

## What is Data Modeling in Power BI?

**Data modeling** in Power BI involves structuring your data in a way that helps you analyze it efficiently. It includes creating relationships between tables, defining primary keys, and setting up the model so that your visuals and DAX formulas work correctly.

Here I am using simple dataset for this practical

### 1. Customers

- CustomerID (Primary Key)
- CustomerName
- Country

### 2. Orders

- OrderID (Primary Key)
- CustomerID (Foreign Key)
- OrderDate
- Amount

### 3. Products

- ProductID (Primary Key)
- ProductName
- Category

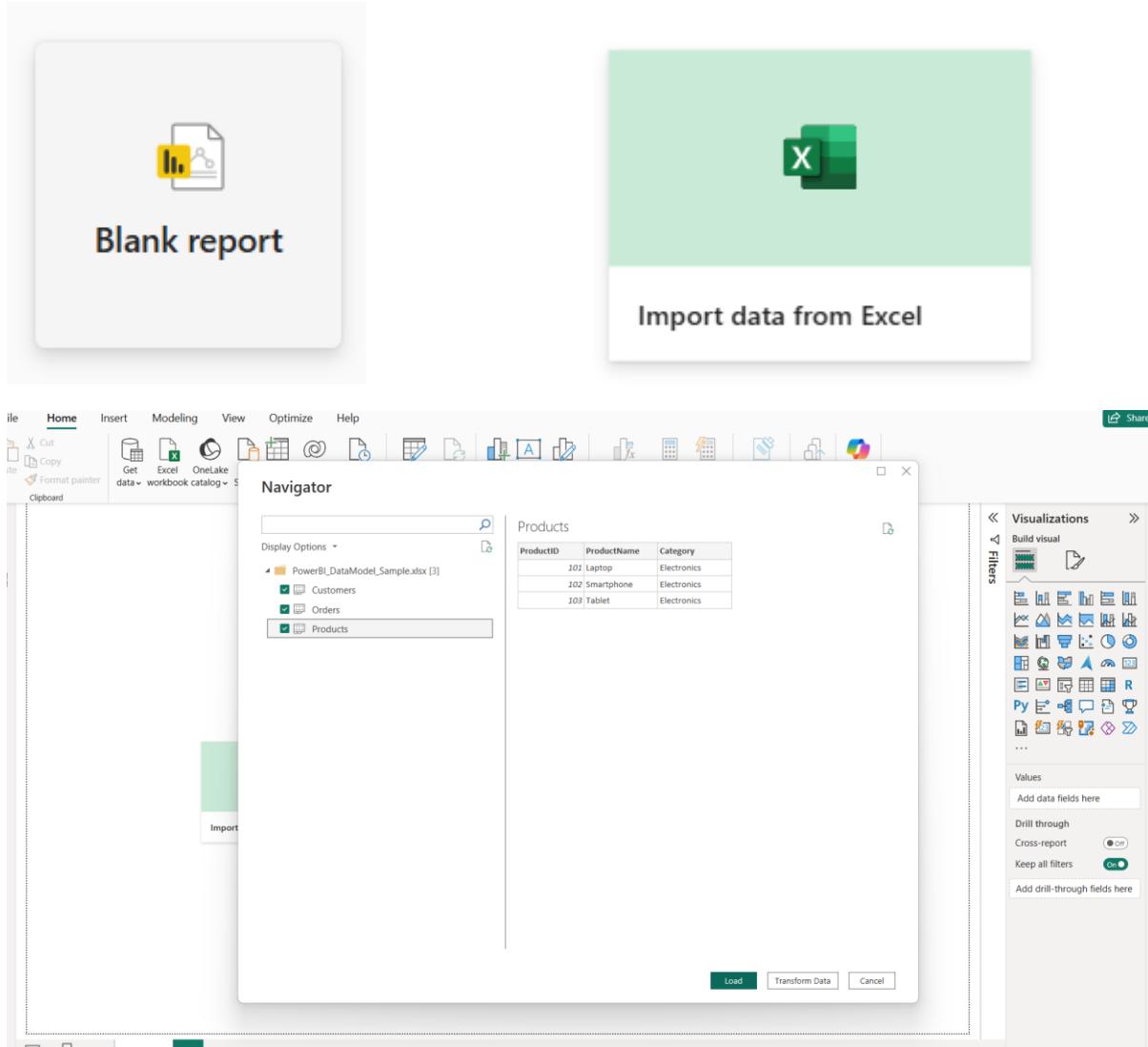
CustomerID	CustomerName	Country
1	Alice	USA
2	Bob	Canada
3	Charlie	UK

ProductID	ProductName	Category
101	Laptop	Electronics
102	Smartphone	Electronics
103	Tablet	Electronics

OrderID	CustomerID	ProductID	OrderDate	Amount
1001	1	101	2024-01-15 00:00:00	1200
1002	2	102	2024-01-17 00:00:00	800
1003	1	103	2024-02-05 00:00:00	300
1004	3	101	2024-02-20 00:00:00	1100

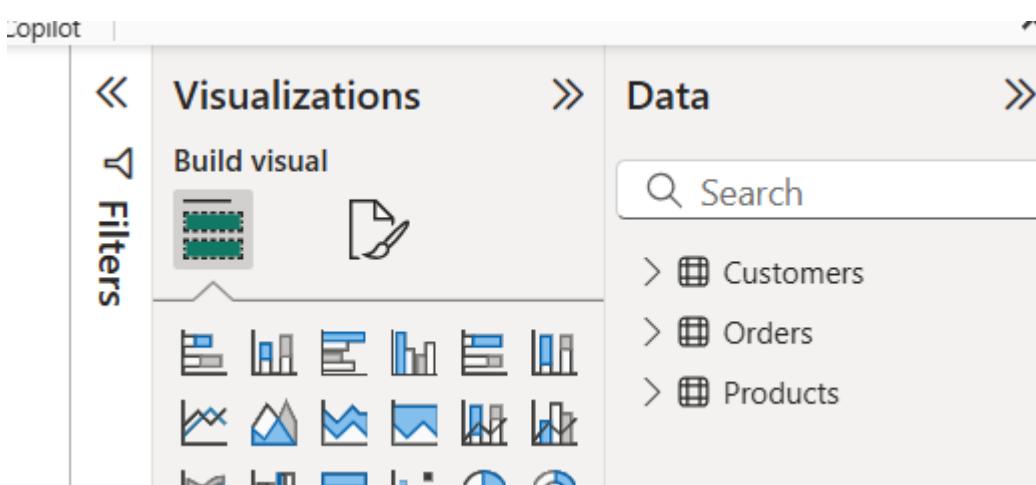
## Step 1: Load the Data

1. Open Power BI Desktop.
2. Click on Home > Get Data > Excel/CSV, and select your dataset files (Customers, Orders, Products).
3. Click Load after previewing each table.



Here all the files that you make or download from the internet

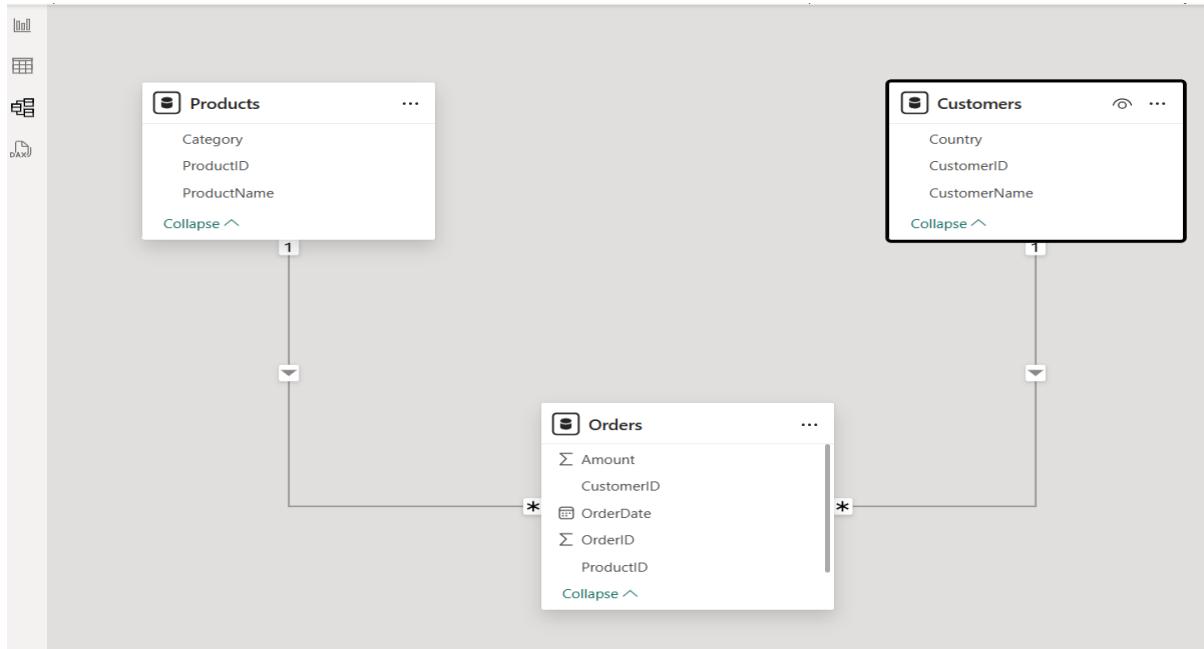
Then simply click on load button.



You can see the loaded files on right hand side on.

## Step 2: Understand Relationships

- Go to **Model View** (icon looks like a grid/relationship diagram).
- Power BI may automatically detect relationships. If not, you can create them manually.

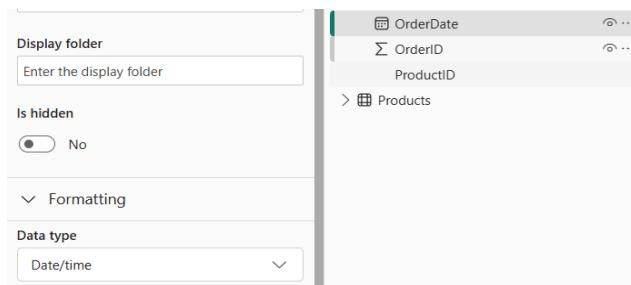


## Step 3: Create Relationships

1. In Model View, drag CustomerID from **Orders** to **CustomerID** in **Customers**.
2. Drag ProductID from **Orders** to **ProductID** in **Products**.
3. Make sure relationships are:
  - **1:Many** from **Customers** → **Orders** (1 customer can have many orders).
  - **1:Many** from **Products** → **Orders** (1 product can be in many orders).
4. Cardinality should show as One to Many (\*:1).

## Step 4: Set Data Types

- Go to **Data View**.
- Select each column and set the **correct data types** (e.g., date for OrderDate, text for names, currency for Amount).



## What is DAX?

DAX stands for **Data Analysis Expressions**. It's a formula language used in Power BI to create:

- **Calculated Columns**
- **Measures**
- **Calculated Tables**

DAX helps you perform **aggregations**, **filtering**, and **row-level calculations** to build dynamic and insightful reports.

### Sample Dataset for Practice (Same as Before)

- **Customers** (CustomerID, CustomerName, Country)
- **Orders** (OrderID, CustomerID, ProductID, OrderDate, Amount)
- **Products** (ProductID, ProductName, Category)

### Practical DAX Usage in Power BI Desktop

#### Step 1: Load the Data

1. Open **Power BI Desktop**.
2. Go to **Home > Get Data > Excel**, and select excel file that you make.
3. Load all three tables: Customers, Products, Orders.

#### Step 2: Create Relationships

- Go to **Model View**.
- Create these relationships:
  - Orders[CustomerID] → Customers[CustomerID]
  - Orders[ProductID] → Products[ProductID]

### DAX Concepts & Examples

#### 1. Calculated Column

Used when you want to add a column to a table, row-by-row.

Example: Add a "Year" column from OrderDate.

#### Steps:

1. Go to **Data View**.
2. Select the **Orders** table.
3. Click on **New Column** and enter:

**OrderYear = YEAR(Orders[OrderDate])**

This creates a new column with the year extracted from OrderDate.

The screenshot shows the Power BI Data Editor interface. In the top navigation bar, 'Table tools' is selected. A tooltip above the table says: 'There are pending changes in: Write a DAX expression that creates a new column in the selected table and calculates values for each row.' The table has columns: OrderID, CustomerID, ProductID, OrderDate, Amount, and OrderYear. The 'OrderYear' column is highlighted. The formula bar at the top contains the DAX formula: `1 OrderYear = YEAR([OrderDate])`. The Data pane on the right shows the structure of the data, including the newly created measure 'Total Sales'.

## 2. Measure

Used for aggregations and summarization (more efficient than columns).

Example: Create a measure to calculate **Total Sales**.

**Steps:**

1. In the **Fields pane**, right-click on **Orders** table > right click > select **New measure**.
2. Enter this DAX formula:

**Total Sales = SUM(Orders[Amount])**

You can now use **Total Sales** in any visual (card, chart, table).

The screenshot shows the Power BI Data Editor interface. The table now includes a new column named 'Total Sales' with the formula `SUM(Orders[Amount])`. The Data pane on the right shows the structure of the data, including the newly created measure 'Total Sales'.

## 3. Other Basic DAX Functions

Function	Use Case Example	DAX Example
SUM	Add up all values in a column	<code>SUM(Orders[Amount])</code>
COUNT	Count the number of rows	<code>COUNT(Orders[OrderID])</code>
AVERAGE	Calculate average value	<code>AVERAGE(Orders[Amount])</code>
DISTINCTCOUNT	Count unique customers	<code>DISTINCTCOUNT(Orders[CustomerID])</code>
IF	Conditional logic	<code>IF(Orders[Amount] &gt; 1000, "High", "Low")</code>

## Visualizing DAX Output

1. Go to **Report View**.
2. Insert a **Table visual**.
3. Add CustomerName from **Customers** and your new **Total Sales** measure.

You'll see total sales by customer, thanks to DAX + relationships!

in applied.

Queries Insert Calculations Sensitivity Share Control

Apply changes Discard changes X

Visualizations > Data >

Build visual

Search

Filters on this visual ...

CustomerName is (All)

Total Sales is (All)

Add data fields here

Filters on this page ...

Add data fields here

Filters on all pages ...

CustomerName

CustomerName Total Sales

CustomerName	Total Sales
Alice	1500
Bob	800
Charlie	1100
Total	3400

Orders

Customers

Products

Columns

CustomerName

Country

CustomerID

CustomerName

Amount

CustomerID

OrderDate

OrderID

Σ OrderID

OrderYear

ProductID

Total Sales

# What Are Data Types & Hierarchies in Power BI?

## ◆ Data Types

Each column in your dataset has a **data type** — such as text, whole number, decimal, date, etc. Power BI uses this information to:

- Interpret data correctly
- Enable appropriate calculations and visualizations

## ◆ Hierarchies

Hierarchies help **organize data into levels** that users can drill down into. For example:

- Date Hierarchy: Year → Quarter → Month → Day
- Geography Hierarchy: Country → State → City

They allow users to explore data more flexibly in visuals like charts and matrices.

## Practical Knowledge in Power BI Desktop

### Step 1: Set Data Types

1. Open your Power BI file and go to **Data View** (table icon on left).
2. Select the **Orders** table.
3. Click on a column (e.g., OrderDate).
4. In the **Column tools** or **Modeling** tab at the top, look for the **Data Type dropdown**.
5. Set:
  - OrderDate → **Date**
  - Amount → **Decimal Number**
  - CustomerID, ProductID → **Whole Number**
  - OrderID → **Whole Number**

Proper data types ensure your measures and visuals behave as expected.

The screenshot shows the Power BI Desktop ribbon with the "Table tools" tab selected. Below the ribbon, the "Column tools" tab is also underlined. The "Orders" table is selected in the Data View. The "OrderDate" column is currently set to "Date". The "Formatting" section of the Column tools pane shows various options for the selected column, including a dropdown for the data type.

OrderID	CustomerID	ProductID	OrderDate	Amount
1001	1	101	15 January 2024	1200
1002	2	102	17 January 2024	800
1003	1	103	05 February 2024	300
1004	3	101	20 February 2024	1100

File Home Help Table tools Column tools

Name: Amount

Data type: Decimal number

\$ % Format Whole number
\$ % 00 0

Structure      Formatting

OrderID	CustomerID	ProductID	OrderDate	Amount
1001	1	101	15 January 2024	1200
1002	2	102	17 January 2024	800
1003	1	103	05 February 2024	300
1004	3	101	20 February 2024	1100

File Home Help Table tools Column tools

Name: CustomerID

Data type: Whole number

\$ % Format Whole number
\$ % 00 0

Structure      Formatting

OrderID	CustomerID	ProductID	OrderDate	Amount
1001	1	101	15 January 2024	1200
1002	2	102	17 January 2024	800
1003	1	103	05 February 2024	300
1004	3	101	20 February 2024	1100

File Home Help Table tools Column tools

Name: ProductID

Data type: Whole number

\$ % Format Whole number
\$ % 00 0

Structure      Formatting

OrderID	CustomerID	ProductID	OrderDate	Amount
1001	1	101	15 January 2024	1200
1002	2	102	17 January 2024	800
1003	1	103	05 February 2024	300
1004	3	101	20 February 2024	1100

And same with the orderID as whole number

File Home Help Table tools Column tools

Name: OrderID

Data type: Whole number

\$ % Format Whole number
\$ % 00 0

Structure      Formatting

OrderID	CustomerID	ProductID	OrderDate	Amount
1001	1	101	15 January 2024	1200
1002	2	102	17 January 2024	800
1003	1	103	05 February 2024	300
1004	3	101	20 February 2024	1100

## Step 2: Create a Date Hierarchy

Power BI automatically creates a hierarchy for any column with **Date/Time** data type. You can also create custom hierarchies.

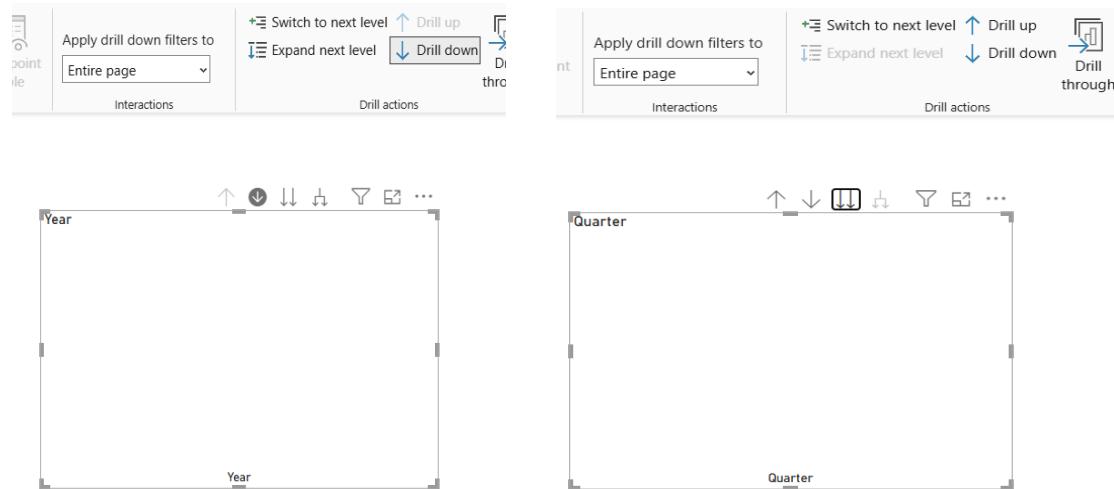
### Default Date Hierarchy

1. Add a **visual** (e.g., clustered column chart) to your report.
2. Drag OrderDate to the Axis.
3. You'll see:

▶ OrderDate

- Year
- Quarter
- Month
- Day

You can use the **drill up / drill down** arrows on the visual to explore data at different time levels.



### Create Custom Hierarchy (Optional)

Let's say you want a hierarchy of Country > CustomerName.

1. Go to the **Data View**.
2. Right-click Country column in the **Customers** table.
3. Select **Create hierarchy**.
4. A new hierarchy will appear; rename it (e.g., Customer Geography).
5. Drag CustomerName into the hierarchy under Country.

Now you can use this hierarchy in visuals to group customers by country and drill down.

> Data >>

Search

Customers

- Country
- Customer Geog...
- CustomerNa...

CustomerName

CustomerName

This screenshot shows a data visualization interface. On the left, there's a sidebar titled 'Data' with a search bar. Below it is a tree view of data fields under 'Customers'. The 'Customer Geog...' and 'CustomerNa...' fields are expanded, with 'CustomerNa...' being the currently selected item, indicated by a checked checkbox icon. On the right, there's a large empty area with a placeholder 'CustomerName' at the top and bottom.

# What Are Visualizations in Power BI?

**Visualizations** are graphical representations of your data — charts, tables, maps, cards, etc.

They help you:

- Analyze trends
- Compare values
- Highlight patterns
- Tell stories with data

## Visuals You'll Learn in This Topic:

1. **Slicers** – for filtering visuals interactively
2. **Cards** – to show single summary values (e.g. total sales)
3. **Tables** – for raw data with rows and columns
4. **Matrix** – like a pivot table, great for grouping
5. **Bar/Column charts, Line charts, etc.** – for comparisons and trends

## Practical Guide in Power BI Desktop

### Step 1: Load the Data

1. Open Power BI Desktop
2. Click **Home > Get Data > Excel**
3. Load all three sheets: **Orders, Customers, Products**

### Step 2: Build a Simple Report

#### ◆ 1. Card Visual – Show Total Amount

**Purpose:** Show a KPI

**Steps:**

1. Go to **Report View**.
2. Click on the **Card visual** (it looks like a rectangle with a number).
3. Drag a measure like **Amount** into the **Values** field.



## 2. Slicer – Filter by Country

**Purpose:** Let users filter the entire report by country

**Steps:**

1. Click on the **Slicer** visual.
2. Drag Country from the **Customers** table into the slicer field.
3. Now you can select a country to filter your entire report.

The screenshot shows the Power BI interface. On the left is a Slicer visual titled "Country" with three options: Canada (unchecked), UK (checked), and USA (unchecked). To the right is the "Build visual" pane, which includes a "Filters" section and a search bar. Under "Customers", "Country" is checked. Under "Orders", "OrderDate" is checked. Other fields like "CustomerID" and "CustomerName" are unchecked.

## 3. Table – Display Raw Data

**Purpose:** Show multiple fields in a table view

**Steps:**

1. Click on the **Table** visual.
2. Drag CustomerName, OrderDate, Amount into the table.
3. Sort or format as needed.

The screenshot shows the Power BI interface. On the left is a Table visual displaying data with columns: CustomerName, Sum of Amount, Year, Quarter, Month, and Day. The data includes rows for Alice, Alice, Bob, Charlie, and a total row. To the right is the "Build visual" pane, which includes a "Filters" section and a search bar. Under "Customers", "CustomerName" is checked. Under "Orders", "Amount" and "OrderDate" are checked. Other fields like "CustomerID" are unchecked.

## 4. Matrix – Grouped Summary

**Purpose:** Like Excel Pivot Table (rows & columns with values)

**Steps:**

1. Click on the **Matrix** visual.
2. Drag Country to Rows, OrderYear (or OrderDate) to Columns, and Amount to Values.
3. Use drill-down arrows to expand rows or columns.

The screenshot shows the Power BI 'Build visual' interface. On the left is a table visualization titled 'Country 2024 Total' with the following data:

Country	2024	Total
Canada	800	800
UK	1100	1100
USA	1500	1500
<b>Total</b>	<b>3400</b>	<b>3400</b>

The 'Build visual' pane on the right contains the following sections:

- Filters:** A grid of icons for filtering.
- Build visual:** A large icon representing the current visualization type.
- Search:** A search bar.
- Customers:**
  - Country
  - Customer Geog...
  - CustomerID
  - CustomerName
- Orders:**
  - $\sum$  Amount
  - CustomerID
  - OrderDate
  - $\sum$  OrderID
  - ProductID
- Products:** A collapsed section.

**Rows:** A dropdown menu currently set to 'Country'.

**Columns:** A dropdown menu currently set to 'OrderDate'.

- Year
- Quarter
- Month
- Day

**Values:** A dropdown menu currently set to 'Sum of Amount'.

## 5. Column Chart – Sales by Product

**Purpose:** Compare numeric values visually

**Steps:**

1. Click on the **Clustered Column Chart** visual.
2. Drag ProductName to **Axis**.
3. Drag Amount to **Values**.
4. Customize with colors, data labels, etc.

The screenshot shows the Power BI 'Build visual' interface with a clustered column chart visualization titled 'Sum of Amount by ProductName'. The chart displays sales data for three products: Laptop, Smartphone, and Tablet. The Y-axis is labeled 'Sum of Amount' with ticks at 0K, 1K, and 2K. The X-axis is labeled 'ProductName' with categories Laptop, Smartphone, and Tablet.

The 'Build visual' pane on the right contains the following sections:

- Filters:** A grid of icons for filtering.
- Build visual:** A large icon representing the current visualization type.
- Search:** A search bar.
- Customers:**
  - Country
  - Customer Geog...
  - CustomerID
  - CustomerName
- Orders:**
  - $\sum$  Amount
  - CustomerID
  - OrderDate
  - $\sum$  OrderID
  - ProductID
- Products:**
  - Category
  - ProductID
  - ProductName

**X-axis:** A dropdown menu currently set to 'ProductName'.

**Y-axis:** A dropdown menu currently set to 'Sum of Amount'.

## Pro Tips for Visual Design

Tip	How To Apply
Use <b>Slicers</b> for user control	Add filters like Date, Country, Product
Add <b>Data Labels</b>	Format pane > Data labels: On
Rename visuals cleanly	Double-click title or use “Visual header”
Use <b>Themes</b>	View > Themes > Choose a professional theme
Align visuals	Use the Format tab → Align & Distribute tools

# What Are Filtering Techniques in Power BI?

Filtering allows you to **narrow down data** based on specific criteria — so users can analyze exactly what they want to see. Power BI offers several filtering levels and tools.

## Types of Filters

Filter Type	Scope	Example Use Case
<b>Visual-level</b>	Only affects 1 visual	Show sales by region for only 2024 in one chart
<b>Page-level</b>	Affects all visuals on page	Filter dashboard to a single country
<b>Report-level</b>	Affects entire report	Apply global filters like “Exclude Cancelled”
<b>Slicers</b>	User-driven filter tool	Let users pick a product category or date range

## Practical Steps in Power BI Desktop

### Step 1: Load the Data

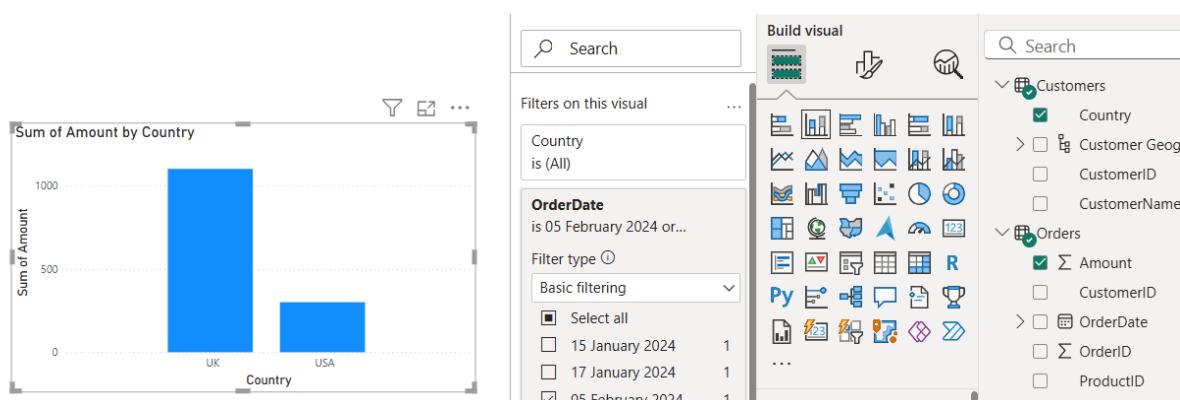
1. Open Power BI Desktop
2. Click Home > Get Data > Excel
3. Select and load Orders, Customers, and Products

### Step 2: Apply Visual-Level Filter

Let's say you have a column chart showing orders by country.

1. Insert a Clustered Column Chart
2. Drag:
  - o Country (from Customers) → Axis
  - o Amount (from Orders) → Values
3. Click the chart to select it.
4. In the Filters pane (right side), find Visual Level Filters
5. Drag OrderDate into this section.
6. Set a filter

Result: Only this chart will show filtered data. Others on the page remain unaffected.



### Step 3: Apply Page-Level Filter

1. In the Filters pane, find Page-level filters
2. Drag Country from the Customers table into it.
3. Select a country (e.g., India)

Result: All visuals on this page only will now show data for India.

