEW DOWNLOADED AT 05:55 PM".

	Product	Discount Band	Units Sold	Manufacturing Price	Sale Price	Sales	Profit
1	TrailBlazer 1000	None	958	\$ 300		287400	47900
2	TrailBlazer 2000	Low	53,4	10 2861		17525,97	4880,97
3	SpeedMaster 1000	Low	918	10 300		269892	40392
4	SpeedMaster 2000	Low	1774	10 125		215097,5	2217,5
5	Explorer 1000	Low	866	250 2861		9976,32	7378,32
6	Explorer 2000	High	2861	3 15		7908,75	2358,75
7	Explorer 2000	High	2861	3 15		7908,75	2358,75
8	Explorer 2000	High	2861	3 15		7908,75	2358,75
9	Pathfinder 1000	Medium	1366	260 20		25134,4	11474,4
10	Pathfinder 2000	Medium	973	10 20		2013-10-01	7978,6
11	Voyager 1000	High	2072	260 15		27972	7252
12	Voyager 2000	High	2861	5 15		8936,4	2166,4
13	Adventurer 1000	High	2641	10 20		45953,4	19543,4
14	Adventurer 1000	High	2641	10 20		45953,4	19543,4
15	EduroMaster 1000	High	602	110 11,5		70445,75	3210,62
16	EduroMaster 2000	None	2146	5 7		15022	125
17	FatTrail 1000	Low	703,75	3 12		17166,6	12831,6
18	FatTrail 2000	High	1728	10 300		508032	76032
19	CrossRider 1000	Low	1901	10 12		22127,64	16424,64
20	CrossRider 2000	Low	349	250 350		117264	26524
21	DuoExplorer 1000	Medium	2861	120 15		40769,25	12159,25
22	DuoExplorer 2000	Medium	727	260 350		239183	50163
23	E-Mountain 1000	Medium	3244,5	250 null		36208,62	26475,12
24							

- You must make sure that you resolve all instances of data duplication before processing your dataset. If left unresolved, these errors can **inflate** the size of the dataset. This inflation could then skew your results.
- Such errors could also lead to unnecessary **storage** because your storage solutions need to host data that your projects don't require. Or they could give rise to extra processing overheads because your software needs to process large amounts of unnecessary data.

Inconsistent data types

- Inconsistent data types occur when values within a single column contain different types of data.
- For example, row 12 of the **Units Sold** column in the dataset contains inconsistent data types. The data types for cells of the **Units Sold** column should all be numeric. Instead, the column has a mix of numeric and text data types.

The screenshot shows the Microsoft Power BI desktop interface. The ribbon at the top includes File, Home, Transform, Add Column, View, Tools, and Help. Under the Home tab, there are buttons for Close & Apply, New Source, Recent Sources, Enter Data, Data Sources, Manage Parameters, Refresh, Advanced Editor, Properties, Choose Columns, Remove Column, Keep Rows, Remove Rows, Reduce Rows, Sort, Split Column, Group By, Replace Values, Data Type: Whole Number, Merge Queries, Append Queries, Combine Files, Combine, and AI Insights. The main area displays a table named 'Sales' with the following schema:

	Product	Discount Band	Units Sold	Manufacturing Price	Sale Price	Sales	Profit
1	TrailBlazer 1000	None	958	\$ 300		287400	47900
2	TrailBlazer 2000	Low	53,4	10 7		17525,97	4880,97
3	SpeedMaster 1000	Low	918	10 300		269892	40392
4	SpeedMaster 2000	Low	1774	10 125		215097,5	2217,5
5	Explorer 1000	Low	866	250 \$345		9976,32	7378,32
6	Explorer 2000	Medium	null fifty	15		7908,75	2358,75
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10	Pathfinder 2000	Medium	973	10 20		2013-10-01	7978,6
11	Voyager 1000	High	2021	260 15		27972	7252
12	Voyager 2000	High	six hundred	5 15		8936,4	2166,4
13	Adventurer 1000	High	2541	10 20		45953,4	19543,4
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15	EnduroMaster 1000	High	663	120 125		70443,75	-9116,25
16	EnduroMaster 2000	None	2146	5 7		15022	125
17	FatTrail 1000	Low	703,75	3 12		17166,6	12831,6
18	FatTrail 2000		1728	10 300		508032	76032
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21	DuoExplorer 1000	Medium	2861	120 15		40769,25	12159,25
22	DuoExplorer 2000	Medium	727	260 350		239183	50163
23	E-Mountain 1000	Medium	3244,5	250 null		36208,62	26475,12
24							

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- It's important to identify and resolve any inconsistent data types within your dataset. If they remain in the dataset, they can cause calculations to misbehave, which can lead to errors in results.

Data combination

- The first reason for combining data is that it allows you to **consolidate information from various sources** or tables into a single table. This consolidation can provide a unified view of the data, making it **easier to analyze and gain insights**.
- The next reason you would combine tables is to create **relationships**. Combining tables is crucial for establishing relationships between related data. In Power BI, relationships between tables are used to create meaningful visualizations and enable interactive analysis. By combining tables, you can link data points across different tables based on **common fields or keys**.
- Combining tables also enables you to **enrich your data by adding additional information**. For example, you may have a table with client details and another table with product information. By combining these tables, you can create a comprehensive dataset that includes both client and product details, allowing for a more comprehensive analysis.
- Another reason to combine data is that it **provides a broader scope for analysis**. By merging multiple tables, you gain **deeper insights** by analyzing data from different angles.
- Lastly, combining tables help **simplify data management** in Power BI. Instead of working with multiple separate tables, having a single consolidated table reduces complexity and makes it **easier to handle data updates, refreshments, and maintenance tasks**.

Ways to Combine Data

- Now that you understand the reasons why it is important to combine data, let's look at the ways to do it.
- In Power BI, there are two ways to combine data: **append** and **merge**.

Append Queries

- When you append queries, you're adding rows of one table or query to another table or query. By adding multiple lists one below the other, you will see **an increase in the number of rows**.
- Say for instance, you have two separate classes, class A and class B, the need to take an exam together. To do this, you have to combine the 20 students in class A with 20 students in class B resulting in a combined class list of 40 students.

Merging Queries

- On the other hand, when merging queries, you consolidate data from multiple tables into a single entity by leveraging a shared column between the tables.
- For example, data with specific contents such as **gender**, **category**, and **city** is stored in different independent tables and referenced by main tables that require this information.

This allows you to use this information within a specific context, enables easy data classification and ensures data integrity.

Data Profiling

- Before analyzing any data set, it is important to examine and evaluate the data you are working with. Analyzing the data without evaluating its accuracy, completeness and alignment with the objectives can lead to misleading results.
- When examining a data set for the first time, there are several aspects you should look at, especially for numerical fields.
- You should check these characteristics for each numerical field:
 - minimum or min,
 - maximum or max,
 - average or mean,
 - frequently occurring values or mode and
 - standard deviation.
- The best way to start assessing data is with data you can immediately troubleshoot.

Example

- Imagine you are reviewing a data set that has an **age** field. For instance, there could be someone in the data set with an age of **200**, which would be extremely unlikely to be true. If so, there may be an **outlier** in the data.
- Look at the **minimum** and **maximum** values, such as appearing between **21** and **77**. These are realistic ages, unlike 200.
- The concept of **distribution of data** refers to **how the data points are spread or arranged within a data set**. It describes the **pattern** or **shape** of the data when plotted on a graph.
- Understanding the distribution of data is crucial in data analysis because it helps you gain insights into the **central tendency**, **variability**, and overall characteristics of the data.

Outliers

- The formal definition of an outlier in statistics is **a data point that significantly deviates from other observations**.

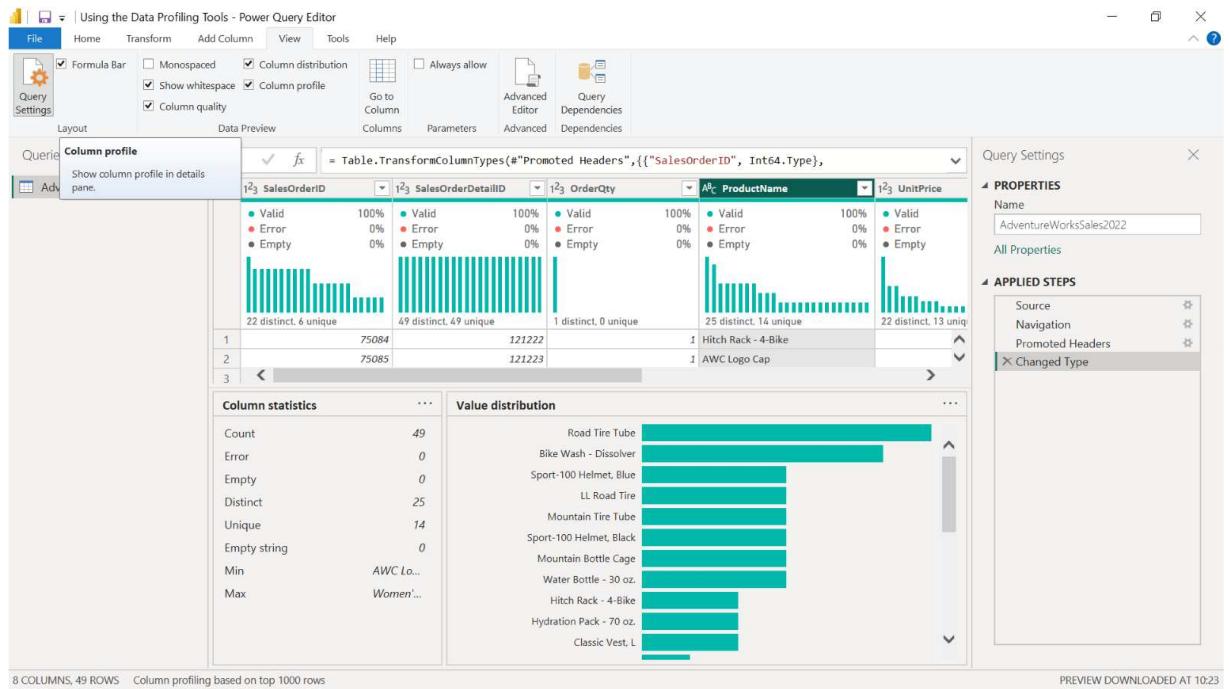
- Outlier data can be handled by applying a technique called **min, max scaling or normalization**.
- The aim is to adjust the mean and standard deviation of the data proportionately while preserving the ratio of the distance between outlier data and other data points.
- Analyzing the distribution allows you to make informed decisions, identify outliers, and choose appropriate statistical techniques for further analysis.
- There are situations where there may be values in the data set that skew the average.
- For example, there may be examples close in age. Let's say there are three individuals aged 80 and above.
- If you solely rely on the average to evaluate the distribution, these outliers can mislead you by increasing the average. In this case, it would be appropriate to examine the distribution more closely.
- When taking a closer look at the data, you may find that the distribution is normal, but the three records mentioned in the example are outliers.

Standard deviation.

- Standard deviation is a **statistical measure that quantifies the amount of variation or dispersion in a data set**.
- It provides a way to understand how individual data points differ from the mean or average of the data set.
- The main objective here is to prevent outliers from causing deviations in your analysis results, minimizing their impact.

Distribution of data.

- The balanced distribution of data points that fall outside the outliers is another factor that affects data quality and your analysis results.
- It is important for descriptive variables such as age, gender, income status, occupation, city and neighborhood to represent as many diverse groups as possible and be evenly distributed among others.
- If not, a cluster of records that closely resemble each other will lead to narrow intervals when defining norms which will mislead your analysis.
- Profiling and statistically analyzing data, including examining its **distribution, min max, mean and mode** values detecting **outliers**, if any, and **normalizing** outliers, ensuring that the data represents the entirety of the data set, are the key elements that demonstrate data quality.
- Considering these factors will enhance the accuracy and quality of analysis and predictions made with this data.



Chapter 3: Modeling Data

What is a Data Model?

- At its core, data modeling creates a **structured representation of data**. Representation can then be used to support different business aims.
- In other words, a data model shows **how different data elements interact**, and it also outlines the **rules** that **influence** these interactions.

How can Power BI Help

Microsoft Power BI is software that provides data analysts with a user-friendly interface for building data models.

- Other benefits of a Power BI data model are that it can be used to define **relationships** between tables and assign **data types**.
- You can also create **calculated columns** and **measures** and update your model as your business requirements change.
- In Power BI, the foundation of creating reports and dashboards lies within the data model. It's important to understand how to design a data model that effectively aligns with the visual elements within your reports and dashboards.
- There are several steps involved in building a data model in Power BI:
 - **Connect** to your data sources,

- prepare and **transform** your data, and
 - **configure** table and **column properties**, then
 - create model **relationships**. And finally,
 - create **measures** and **calculated columns** using **DAX** or data analysis expressions.
- Once your data model is in place, you can analyze the data to generate insights to help you achieve your business objectives.

Optimizing Data Model

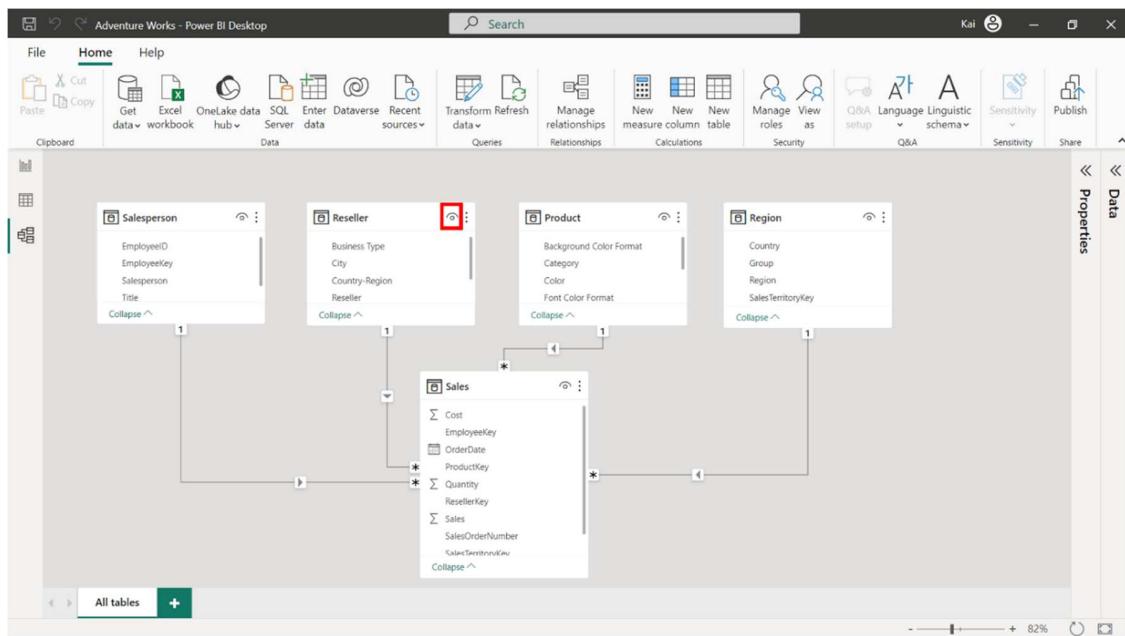
- By optimizing the data model, you can significantly improve the **performance** of your Power BI reports and dashboards.
- It's also easier to aggregate structured data in a data model, thanks to the clear relationships and hierarchies.
- With an effective data model, you can perform more advanced analytical capabilities like **complex measures** and **predictive analysis**. When your underlying data is structured, organized, and aligned, your insights and reports are more likely to be accurate and reliable.

How to build Data Model with Power BI

- **First, you need to connect to data sources:**
 - by executing a query in Power Query Editor.
 - The result is then loaded into the Power BI data model as a table.
 - Using Power Query in Power BI, you can finish importing and cleaning their data sources. This creates a data model that contains cleaned for example customer, date, employee, and marketing data as separate tables.
 - **Each table in the model** represents a specific **business entity**, and each table also has its own related attributes.
- **The next step is to define the relationships between the tables** in Power BI's model view:
 - The company can link for example its customers and sales tables using the Customer ID column, which is common to both tables.
- **Finally, the company needs to create measures and calculated columns using DAX:**
 - DAX is a syntax used in Power BI to analyze data.
 - You can use DAX to create **aggregations** and **custom calculations** to generate insights on important aspects of their data, like sales totals.
- A strong understanding of data models will help you:
 - maximize your data's full potential.
 - Building sophisticated data models
 - creates a robust foundation for data analysis and generating insights.

Model view elements

- The **Model view** can be accessed by selecting the **model** icon on the left sidebar of Power BI desktop. The **Model view** contains the following UI elements:
 - Diagram view (canvas)**
 - Data pane**
 - Properties pane**
 - Home ribbon**



Introduction to schemas

- Generating business insights often means working through large amounts of data. And it's important that this data is stored and structured meaningfully.
- As a data analyst, you'll frequently use schemas when designing your data models. So, it's important that you understand the different types of schemas available, along with the advantages and disadvantages of each.
- With this knowledge, you can choose the schema that best suits the needs of your database and business objectives.
- With Power BI, you can structure your data using a schema.
- You can use a schema in Power BI to organize and build relationships between these different data sources.

What is a Schema?

- A schema refers to **a structure that defines the organization and relationships of tables within a dataset**.
- It represents **the logical framework** of how the data is organized and connected.

- A schema plays a crucial role in defining the data structure. It also enables efficient data analysis, helps with the creation of visualizations, and assists with generating meaningful insights from your data.
- In the context of Power BI, a schema is a logical blueprint that defines the structure, organization, and relationships of tables.

Types of Schemas

- There are three different types of schemas that can be used to organize and structure data:
 - a flat schema,
 - a star schema, and
 - a snowflake schema.

Flat Schema

- A flat schema is the simplest form of a data model.
- All attributes and fields related to the entity are stored in a **single table**.
- As you discovered in earlier courses, a table is a set of rows containing data, with each row divided into columns. Each column represents a piece of information with a specified data type. The required attributes and entities are stored in the rows and can be extracted as required from the columns.

Advantages of a flat schema.

- It's easy to retrieve data from.
- It's less complex to analyze flat schema data, and it's a simpler way to visualize data.

Disadvantages of Flat Schema

- It requires large datasets, which are **difficult** to maintain and **slow to query**.
- It leads to **data redundancy** and **inconsistency**, so is more suited to smaller datasets.
- And it doesn't allow for complex datasets, which require more flexibility and detail.

Star schema data model

- A star schema is a more advanced approach to structuring and organizing quantitative, or measurable data in Power BI.
- It allows for multiple tables to be connected through one central table.
- In a star schema, a central fact table connects to multiple dimension tables.
- These connections look like a star shape, so it's called a star schema.
- For example your company can build a star schema using a central fact table that contains sales transactions. The company can then link the fact table to dimension tables that contain records for customers, employees, dates, and marketing campaigns.

Components of the star schema

- First, there's the **fact** and **dimension** tables.
- And there are table **relationships**.
- There are many different types of relationships.

Star schema advantages

- By storing data in separate tables, star schemas help to **reduce data redundancy** and boost **query performance**.
- It also provides a clear, logical data model, which makes it **easier to understand** the data structure.

Star Schema Disadvantages

- less flexible than other schema types.
- Adding or modifying tables can require extensive changes to the schema, and
- the star schema can struggle to manage complex relationships.

Snowflake schema.

- A snowflake schema is an extension of the star schema.
- It breaks down the dimension tables into multiple related tables.
- Existing tables in a star schema can be further denormalized into other tables, which creates a hierarchy.
- Yet these tables maintain a relationship with the dimension and central facts tables.
- For example, you can further normalize its **product** data into **supplier** and **category** data tables.

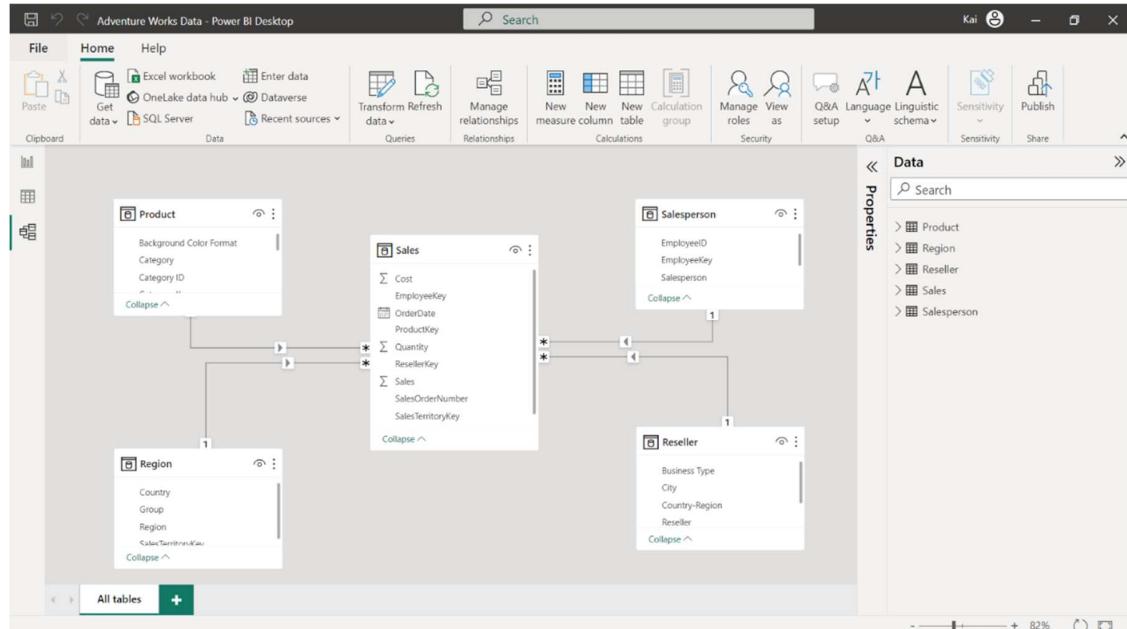
Advantage of Snowflakes Schema

- It provides more efficient data storage and retrieval.
- It improves data integrity and consistency, and
- it reduces data redundancy.
- It also offers scalability and flexibility by integrating new data tables as required.

Disadvantages of a snowflake schema

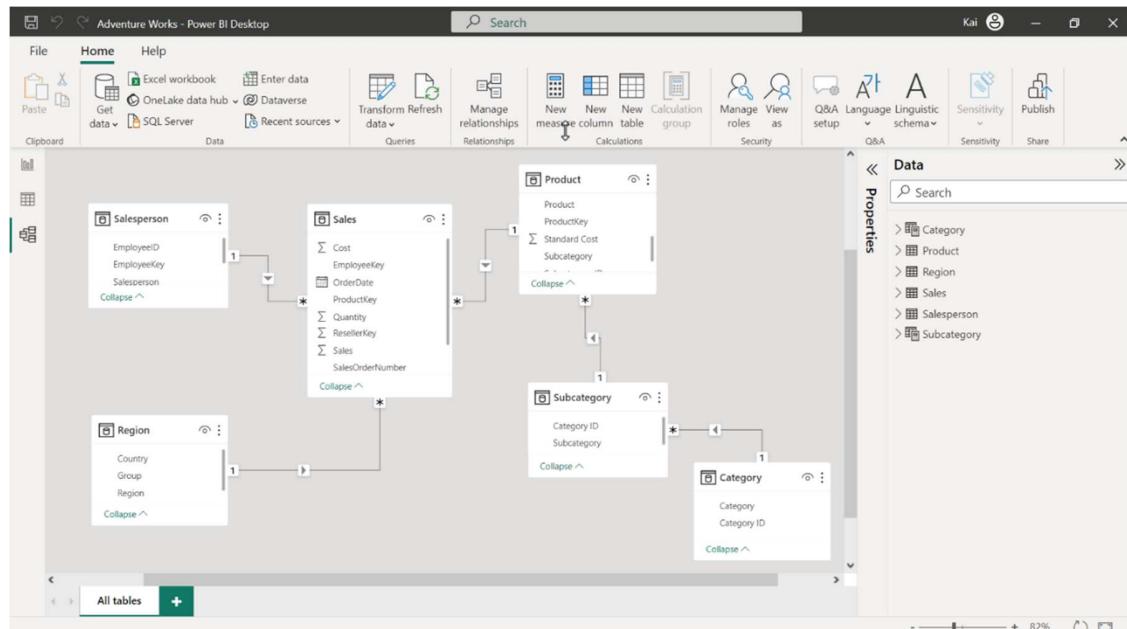
- It's more **difficult to perform** data analysis because of the extra relationships.
- These new relationships also make the schema **more challenging to understand** and manage, and
- They result in **slower queries**.

Star schema



- A Star schema is a type of schema used in data warehousing and dimensional modeling. In this schema, a central fact table is connected to one or more dimension tables based on the common field or column in both fact and dimension tables.
- In the Company schema, the **fact table** contains **quantitative data**, such as sales amounts or product quantities. In contrast, the **dimension tables** store **descriptive data**, such as customer information, product details, or dates.

Snowflake schema



- A Snowflake schema is an extension of the Star schema. In this schema, dimension tables are split into multiple related tables to reduce data redundancy and improve data integrity. This process is referred to as normalization.
- In the Company schema, each dimension table is connected to one or more related tables, forming a hierarchical structure that resembles a Snowflake.

Introduction to DAX

- What if you're analyzing a data model and the data you need isn't in the original model?
- If it's not possible to derive the data from the original model, you can use DAX (data analysis expressions) to create custom calculations to generate the data.
- For example, if your company needs to identify its top-selling products and calculate its revenue but these insights are beyond the scope of the original data model. They can only be generated by calculating the existing data. So you must use DAX or data analysis expressions to complete this task.

What is DAX?

- DAX is a programming language used in:
 - Microsoft SQL Server Analysis Services,
 - Power Pivot in Excel, and
 - Power BI.
- It is a library of:
 - functions,
 - operators, and
 - constants used in formulas or expressions to create additional information about the data are not present in the original data model.
- With DAX expressions, you can create **custom calculations** on data models to extract maximum information from your data to solve real-world problems.

Dax Fundamentals

- To master DAX, you need to understand its
 - syntax,
 - different data types,
 - the operators, and
 - how to refer to columns and tables using functions.

DAX Syntax

- DAX usually computes values over columns in a table, so you need to know how to reference a column in a table:
 - First, write the **name** of your new calculation.
 - Then add the **equals sign** operator.
 - Next, write the name of your **DAX function**,
 - then **parenthesis** that contain the logic of your formula.
 - Write a **table name** enclosed in **single quotes**, followed by the **column name** enclosed in **square brackets**.

- You can omit the table name if the reference column is on the **same table**. Let's demonstrate this using an example from Adventure Works.

Example of DAX Syntax

- If sales table doesn't include any data that denotes the total number of products sold. The company could generate this data using DAX.

Total Products Sold = SUM ('Sales'[Quantity])

- In the DAX expression:
 - **sales** is the table name followed by the column name **quantity** to be referenced and
 - **SUM** is the **DAX aggregation function**.
 - **Total product sold** is the name of the new **calculated column** that holds the results of the calculation.
- When executed, this DAX formula adds a **new column** to the existing table that contains the required data.

Creating calculated columns

- You might often encounter tables that don't have the data you need.
- You can generate this data by combining existing columns to create a new calculated column.
- If your company is analyzing the data in its **Sales** table and realizes there's no data for the profit margins on its product categories in the original data source. **Calculated columns** are the perfect solution to this problem.
- You can add data on its profit margins using DAX expressions to create new calculated columns within the original data source.

What is a Calculated Column?

- A calculated column is a **new column added to an existing data table in Power Bi**.
- Data analysts can use calculated columns to **derive new data from existing columns and add it to the data model**.
- Once added, these columns can be used in any part of a report or visual just like any other column.

Difference between Traditional and Calculated Columns

- Traditional columns are filled with data **imported** from a data source.
- A calculated column is created by defining a **DAX expression**.

Creating Calculated Column

- You can create a DAX expression that calculates the data from two or more columns.

- The result of this calculation is then added to the table as the newly calculated column.
- Write the name of your calculated column and an equals operator. Then write the names of the tables to be referenced in single quotation marks, and their respective column names in square brackets. Include a relevant arithmetic operator depending on the operation required.

For example, you can create a Total **Sales** calculated column by multiplying the quantity and unit price columns in its Sales table.

Demo 2 Creating Calculated Column

Scenario

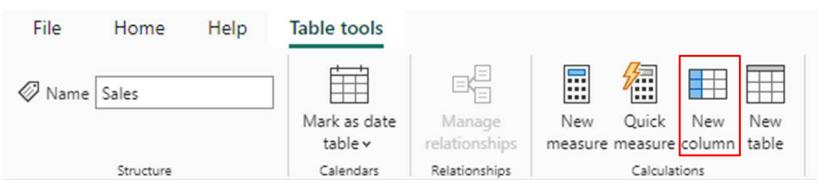
- Your company wants to calculate its **profit margin** from its **Sales** data in its Sales table by creating calculated columns.
- However, the table is missing this data
- You need to add it using DAX and Calculated Columns

Steps

1. Use file **Sales6.xlsx**
2. Create a new Power BI file and import the Sales table.
3. The workbook contains one table called **Sales**. The table tracks Company recent sales data.
4. Load the table Sales into your model.
5. Your company wants to calculate its **profit margin** from its **Sales** data in its Sales table by creating calculated columns.

Total Sales Column

6. Access power BI's **table view** to view the **Sales** table, your company needs to calculate its profit margin. But to do this, it must first calculate its **Total Sales** for the quantity of each item sold.
7. However, the table is missing this data. You can add this data to the table by creating a new Total Sales column. You just need to **multiply** the **quantity** and **unit price** columns.
8. Select the Sales table from the data pane on the right-hand side of Power BI desktop.



9. In the **Table Tools** tab, select the **new column** from the **Calculations** group.

10. This opens the **DAX formula bar**.

11. Write **DAX code** in the Formula bar that multiplies the quantity column by the unit

The screenshot shows the Power BI DAX formula bar. The formula '1 Total Sales = Sales[Quantity] * Sales[Unit Price]' is entered in the formula field. The formula bar has tabs for Structure, Formatting, and Properties. A checkmark icon is visible next to the formula.

price column and adds the result as a new **Total Sales** column.

12. Press **Enter** to execute the code.

13. A new Total Sales calculated column appears under the Sales table in the Data view on the right-hand side of the Power BI interface.

14. You can use this new column in any report or visualization like any other table column.

Profit Column

15. Now that you've identified the Total Sales data, you can create a **Profit** column to determine how much profit has been made on each item.

16. Write another DAX formula that subtracts the **cost** from the **Total sales** and generates the data as a new **Profit** column.

The screenshot shows the Power BI DAX formula bar. The formula '1 Profit = Sales[Total Sales] - Sales[Cost]' is entered in the formula field. The formula bar has tabs for Structure, Formatting, and Properties. A checkmark icon is visible next to the formula.

17. Press **Enter** to execute the formula. The new Profit Calculated column is added to the sales table.

Profit Margin

18. Now that you've identified the profits, you can create the **profit margin** column.

19. Select new column again. Then write another DAX formula in the formula bar that divides the **Profit** and **Total Sales** columns and generates the result in a **Profit Margin** Calculated column.

The screenshot shows the Power BI DAX formula bar. The formula '1 Profit Margin = DIVIDE(Sales[Profit],Sales[Total Sales],0)' is entered in the formula field. The formula bar has tabs for Structure, Formatting, and Properties. A checkmark icon is visible next to the formula.

Margin Calculated column.

20. Press **Enter** to execute the formula. The profit margin column is added to the data.

Format Columns

21. Finally, you need to format the calculated columns, select the **profit** column and format it as **currency**.

22. Then format the **profit margin** column as a **percentage**.

Measures

What are Measures?

- Measures in Power BI are used to perform calculations on data model fields.

- Measures play a pivotal role in data analysis and interpretation.
- Measures are used in Power BI to perform aggregations, calculations or evaluations on data that provide meaningful insights.
- Measures are typically used in data visualization elements. Examples of these elements include charts, tables, and cards.
- By using measures, you can compute aggregated values such as **sums**, **averages**, **minima**, **maxima**, **counts** or more complex statistical calculations.

Benefits of Measures

- **Measures are calculated in the context of the visualization** of a report they are used in:
 - This means they are dynamically updated based on filtering and other interactions within the report.
 - In other words, if the context changes, then so does the measure.
 - This dynamic calculation allows you to dive deeper into data and gain insights from different angles and perspectives.
- **Measures are reusable:**
 - Once created, you can continue to recall them in your code.
 - This reduces the repetitive work of creating the same calculations and ensures data consistency across all reports.
- **Track Performance:**
 - Measures can be used to track the performance of different aspects of a business. Measures are commonly used to create key performance indicators, or **KPIs**, essential to monitor business performance.
 - KPIs provide a quick snapshot of performance against predefined targets or benchmarks.
- **Maintain consistency:**
 - Measures help maintain consistency in metrics across different visualizations and reports.
 - Consistency ensures the same results show, regardless of filtering or grouping.
 - In your measures, your calculations must be standardized and uniformly applied throughout the analysis. This ensures accurate and reliable reporting across various visualizations and dashboards.

Measure Syntax

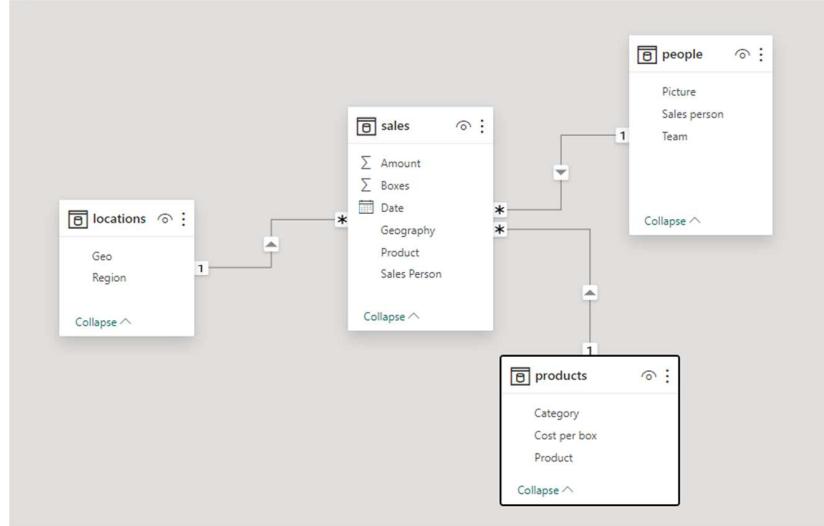


reusable and complex calculation capabilities, enabling businesses to gain insights from their data and make data driven decisions effectively and efficiently.

Demo 3 Creating Measures

1. Open **Demo 3 START.pbix**.

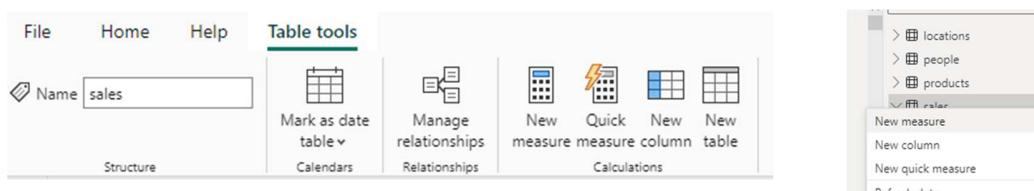
2. Explore your Data Model.



3. This is a chocolate company; Sales are recorded in **Sales** table.
4. The Salespersons recorded in **People** table.
5. The location of the Sales is stored in **Location** table.
6. What chocolate you have sold in the Product table.

Create Total Sales Measure

7. We want to answer the question: What is the total money we have generated?
8. Go to **Table view** and see the data in the tables.
9. In the Sales table we have an **Amount** Column, that is what we want to get its total.
10. Select **Sales** table.
11. **Table tools** ribbon appears on top.
12. Create new measure either:
 - a. Right Click **Sales** table and select **New Measure**, or
 - b. Select **New Measuer** from the Ribbon.



13. Write the DAX Code to create the measure:

Total Amount = `SUM(sales[Amount])`

- 14.

The screenshot shows the Power BI Data view with a table structure. The columns are Sales Person, Geography, and Sales. A context menu is open over the 'Sales' column, with the option 'sales[Amount]' highlighted.

15. Just write **SUM** and choose sales[Amount] then press Enter.
16. The Measure appears in the table.

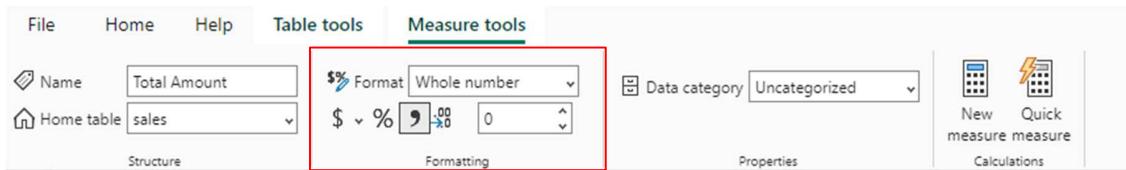
The screenshot shows the Power BI Fields pane for the 'sales' table. It lists various fields such as Amount, Boxes, Date, Geography, Product, and Sales Person. At the bottom, a new measure named 'Total Amount' is listed, which is highlighted with a red box.

17. Think of a measure as something Acts on **Top of your data**.
18. That is why we could not consider it as a column in the table.
19. You can only see its value when you use in reports.
20. Go to **Report View** and Create a Card with the measure you have created.
21. To make it total clearer create a table with **Geo** and the **Total Amount** measure.

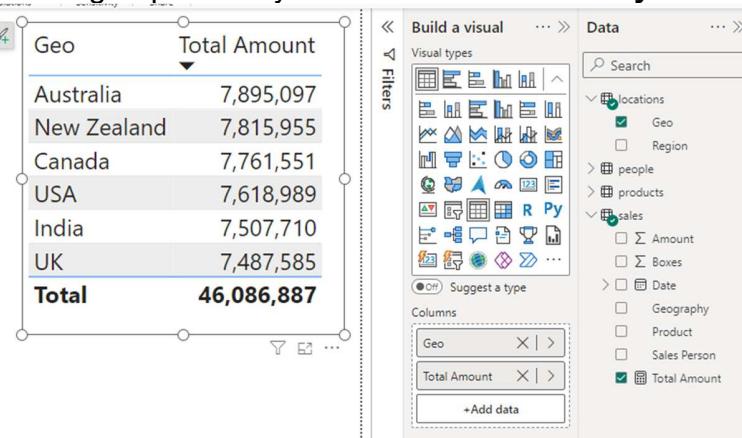
The screenshot shows the Power BI Report View. On the left, there is a card visual with the value '46M' and the title 'Total Amount', which is highlighted with a red box. On the right, the ribbon is visible with the 'Data' tab selected. In the Fields section of the ribbon, the 'Total Amount' measure is checked, also highlighted with a red box.

Format Measure

22. Go to **table view** and select your measure.
23. **Measure Tools** appear on the ribbon.

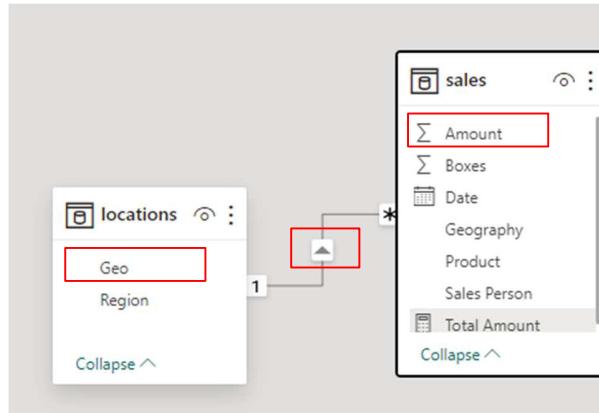


24. In Format group format your measure as **Currency** with no decimals.



25. That is the power of Power BI it follows the filter direction to calculate each region amount as you specified in the measure.

26. For example it takes **Australia** form the **Geo** and filter the **Amount** according to and then calculate your measure to get the total.



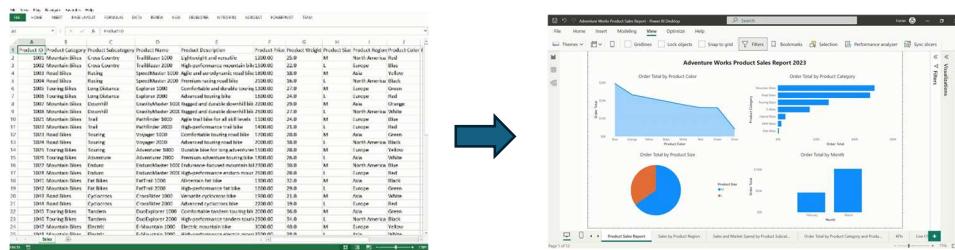
27. It takes into account the filter direction in the model.

28. Remember that Power BI first **Filter Data** then **Apply calculation**.

Chapter 4: Visuals

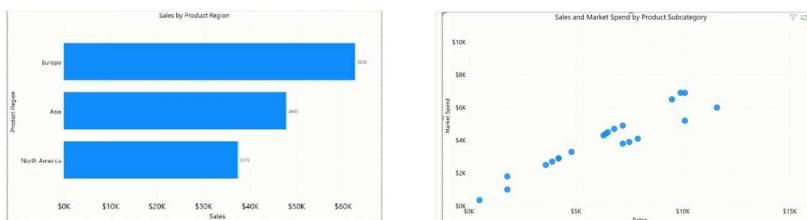
What are visualizations?

- Data visualizations can act like a navigation system with a clear interactive display
- Visualization is a graphical representation of data.
- Converting raw data into a visual format using Power BI can help you identify **patterns**, **trends** and **insights** that might not be apparent in text-based data.
- The data comes from several sources, ranging from sales and regional reports to customer feedback. In a spreadsheet this data would be complex and hard to digest. However, you can use Power BI with its many ways to visualize data to transform the data into a **compelling**, **interactive**, and easily **digestible** format.
- Visualizing data for business intelligence is crucial. Particularly in complex and dynamic business environments.



How data visualization can enhance business intelligence

- Data visualizations can reveal **patterns**, **trends**, and **correlations** hidden in raw data.
- For example, you could use a **bar chart** to visualize sales data demonstrating geographic regions where sales are the highest.
- You could also use a **scatter plot** to identify **correlations** between marketing spend and sales performance.



- Power BI's interactive visualizations allow companies to dive deep into their data. They can drill down into specific areas of interest such as analyzing sales trends for a particular product in a specific market over a given period leading to more precise data driven decision making.
- Visualizations make data more accessible to a **broader audience**. Not everyone at organizations will be comfortable interpreting raw data but most stakeholders can understand a well-designed charter graph. As a result, more stakeholders can **engage** with the data and contribute to data driven decision making.
- Visualizations are a powerful **communication tool** and can tell a **compelling story** with data, making the insights more memorable and persuasive.

- To demonstrate the success of a new product line to stakeholders, you could use visualizations to highlight **key performance metrics** in a visually engaging way

Creating visualizations in Power BI

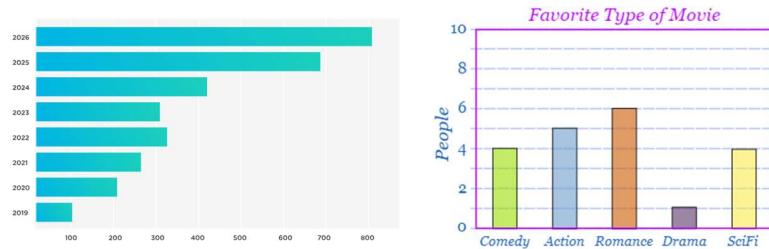
- Creating visualizations in Power BI begins with **connecting** to your desired data sources. These can range from Excel spreadsheets to SQL databases.
- Once connected, you can use **Power Query** to **extract**, **transform** and **load** the data into Power BI. These transformations include:
 - renaming columns,
 - changing data types,
 - filtering rows and
 - combining data from multiple sources.
- You can then load this refined data into Power BI's **data model** for further manipulation, using data analysis expressions or **DAX** as a formula language for creating custom calculations.
- The next stage of the workflow involves **representing** this process **data in visualizations**.
- Power BI provides a wide variety of visualization types, such as **bar charts**, **scatter plots**, **pie charts** and even **geographical maps**.
- After selecting a visualization type, you map the data elements to different aspects of the visualization. From adding values to the axes or fields to the color scheme.
- Power BI allows you to add **slicers**, which are visual filters that allow viewers to segment and filter the data in real time to enhance the usefulness and interactivity of these visualizations.
- The final step in the workflow involves **arranging the visualizations on a report page** and then **sharing** the report with other stakeholders.
- The **Power BI service** allows you to **publish** these reports enabling a broader audience to interact with them online, even on mobile devices.
- Visualizations don't only present data in a more understandable form, they also enable real time data analysis for example, as sales figures are updated, the visualizations in power BI will update automatically. This provides companies with up-to-date accurate insights and enables them to react more quickly to changes in their business environment.
- Data analysts must carefully craft them to communicate the right insights effectively.

This includes ensuring you select the **correct type of visualization** for the data you want to represent. For example, while **pie charts** are appropriate for displaying **parts of a whole**, **line graphs** are more suitable for displaying **trends**.

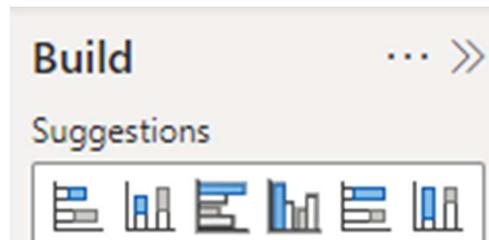
Bar and Column Charts

- Bar and column charts are popular types of visualizations to display data in a clear and organized way.
- They are beneficial for showcasing categorical data or data that can be organized into distinct groups.
- Bar charts display data horizontally, whereas column charts display data vertically.
- The simplicity and intuitive nature of bar and column charts make them effective tools for presenting data and identifying patterns or trends over time.

- With six different types of bar and column charts in Power BI, you can convert raw data into visually appealing and meaningful insights.
- A column chart is a data visualization where each category is represented by a rectangle, with the height of the rectangle being proportional to the values being plotted.
- A Bar chart is the same as column chart, but data is presented horizontally. It is good for long category names.

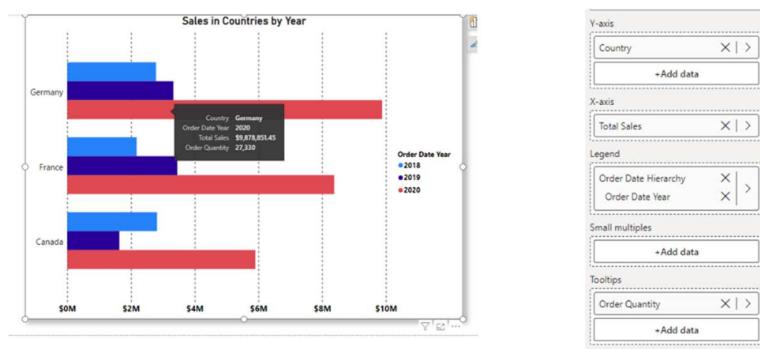


- There are 6 types of Column and bar charts



4 essential field wells in Column and Bar Charts:

- The legend, X-axis and Y-axis, and tooltips.
- The field wells represent different sections of your chart that you can customize according to your requirements.



legend

- It displays under the title or on the side of a chart.
- The legend field controls the color coding or grouping of the bars or columns in your chart.
- It helps to differentiate between different categories or subgroups within the data. The legend makes it easier to understand which color in the chart represents which item.
- You can hide the legend by turning it off in the Format tab on the visualizations pane,

- you can hover your mouse over the bar or column to display the data if the legend is not shown.

The x and y axis

- Each axis represents the data points you want to compare or analyze.
- For bar charts, the x axis shows the values like order, quantity, and total sales, and the y axis shows the categories like month or product regions.
- For column charts, this is reversed. The x axis shows the category, and the y axis shows the values like order, quantity, or total sales.

Tooltips

- A tooltip displays data or extra information when you hover over the data points of a chart.

Pie and donut charts

- These charts, which are circular and cut into slices, provide a way to represent data proportionally.
- While pie and donut charts are useful for comparing different categories, they become less effective when comparing large amounts of categories as the slices become too small and difficult to distinguish between them.
- In a pie chart, each slice of the pie corresponds to a unique category from your data set. The size of each slice is directly proportional to the quantity it represents.
- Like a pie chart, a donut chart segments are proportional to the data they represent. The difference between a pie and a donut chart is that the donut chart is ring-shaped with a circular central space. You can use this space to provide context for the surrounding segments.
- When choosing between a pie and a donut chart to represent parts of a whole, the donut chart may be a better choice if you'd like to display additional information in the space in the center.



Line Chart

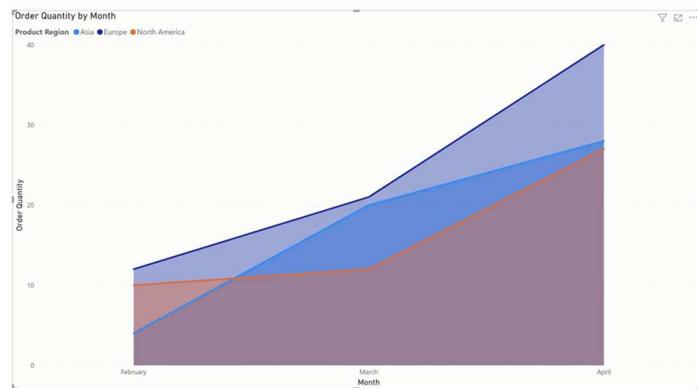
- A line chart uses a line to connect individual data points.
- It is the perfect tool for illustrating a sequence of values or displaying trends over time.
- For example, a line chart can help companies understand how sales are progressing month to month or year to year.

- A line chart with multiple lines can show sales across different regions over time and help the stakeholders understand the trend or sales performance.



Area Chart

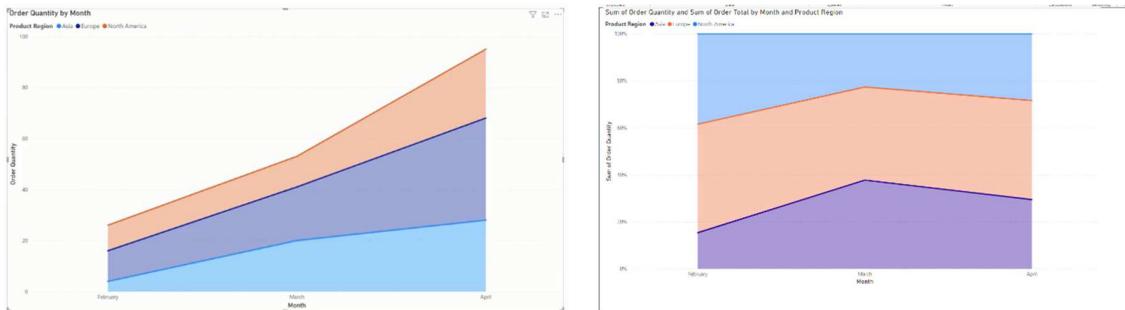
- While a line chart focuses on trends, an area chart emphasizes the magnitude of changes.
- It can display the part-to-whole relationships among your data, making it easier to compare quantities.
- For example, regional sales represented by an area chart can help stakeholders intuitively understand and compare the degree each product region contributed to total sales for each month.



Stacked Area Chart

- There's a variant of the area chart called a stacked area chart, where the data points from multiple categories are stacked on top of one another.
- This can be useful when emphasizing the total across several categories.

- For example, you could use a stacked area chart to illustrate the total orders over a period and demonstrate how each product region contributes to the total.



When to use bar and column charts, or line and area charts?

- When presenting a few items, bar and column charts can be visually appealing and effective.
- However, when dealing with many data points, these charts can become cluttered and difficult to read. Each bar or column takes up a certain amount of space, and the chart can become overcrowded if there are too many to plot.
- Unlike bar and column charts, area charts are effective for visualizing changes in multiple values over time.
- Both line and area charts are effective in visualizing the changes in values of multiple categories, particularly over time.

While line charts are useful for identifying trends, area charts offer a further benefit. They help us interpret the magnitude of the values. They also effectively illustrate the cumulative impact of the data points over the selected time, providing an overall picture of the data trends.

Table Visualization

- There are moments when your audience wants simplicity, a straightforward, no frills presentation.
- Microsoft Power BI table visualization is useful when you want to employ the classic clear-cut style of tables to ensure your audience can grasp the essence of the data quickly.
- It elegantly presents refined data, allowing viewers to immediately consume critical information and insights. The table displays summarized insights which is much more user friendly to work with.
- You can even customize the table visualization to improve its aesthetic appeal or aid engagement and comprehension.

Conditional formatting

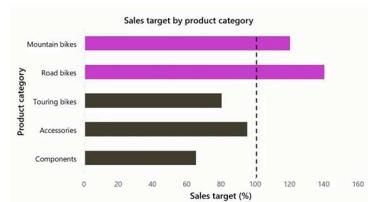
- Conditional formatting is a feature that allows you to apply specific formatting to cells or rows in a table or matrix based on specific conditions.
- This feature is significant when you have vast amounts of data and want to highlight certain elements that meet specific criteria.

- For example, if the total profit displayed in a table was a negative value indicating a loss, you could highlight this by using conditional formatting to change the value to a red color.
- Other visuals also support conditional formatting. For example, you can format a **bar chart** so that if the sales target for a specific product category goes beyond a certain threshold, that category's bar will change color.
- Conditional formatting offers many benefits:
 - It provides immediate insights,
 - allowing users to quickly spot trends, anomalies, and focal points.
 - making the information more accessible and readable.

reducing the potential for errors.

Profit table

Year	Revenue (\$)	Expenses (\$)	Profit (\$)
2020	85000	90200	-5200
2021	120000	95000	25000
2022	110000	112000	-2000
2023	160000	115000	45000



Working with themes

- Your report should always align with the company's brand, colors, and style guide.
- Using the design elements of the report to reflect the company's brand aesthetics would be a tedious, time-consuming task.
- Luckily, themes in Microsoft Power BI could simplify the task at hand and save you a lot of time and effort.

What are themes?

- Themes in Power BI are predefined sets of colors, fonts, and visual styles that you can apply to your reports easily and quickly.
- They ensure visual consistency across different reports and can save significant time that would be otherwise spent customizing individual items.
- You can customize themes to align with company color schemes and design guidelines. This can help enforce a strong brand identity in your reports and create a more impactful and professional appearance.
- Using themes in Power BI can **enhance accessibility** in a variety of ways. Power BI offers theme customization options you can use to cater to specific **accessibility** needs, such as **high contrast themes** for users with visual impairments.

You can also enhance readability by using themes that employ distinct and consistent colors, assisting users in differentiating between various data points and categories

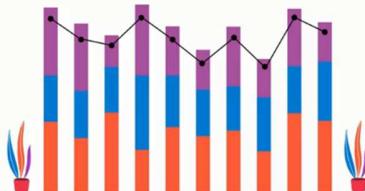


Combo Chart

- In Power BI, a combo chart is a dynamic combination of a line and a column chart, allowing you to visually represent two different, yet interconnected data points.
- Power BI offers two types of combo charts:
 - (1) **A line and a stacked column chart**
 - (2) **A line and a clustered column chart**.
- A line and stacked column chart is helpful for displaying a total across the series of data and how each individual part contributes to the total.

Line and clustered column charts are excellent for comparing several sets of data side by side Matrix

- The matrix visual is similar to a table but has key features that allow the report designer to



A line and a stacked column chart



A line and a clustered column chart

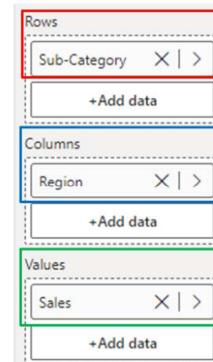
communicate multiple levels of information in the data.

- A table supports two dimensions, and the data is flat, meaning duplicate values are displayed and not aggregated. On the other hand, a matrix makes it easier to display data meaningfully across multiple dimensions because it supports a stepped layout.
- Unlike the table, the matrix automatically aggregates the data, enabling the viewer to drill down into the detail.

Sub-Category	Region	Sales
Accessories	Central	33,962
Accessories	East	45,038
Accessories	South	27,280
Accessories	West	61,120
Appliances	Central	23,581
Appliances	East	34,191
Appliances	South	19,525
Appliances	West	30,240
Art	Central	5,763
Art	East	7,497
Art	South	4,662
Art	West	9,214
Binders	Central	56,926
Binders	East	53,500
Binders	South	37,032
Binders	West	55,967
Total		2,297,339

Sub-Category	Central	East	South	West	Total
Accessories	33,962	45,038	27,280	61,120	167,400
Appliances	23,581	34,191	19,525	30,240	107,537
Art	5,763	7,497	4,662	9,214	27,136
Binders	56,926	53,500	37,032	55,967	203,425
Bookcases	24,153	43,819	10,900	36,007	114,879
Chairs	85,227	96,262	45,177	101,786	328,452
Copiers	37,260	53,220	9,300	49,750	149,530
Envelopes	4,638	4,375	3,344	4,120	16,477
Fasteners	776	821	504	923	3,024
Furnishings	15,256	29,067	17,310	30,071	91,704
Labels	2,454	2,607	2,358	5,086	12,505
Machines	26,800	66,107	53,890	42,445	189,242
Paper	17,491	20,174	14,146	26,664	78,475
Phones	72,410	100,628	58,311	98,698	330,047
Storage	45,933	71,618	35,770	70,539	223,860
Supplies	9,470	10,763	8,320	18,126	46,679
Tables	39,152	39,141	43,919	84,755	206,967
Total	501,252	678,828	391,748	725,511	2,297,339

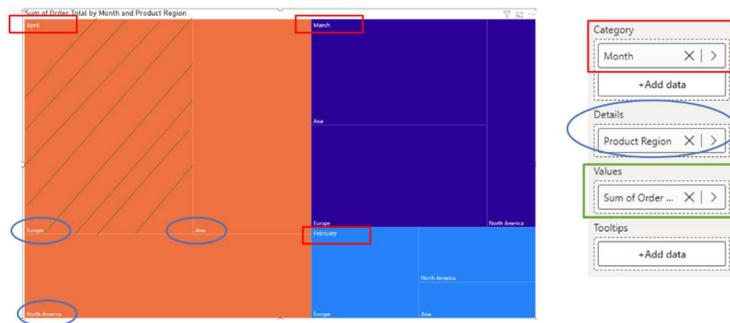
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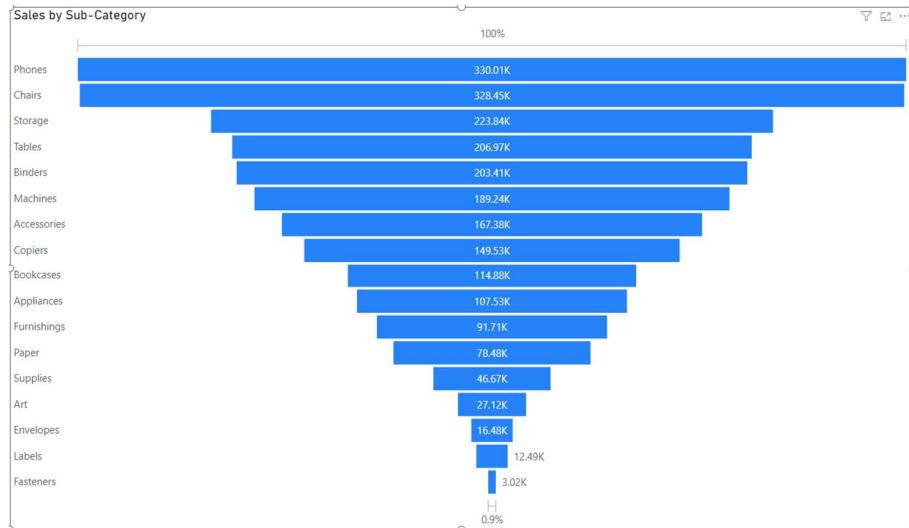
e. This can be useful to track and compare different metrics over the same period

Treemaps

- Like a pie or donut chart, treemaps are another helpful tool in Power BI for illustrating your proportional data.
- However, instead of circles, treemaps use rectangles to display your data, making the best use of **space** in your reports and add variety by displaying data in new and exciting ways.
- A treemap is a unique visual used to display **hierarchical** data or data that's organized in a treelike structure as nested rectangles.
- The entire chart represents the total dataset or tree and each **rectangle** or branch represents a **portion** of the whole tree.
- Each **rectangle size** corresponds to the **value** or size of the data it represents.
- While pie and donut charts are familiar and widely used to represent data proportionally, pie and donut charts can become **cluttered** and **difficult** to read when dealing with **many categories** of variables, or when the **differences** between data points are **small**.
- However, the design of a treemap chart allows for easier visualization and interpretation of larger datasets. Its rectangular, nested structure means it can handle more data points without becoming overly complex.



Funnel charts



Funnel Chart in Marketing and Sales

- Funnel charts in Power BI are one type of visualization you can use to represent the **progression** of data through **different stages** like a **sales workflow**.
- The funnel visualization displays a **linear process** that has **sequential connected stages**, where items flow sequentially from one stage to the next.
- Funnel charts are commonly used in **business** or **sales** contexts. They are well suited to visualizing data that's sequential and moves through at least four stages, where you expect a **greater number of items** in the **first stage** than in the **final stage**.
- The charts can help reveal **bottlenecks**, such as where a significant number of items are being **lost** or not moving forward in linear processes.
- In addition, you can use them to calculate a **potential outcome** by stages such as **revenue**, **sales** or **deals**, and track **conversion** and **retention rates**. These rates relate to how many **potential customers** move through each stage of the sales process and stay in the process.
- Similarly, you can use them to track the progress and success of **click through advertising** campaigns.

Sales Funnel Chart

- A funnel chart representing the stages of a sales workflow.

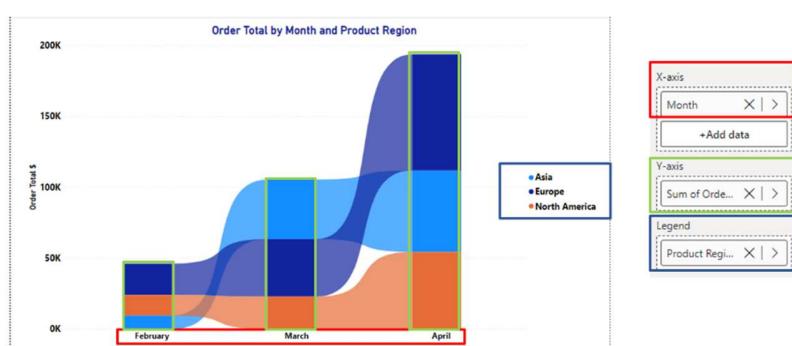


- Each bar in the chart represents a stage the customer goes through during the sales process:
 - **Lead Stage:** at the top of the funnel, representing customers interested in a product or service.
 - **Qualify Stage:** leads are evaluated for their potential.
 - **Solution Stage:** presented tailored solutions.
 - **Proposal stage:** sent formal sales proposals.
 - **Finalized stage:** is where the lead agrees to the proposal closing the sales deal.
- Each stage in the chart decreases as the lead conversion process progresses, creating a funnel shape.

The narrowest part of the funnel represents the leads that resulted in actual sales.

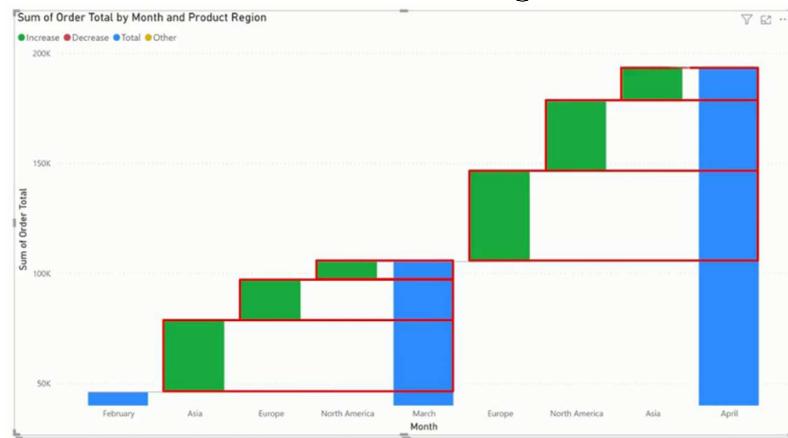
Ribbon Charts

- A ribbon chart is a form of stacked chart for visualizing data and changes over time and has a clear ranking order.
- These charts stack the highest ranked series at the top of the chart, making it easy to track shifts in the rankings over time.
- They are also helpful for comparing the **performance** of different categories across distinct time intervals.



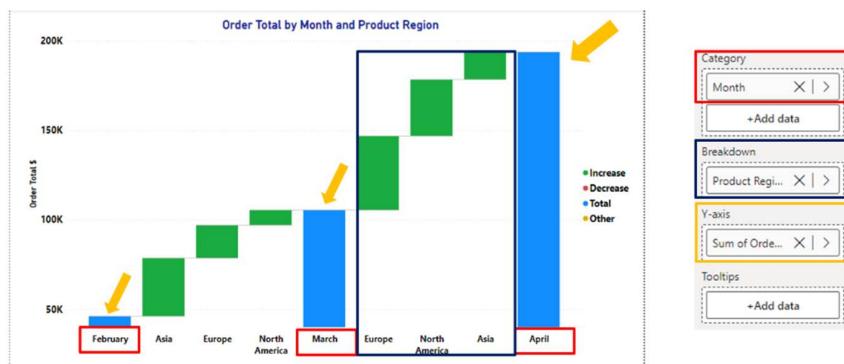
Waterfall Charts

- Waterfall charts show a **running total** as Power BI adds and **subtracts** values.
- These charts are useful for understanding **cumulative effects**.



- In data analysis and visualization, **cumulative effects** refer to **how an initial value is affected by a series of positive or negative sequential factors, events, or changes over time**.
- For example, a waterfall chart can be used in financial analysis to visualize how a company's net income results from a cumulative effect of various financial elements including **revenue**, **costs**, and other **factors** like taxes.

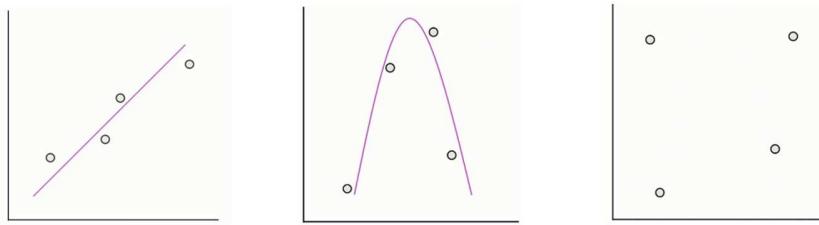
With this visual, stakeholders can intuitively grasp the overall **sales performance**, as well as easily compare and contrast the contributions of each month and the regions to the sales



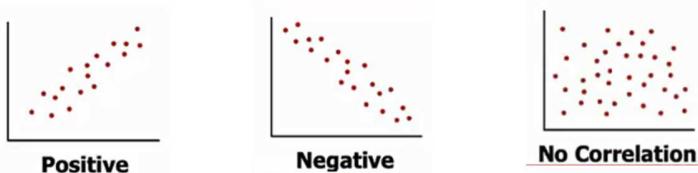
Scatter charts

- Scatter charts are a powerful tool in data visualization. They use **dots** to represent **values** obtained for **two variables** in a dataset, plotting these two numeric variables along **two axes**.
- Scatter plots help illustrate how one factor is affected by another, representing **correlations** between the variables.
- The relationship between the variables can be:
 - **linear**, follows a straight line,

- **nonlinear**, follows a curved line, or
- **random**.

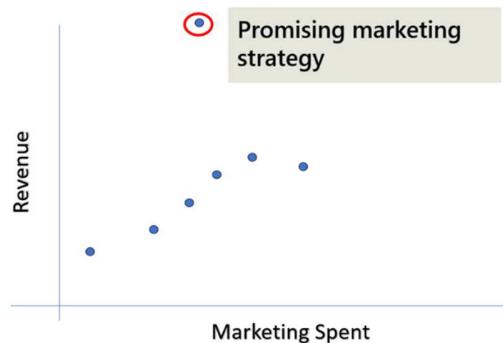


- Scatter charts can help you identify **trends**, **patterns**, and perhaps most importantly, **anomalies** like **outliers** in your data.



- Anomalies refer to deviations from the general pattern of the data.
- Outliers are a type of anomaly where valid data points significantly differ from other observations deviating from the general data trend. They tend to lie far away from other data points in a scatter chart.

Example:



- in a scatter chart representing the relationship between **sales revenue** and **advertising spend**, you might expect the data points to show a **positive correlation** where **higher advertising spend** is associated with **more sales**.
- An **outlier** would be a data point representing **unusually high sales revenue and low marketing spend**. This data point is worth investigating as it may indicate an effective marketing strategy able to generate revenue beyond what is expected based on the amount of money spent on marketing.
- A keen eye for **outliers** is essential because they can dramatically skew statistical measures and data distributions. Though they might seem problematic at first, outliers often carry vital information about the process under investigation or the data gathering mechanism. They

can help businesses gain valuable insight into potential issues or areas for improvement and optimization.

Scatter, Bubble and Dot Plot Charts

Dot Plot Chart

- Dot plot is one such visualization that is popular when presenting **categorical** data in relation to a **numerical** value.

Scatter Plot Chart

- To display the relationship between two numeric variables, you can create a scatter plot that defines the correlation between variables.

Bubble Chart

- A variation of a scatter plot is a bubble chart that can display the relationship between **three variables**.
- The third variable is represented in the **size of a bubble**.

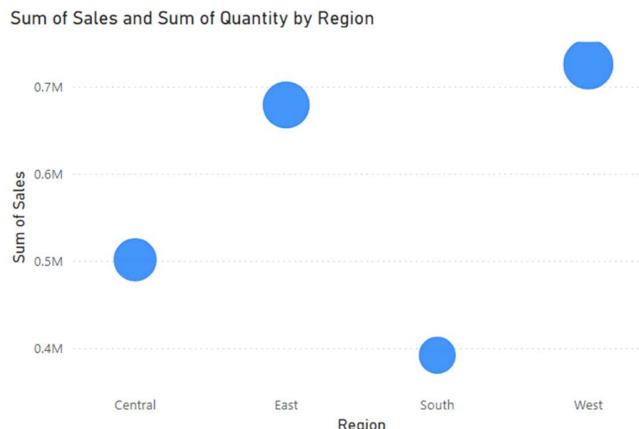
Dot Plot Chart

- Dot plot is one such visualization that is popular when presenting **categorical** data in relation to a **numerical** value.
- A dot plot is like a bubble chart, but instead of numeric data, you use categorical information on the x-axis.
- Dot plot charts are a simple, yet effective data visualization technique used to display the distribution of data points along a single axis.
- In a dot plot chart, each data point is represented by a dot, and dots are stacked vertically above the corresponding data values on the axis. This makes dot plots especially useful for visualizing the distribution and frequency of categorical data.
- Power BI does not have any visual named **dot plot** or dot chart, but you can create a dot plot by converting a scatter chart to a dot plot. However, there are certain custom visuals available in the Power BI marketplace that are used to directly create dot plots in Power BI.

Example

- Your Company needs insights into regional product category sales performance.
- They need to know:
 - the **quantity** sold for each category and
 - the **revenue** per **country**.
- The challenge is the number of variables to be presented in a single visual.

- As a Power BI analyst, you can deploy a dot plot to present categorical information such as **category** or **country** on the **x-axis**, **sales** on the **y-axis**, and **quantity** as the **size of the dot**.



Card, Multi-row Card, Gauges, KPI

Card visualization

- The card visualization displays one value or a single data point.
- This type of visualization is ideal for representing essential statistics you want to track on your Power BI dashboard or report.
- For example, you could use a card visual in a sales dashboard to provide a snapshot of the total sales revenue, enabling stakeholders to gain instant insight into overall financial performance.

123

Multi-row card visualization

- Multi-row card visualization that displays one or more data points, with one data point for each row.

February	46100	Sum of Order Total
March	105400	Sum of Order Total
April	193700	Sum of Order Total

points, with

Radial gauge Visualization

- This visual is a circular arc that displays a **single measuring progress** toward a **goal or target**, or the health of a single measure.
- Although radial gauges can highlight critical insights visually appealing, engaging way, they **take up a lot of space** compared to the insights they provide.
- Power BI spreads all the data values evenly along the arc, from the minimum leftmost value to the maximum right most value.
- The **default maximum value is double the actual value**.
- You should specify the target **minimum** and **maximum** values using the corresponding field wells in the visualizations pane, to create a realistic gauge chart that represents your data.
- The **shading** in the arc represents the **progress** towards your target, and the **value** underneath the arc represents the **progress value**.



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KPI visualization

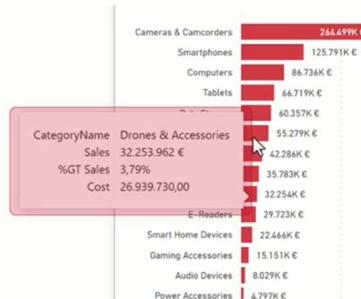
- It is a powerful tool for **tracking** the performance of a metric against a **target**.
- The KPI visual also includes a **trend line** or **chart** to show the data's trajectory over time.
- It displays an indicator that shows whether the performance is above or below the target.
- The KPI visual usually has three field wells:
 - **Indicator**, which is the primary measure you are tracing.
 - **Trend axis**, which shows how the indicator is performing over time.
 - **Target goals**, which represents the benchmarks you are trying to achieve.
- Key performance indicators act as a health checkup for a business, providing stakeholders with insights into their progress toward reaching business goals.



Interactive Report

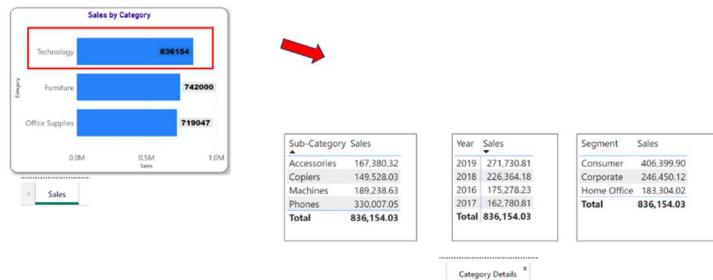
Custom tooltips

- Tooltips in Power BI display additional information about the data being displayed in your visuals when users hover over different data points.
- You can create custom tooltips by adding extra items to the tooltips field well, for a visual, tailoring the content to the needs of your report users.
- Tooltips can contribute to improved accessibility of Power BI reports and dashboards in various ways.
- Tooltips allow you to provide an extra layer of detailed information without cluttering the dashboard.



Drill Through

- While **drill down** only allows users to navigate from a broader to more detailed level within the **same visualization**, with Power BI's **drill through** feature, users can **navigate** from a **visualization** to a **separate detailed report page** focused on the selected data point.



Bookmarks

- Bookmarks in Power Bi are a way to **capture the current state** of the report you are viewing and share this state with other viewers.
- For example, if you apply filters to a report, you can save the filtered state as a bookmark. Viewers can then select the bookmark and the report will change to the filtered state you established.
- When adding a bookmark, there are four state options that you can save:
 - Data** properties such as filters and slicers,
 - Display** properties such as visualization highlighting and visibility.
 - Current page** changes, which present the page that was visible when you added the bookmark,
 - All visuals or selected visuals**: selecting if the bookmark applies to All visuals or selected visuals.
- Bookmarks will enable different users to focus on different parts of the data without setting up **filters** every time.
- You can also **highlight specific insights** and create customized views relevant to the different departments.
- By default, all states are saved for all visuals.**
- If you modify a report after you create a bookmark, any visualizations not present when you created the bookmark will appear in a default state. **So remember, if you change a report, you should make sure to update your bookmarks to reflect the changes.**
- Given that bookmarks in Power Bi are excellent for creating **tailored, interactive** reports that users can easily navigate and extract crucial insights from



Page Navigator and Bookmark Navigator

- You can use either or both features to make your users navigate your report so easily.

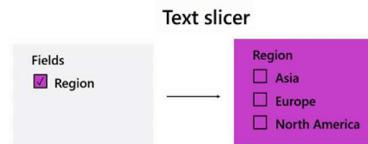


Slicers

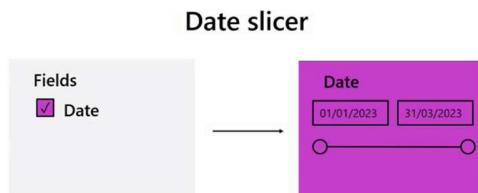
- A slicer is a great way to apply common **filters** to a report page quickly.
- When added to a report, you can use the slicer to display a list of commonly used or most important filters.

Slicer Format

- The slicer can be displayed in **multiple formats** depending on the **field** on which the slicer is filtering.
- For example, if you apply the slicer to a field with **text data type**, the slicer can display as a list of unique entries in that field.



- Similarly, if you apply the slicer to a field with a **date type**, the slicer can be displayed as a **date range selector**.



- However, no matter which format the slicer is displayed in, the underlying behavior is the same.
- The slicer provides a list of filters that users can apply to the visualizations in the report. When a filter is selected, the visualizations will immediately update to reflect the filtered data.
- It is important to note that you do not need to connect every visualization in a report to the slicer.

Slicer Impact

- As a Power BI data analyst, you can **configure** which visualizations are **impacted** by the slicer's selected filters.

- You can also **synchronize multiple slicers** so that when a slicer applies a filter, other slicers on different pages are updated to reflect the selected filter. This is useful when filtering through multiple layers of data.
- For example, if you had one slicer for regions on a sales page and another slicer for regions on a costs page, when you select a specific region, the region is selected on both slicers. This helps improve the user experience as filtering remains consistent as you navigate multiple pages of the report.

Cross-filter and cross-highlight

- Microsoft Power BI's cross filter and cross highlight functionalities make it possible for you to **emphasize** related data across multiple charts or **remove** unrelated data.

Cross-filter

- Cross filtering refers to the practice of selecting an item or data point on one visual, which in turn **filters out unrelated data** in another visual.
- It creates a relationship between two separate visuals, such that a selection in one visual affects the data shown in another.
- For example, with cross filtering, selecting the Mountain Bikes column in a report will filter the table visual to display only sales data related to this product category. The other product categories are no longer shown.



Cross-highlight

- With cross highlighting, when you select a data point in one visual, it **highlights** the related data in other visuals instead of filtering out unrelated data.
- This is the **default behavior** for most visuals in Power BI.
- Unlike cross filtering, it still **displays unrelated data**. However, it's **dimmed or faded**.

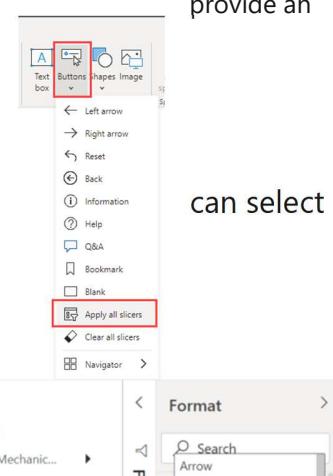


Buttons

- With *buttons* in Power BI, you can create reports that behave similarly to apps, and create an environment where users can hover, click, and further interact with Power BI content.
- When you share your reports in the Power BI service, buttons provide an app-like experience.

Create buttons

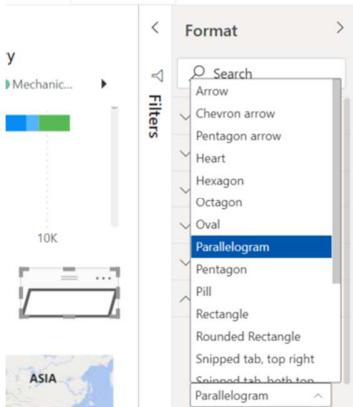
- In Power BI Desktop, on the **Insert** ribbon, select **Buttons** to reveal a drop-down menu, where you can select the button you want from a collection of options.



can select

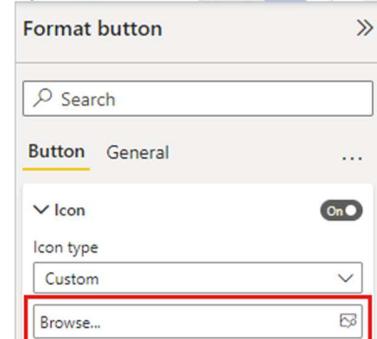
Customize a button

- The **Format** pane shows you the many ways you can customize the button to fit your requirements. For example, you can customize the shape of a button.
- Select the button, navigate to the Shape tab of the Format button pane, and customize the button to any of these shapes:



Add a custom image or icon

- Select the button, and navigate to the **Style > Icon** tab of the **Format button** pane.
- Select the **Custom** option for **Icon**, then select **Browse**.

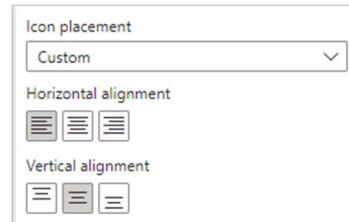


- After you add your image, you can customize the **Image fit** and **Icon placement**. With icon placement, you can place the image either **Left of text**, **Right of text**, **Below text**, or **Above text**.



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of

- You can choose the **Custom** option to icon's **Vertical alignment** and **Horizontal alignment**.



control the

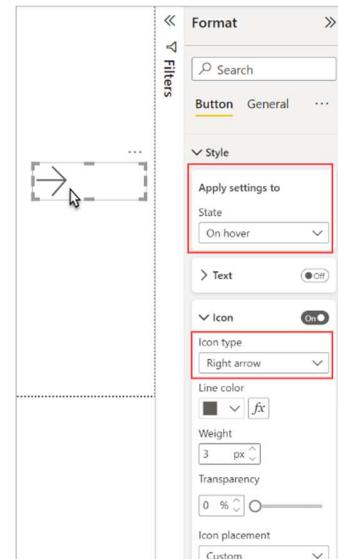
- You can also customize the **Icon size**. By default, the icon size is set to **Auto**, meaning that as you resize the button, the icon size automatically changes size. You can set a fixed **Icon size** (in pixels) by typing a number in the **Icon size** box.

Add effects

- Just like Power BI built-in shapes, Power BI buttons can have artistic effects to suit your design needs:
 - **Shape shadow** effects
 - **Shape glow** effects
 - Button **Shape rotation** and **Text rotation**.

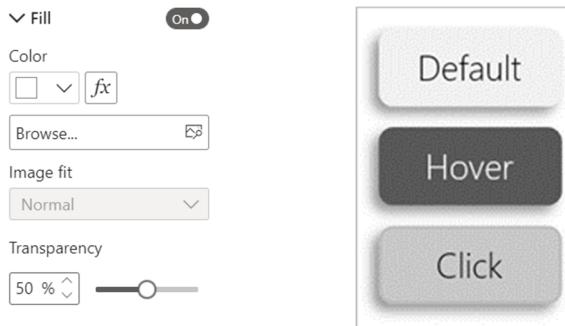
Button states

- Buttons in Power BI have four possible states:
 - **Default**: How buttons appear when not hovered over or selected.
 - **On hover**: How buttons appear when hovered over.
 - **On press**: How buttons appear when selected.
 - **Disabled**: How buttons appear when they can't be selected.
- You can modify many of the cards in the **Format** pane individually, based on these four states, which provide plenty of flexibility for customizing your buttons.
- The following cards in the **Format** pane let you adjust the formatting of a button for each of its four states:
 - Shape
 - Style
 - Rotation (applies to all states automatically)
- To select how a button should appear for each state:
 1. In the **Format** pane, select the **Button** tab, and then expand the **Shape** or **Style** card.
 2. Select **State** under **Apply settings to** at the top of the card, and then select the settings you want to use for that state.



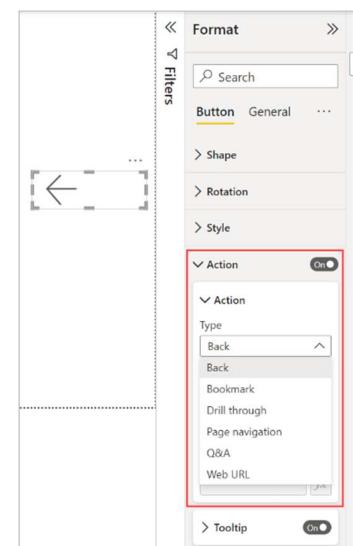
Buttons support fill images

- Power BI buttons support fill images. With fill images, you can customize the look and feel of your button, combined with the built-in button states: default, on hover, on press, and disabled (for drillthrough).
- Under **Style**, set **Fill** to **On**, and then **Browse** for an image for each style state.



Actions for a button

- You can select which action is taken when a user selects a button in Power BI:
 - **Back** returns the user to the previous page of the report. This action is useful for drillthrough pages.
 - **Bookmark** presents the report page that's associated with a bookmark that is defined for the current report.
 - **Drillthrough** navigates the user to a drillthrough page filtered to their selection, without using bookmarks.
 - **Page navigation** navigates the user to a different page within the report, also without using bookmarks.
 - **Bookmark navigation** navigates the user to a different state in the report, either on the same or a different page, by using bookmarks.
 - **Q&A** opens a **Q&A Explorer** window. When your report readers select a Q&A button, the Q&A Explorer opens, and they can ask natural-language questions about your data.
 - **Apply all slicers** and **Clear all slicers** buttons apply all the slicers or clear all the slicers on a page.
 - **Web URL** opens a web page in a browser.
- Certain buttons have a default action that's selected automatically. For example, the **Q&A** button type automatically selects **Q&A** as the default action.
- To select a button action:
 - On the **Button** tab of the **Format** pane, turn the **Action** to **On**, and then expand the card.
 - Expand **Action**, and then select the **Type** of button action.

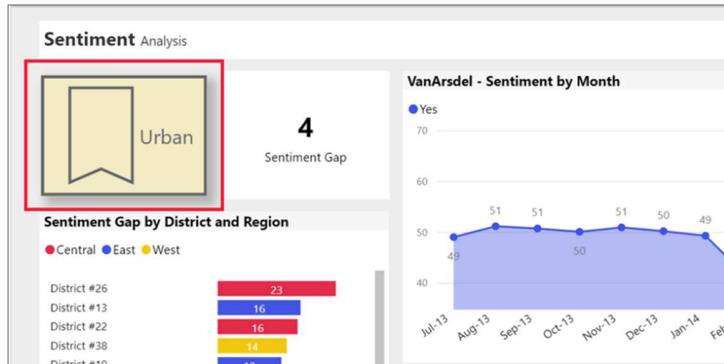


Back buttons

- A back button can have an arrow icon.
- When you select it, Power BI takes you to the previous page. Back buttons are often used with **drillthrough**

Bookmark buttons

- When a report designer adds a bookmark button, it's just an alternate way to navigate to a particular report page associated with that bookmark



Drillthrough buttons

- There are two ways to drill through in the Power BI service.
 1. Right-click a data point in a visual, select **Drill through**, and choose the destination.
 2. Add a **drillthrough button**. The button makes the action more obvious and calls attention to important insights.
- Drillthrough buttons can have more than one prerequisite. If you don't fulfill all the prerequisites, the button won't work.

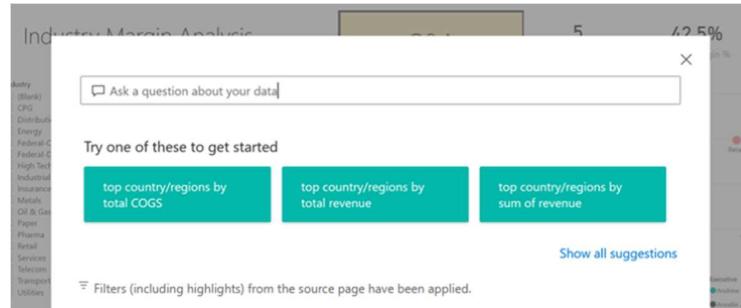


Page navigation buttons

- Page navigation buttons take you to a different page in the same report.
- Report designers often create navigation buttons to tell a story or guide you through the report insights.

Q&A buttons

- If you select a Q&A button it opens the Power BI Q&A Explorer window. The Q&A window displays on top of the report page and closes when you select the X.



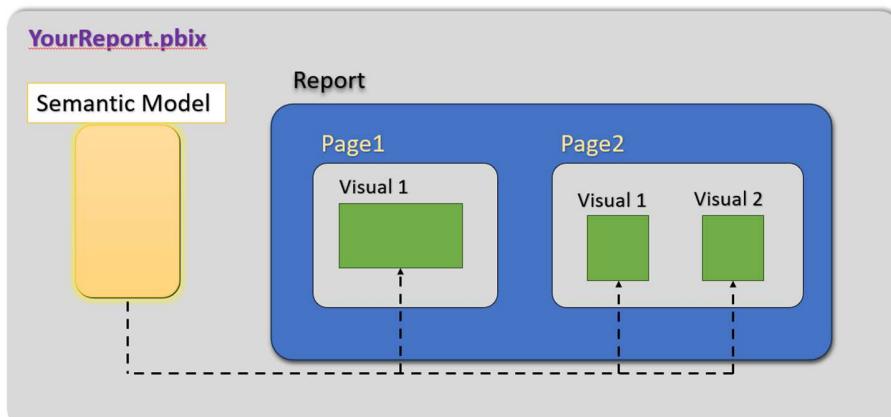
Web URL

- Web URL buttons open a new browser window.
- Report designers might add this type of button as a reference source, to link to the corporate website or a help page, or even as a link to a different report or dashboard.

Chapter 5: Power BI Service

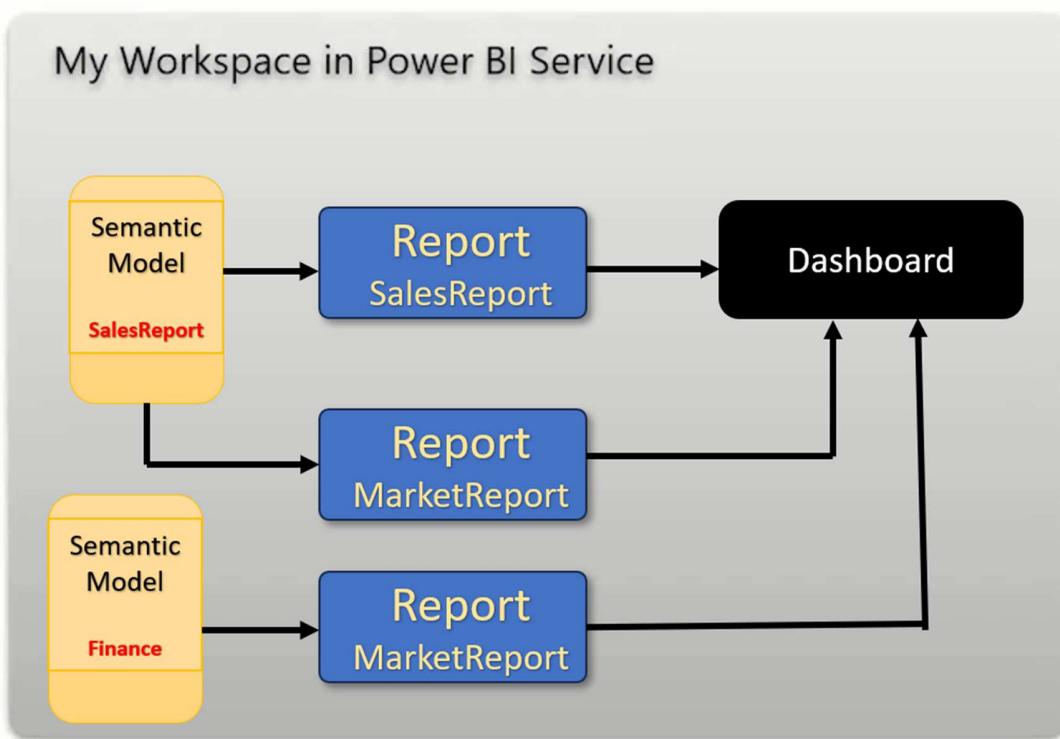
The Structure of .pbix file

- The file you create in power BI desktop is saved with the extension of .pbix file.
- It contains **Semantic Model** (known as dataset before) and **pages** with **visuals**.
- Visuals in pages gets its data from the **Semantic Model**.
- A report can be connected to only one **Semantic Model**.



Publish your report to Power BI Service

- When publish your report to the power BI service the .pbix file is separated into a **Report** and a **Semantic Model**.
- You can use the Semantic Model to create many other Reports.
- Remember that a **Report** can get its data from only one Semantic Model.
- You can create a **Dashboard** from visuals from many reports.



Create a Power BI Account

- To publish your .pbix file you must have at least a free Power BI account to publish your file to **My Workspace** you have.
- **My Workspace** is a personal workspace you cannot share with others.
- If you have a **Pro power BI account**, you can create many others workspace and share your work with others.

If you do not have an account, please watch my video on my channel on YouTube, to Create a developer account on Microsoft Developer program to proceed with exercises in this chapter.



<https://youtu.be/eKlyMuZ5OcE?si=4MTyvvd6ycmAxEZ7>

The screenshot shows the Microsoft 365 Start screen with a grid of app icons. To the right, a Power BI report titled "Sales Report" is open in a browser window. The report contains three visualizations:

- Sum of Sales by Country:**

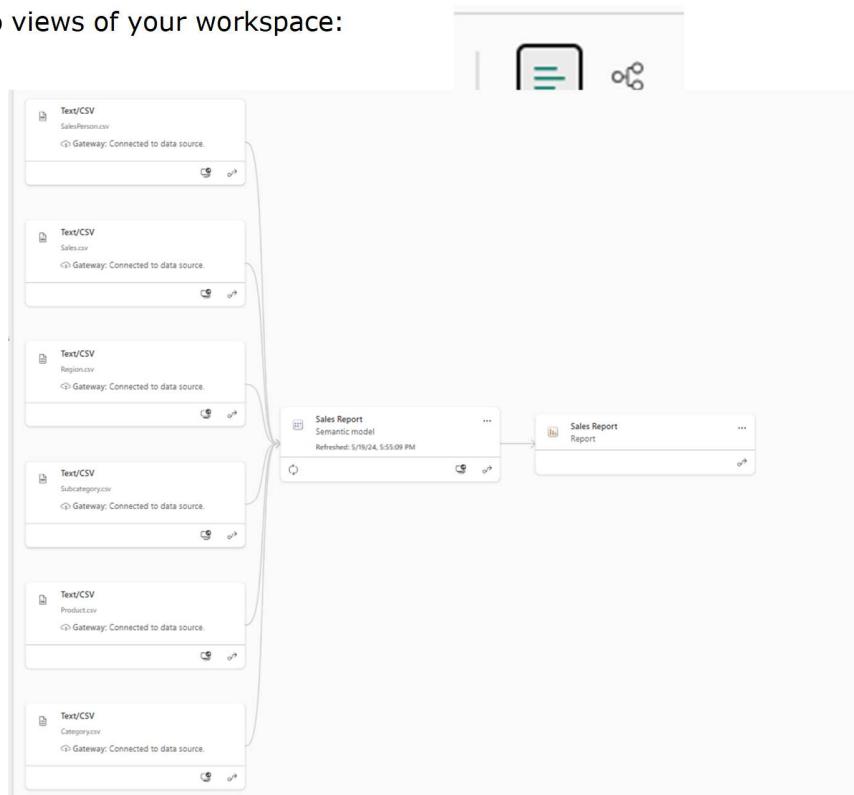
Country	Sum of Sales
United States	52M
Canada	14M
France	5M
United Kingdom	4M
Germany	2M
Australia	1M
- Sum of Sales by Category:**

Category	Sum of Sales
Shoes	64M
Components	11M
Clothing	2M
Accessories	1M
- Sales by Group:**

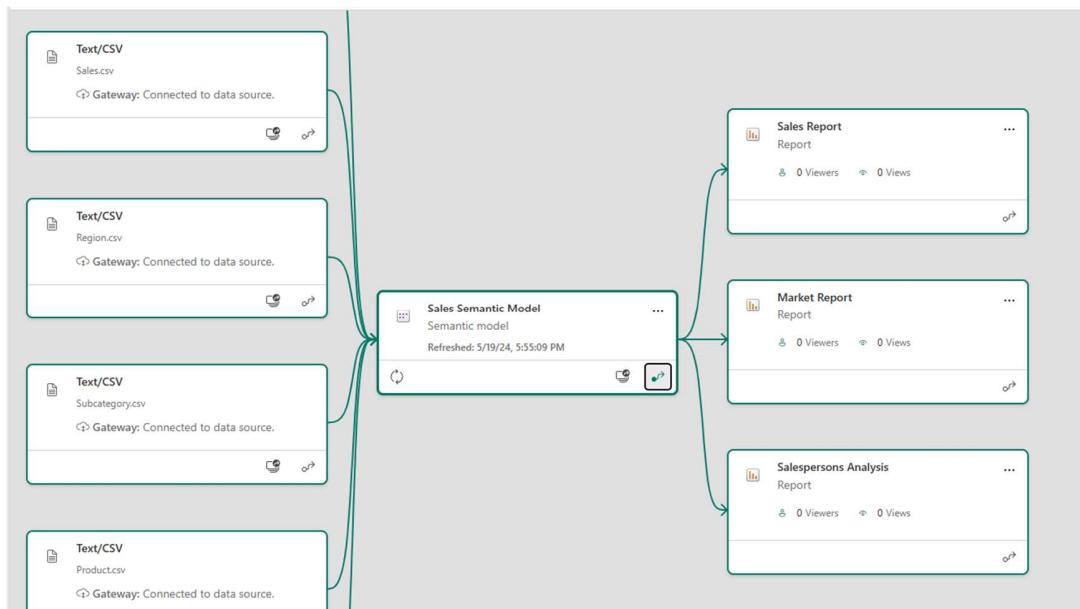
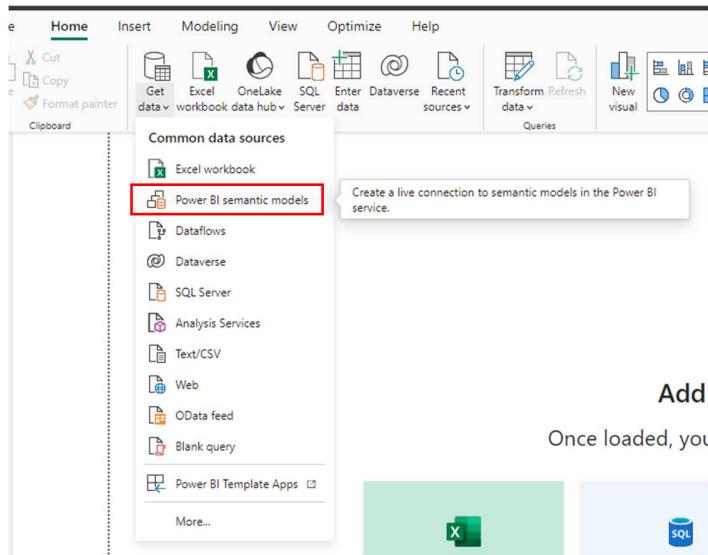
Group	Sum of Sales
North America	10.29M (13.27%)
Europe	6.87M (8.43%)
Pacific	65.87M (88.29%)

Lineage View

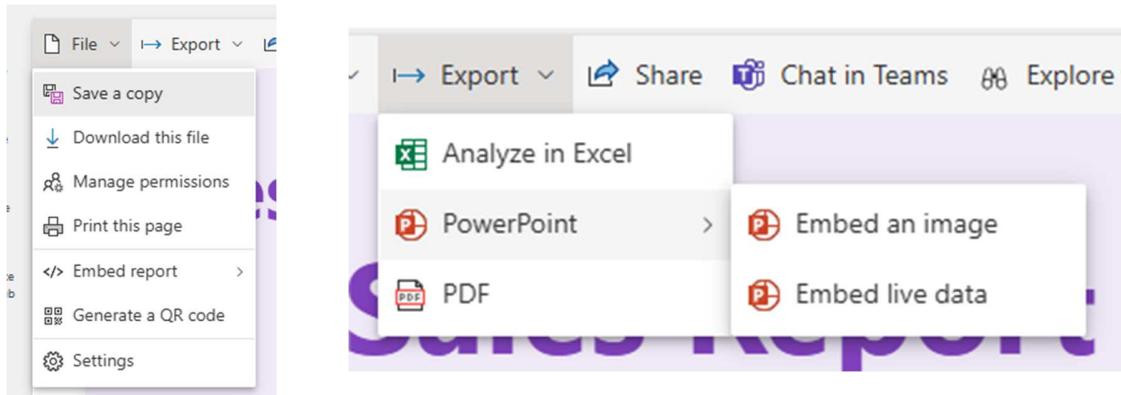
1. Notice you have two views of your workspace:



Creating Reports Using the Same Semantic Model

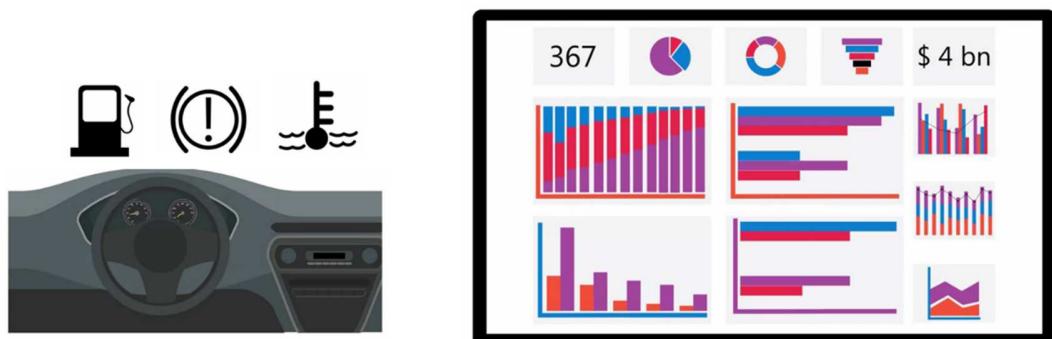


Explore Menu of Online Report



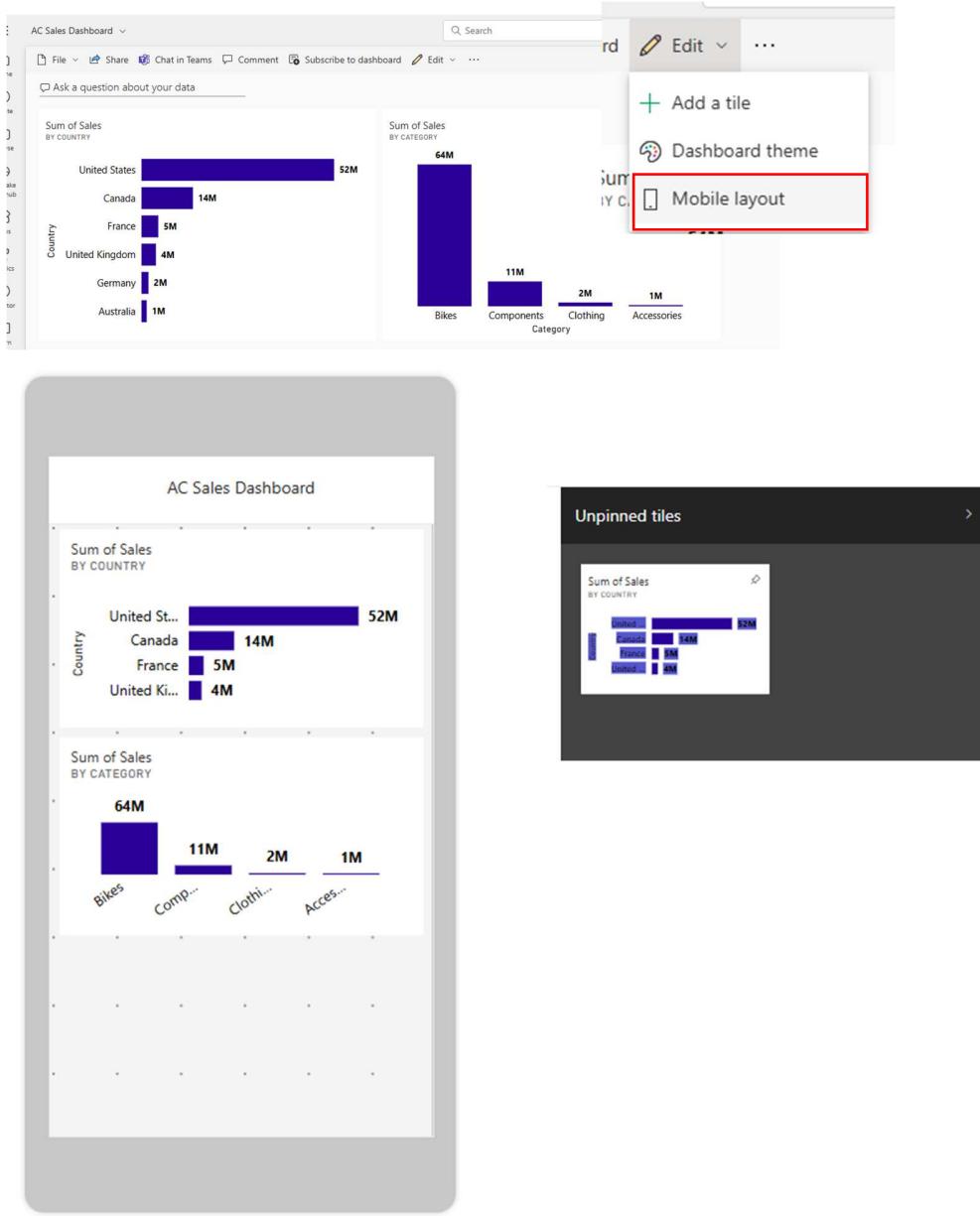
Dashboard

- Consider the dashboard of a car. It presents critical data like speed, fuel level, and engine temperature in a consolidated visually understandable way. This information allows you to make necessary decisions while driving.
- Similarly, in the business context, a dashboard **visualizes** the **critical information** required to accomplish specific objectives, skillfully arranged and consolidated on one screen.
- Dashboards can present data from **different sources** in various forms, making it easier for



stakeholders to understand.

Mobile View



Pinning a Live Report

Preview: Last saved state

Market Report
MARKET REPORT

Pin to dashboard

Select an existing dashboard or create a new one.

Where would you like to pin to?

Existing dashboard
 New dashboard

Select existing dashboard

AC Sales Dashboard

Pin live page enables changes to reports to appear in the dashboard tile when the page is refreshed.

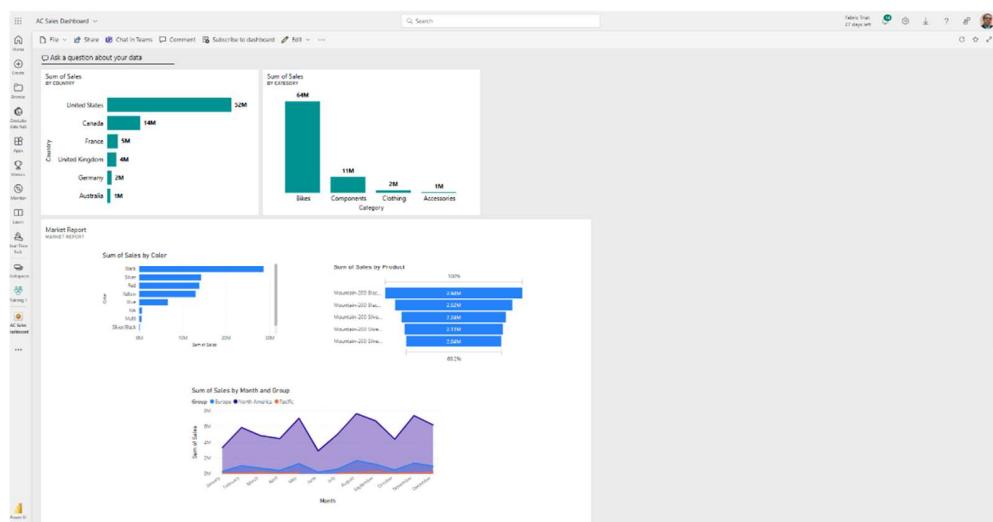
Pin live **Cancel**

Subscribe to report **Set alert** **Edit** ...

See related content
 Open lineage view
 Open usage metrics
 Pin to a dashboard
 View semantic model

Sum of Sales

Mountain-200 Black, 4Z



Quick Insights

The screenshot shows the Power BI interface with a context menu open over a semantic model named "Sales Semantic Model". The menu includes options like "Explore this data (preview)", "Analyze in Excel", "Create report", "Auto-create report", "Create paginated report", "Delete", "Get quick insights" (which is highlighted with a red box), "Security", "Rename", "Open data model", and "Settings".

Below the interface, two notifications are shown:

- A progress notification: "Searching for insights" - "Searching Sales Semantic Model. We will notify you when your insights are ready."
- A completed notification: "✓ Insights are ready" - "You have insights for Sales Semantic Model." with a "View insights" button.

The main area displays four cards representing quick insights:

- Count of SalesPerson and Count of Country**: A scatter plot showing a positive correlation between the count of salespersons and countries. The text states: "There is a correlation between SalesPerson and Country."
- Average of Unit Price**: A bar chart comparing average unit prices across categories. The text states: "BIC has noticeably more Unit Price." Data table:

Category Key	Average Unit Price
BIC	~800
COM	~200
G.O	~100
ACC	~50
- Sales BY GROUP**: A donut chart showing sales distribution by group. The text states: "'North America' accounts for the majority of Sales." Data table:

Group	Sales
North America	~75%
Europe	~20%
Pacific	~5%
- Subcategory ID BY CATEGORY**: A bar chart comparing subcategory IDs across categories. The text states: "'Components' and 'Bikes' have noticeably more Subcategory ID." Data table:

Category	Subcategory ID
Components	~180
Bikes	~120
Clothing	~80
Accessories	~50

Q&A

AC Sales Dashboard

Ask a question about your data

Sum of Sales BY COUNTRY

Country	Sum of Sales
United States	52M
Canada	14M
France	5M

Sum of Sales BY CATEGORY

Category	Sum of Sales
64M	

Total Sales

Try

- Total sales person salespeople
- Total sales territory key
- Total sales order number
- Show more

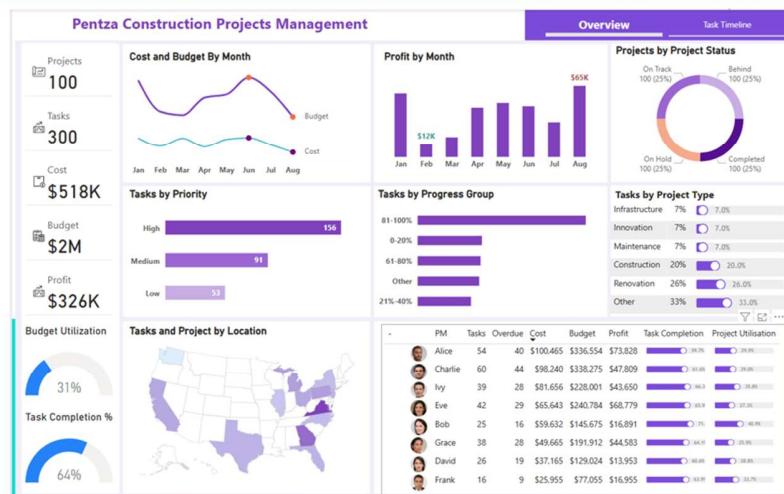
77.55M

Product

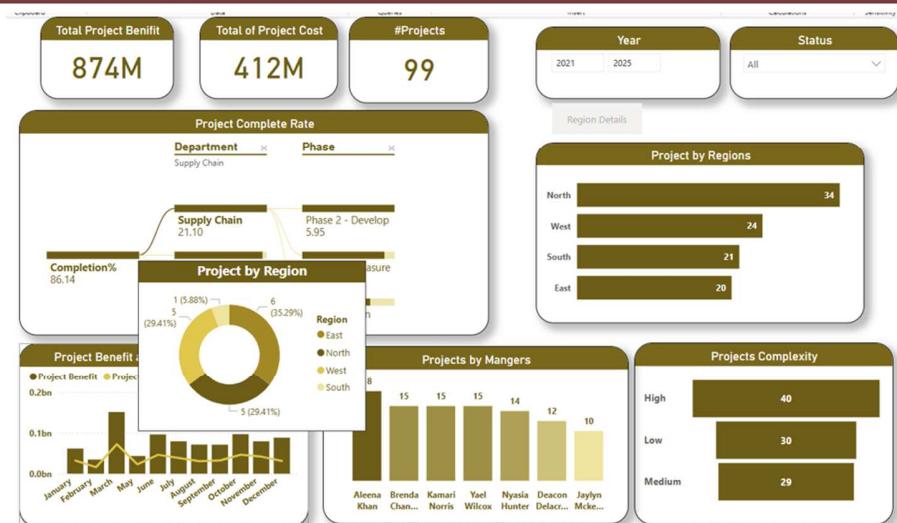
Product	Count of Sales
Mountain-200 Black, 38	639
Mountain-200 Black, 42	315
Road-350-W Yellow, 48	305
Road-350-W Yellow, 40	300
Mountain-200 Silver, 38	280
Mountain-200 Silver, 42	275
Touring-1000 Blue, 60	265
Mountain-100 Black, 38	185
Mountain-100 Black, 44	180

Chapter 6: Business Reports Examples

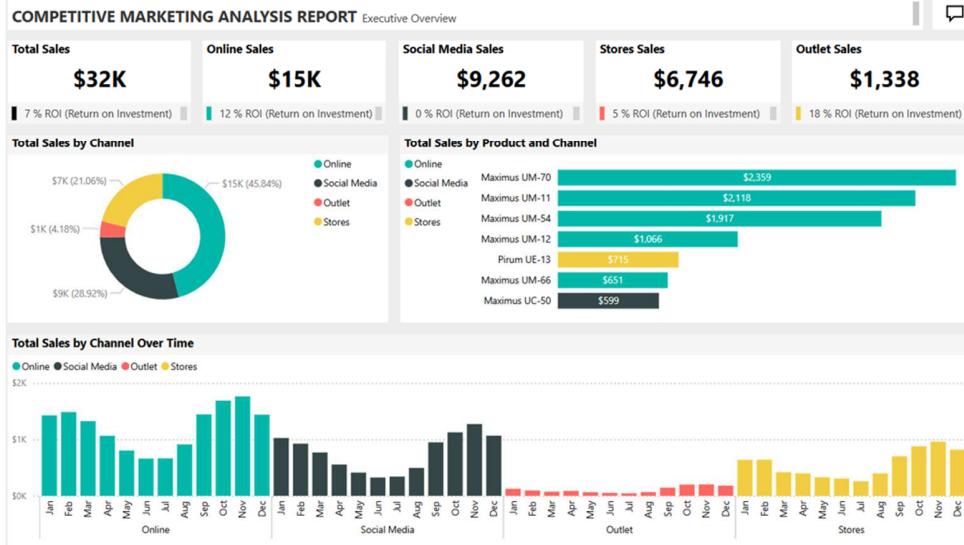
Projects Management



Projects Management



Marketing



Tendering

إدارة العطاءات

الرئيسية

تحت دراسة

عطاءات فترة

بحث عن عطاء

مركز أول واستند

Top 5

متابعة العطاءات

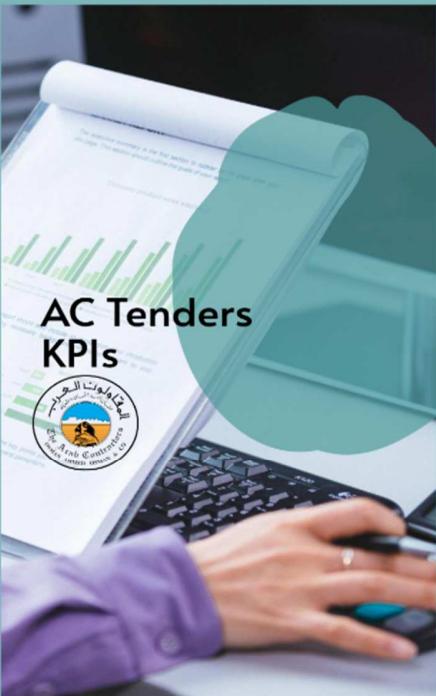


Tendering



The Tendering Department

POWER BI
MANAGER GUIDE



AC Tenders
KPIs

Start

About Program

AC TENDERS



تحت الدراسة
تقارير
بحث
حول البرنامج