

Data Modelling for Business Reporting

Prepared by Eng. Ahmed Hussein, MBA,
PfMP©, PMP©, CMP APMG

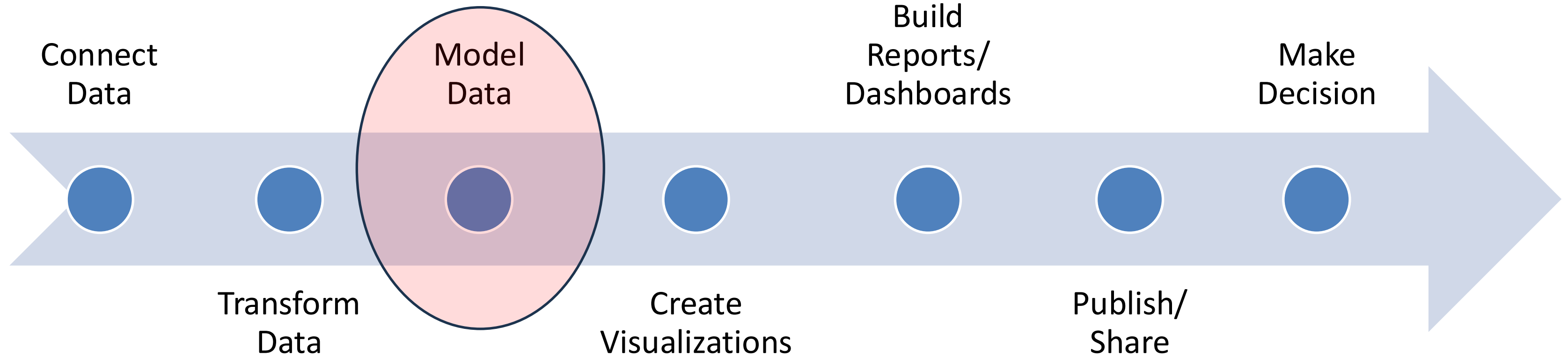
Course: From Data to Decisions using Power BI

Lecture 03



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Power BI Workflow (The Analytics Journey)



Each stage adds value — skip one and the chain breaks

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What we will cover

1. The Purpose of data modeling
2. Relationships, Fact & Dimension tables
3. Creating relationships between tables
4. Modeling Features in Power BI

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03

1. The Purpose of Data Modeling



A good data model makes Power BI reports more accurate, flexible, and easier to maintain.

Business Scenario

Building a Sales Performance Model

Your company wants to build a Power BI report to analyze quarterly sales performance. The management team wants to answer questions such as:

- Which products generated the highest revenue?
- Which customer segments are most profitable?
- Which regions are underperforming?
- How did sales perform by month and quarter?
- Which salespeople achieved the best results?

Business Scenario

Business Challenge

The data exists in separate tables. To answer management questions, Power BI must understand how these tables are related.

Available Data Tables

Table

Sales Transactions	Transaction ID, Date, Customer ID, Product ID, Quantity, Revenue
Customer Master	Customer ID, Customer Name, Segment, City, Industry
Product Master	Product ID, Product Name, Category, Unit Cost
Date Table	Date, Month, Quarter, Year

Data modeling connects separate business data tables so they can work together in one report.

From Clean Data to a Data Model

The Next Step After Power Query

In Session 2, we cleaned and prepared data using Power Query. Now, we need to organize that data into a model that Power BI can use for analysis.

Data Preparation vs Data Modeling

Data Preparation

- Cleans messy data
- Removes duplicates and errors
- Fixes data types
- Standardizes values
- Prepares individual tables

Data Modeling

- Connects related tables
- Defines relationships
- Supports filtering and calculations
- Enables accurate reporting
- Makes tables work together

From Clean Data to a Data Model

Power Query prepares the data; data modeling connects the data for analysis.

After cleaning, the Sales, Customer, and Product tables are accurate. But they still need to

be connected using:

- Customer ID

- Product ID

- Date

Example

A sales table alone may show that a transaction generated \$5,000. But with a data model, we can also know:

- Which customer made the purchase
- Which product was sold
- Which region generated the revenue
- Which month or quarter it happened in

What is a Data Model?

Organizing Data for Analysis

A data model is the structure that shows how different tables in Power BI are connected and used together for reporting. It allows Power BI to answer business questions across multiple data sources.

In Power BI, a Data Model Includes:

Component	Description	Example
Tables	Groups of related data	Sales, Customers, Products
Columns	Fields inside each table	Customer ID, Product Name, Revenue
Relationships	Links between tables	
Measures	Calculations used in reports	Total Revenue, Total Profit, Profit Margin

A data model turns separate tables into one connected business view.

Why One Big Table is Not Always Best

The Problem with Combining Everything into One Table

Many beginners try to put all data into one large table. While this may seem simple at first, it can create reporting and maintenance problems.

One Big Table vs Connected Tables

One Big Table

Repeats customer and product details many times

Makes the file larger and slower

Harder to update customer or product information

More risk of inconsistent values

Difficult to scale as reports grow

Connected Data Model

Stores customer and product details once in separate tables

Improves performance and organization

Easier to maintain reference data

Creates a more reliable structure

Easier to expand with new tables

A good data model reduces duplication, improves accuracy, and makes reports easier to maintain.

Common Modeling Mistakes

Mistake	Impact
Using one large flat table	Creates duplication and poor performance
Wrong relationship fields	Produces incorrect analysis
Mixed data types	Relationships may fail
Too many bi-directional filters	Can create confusing results
Unclear column names	Makes reports harder to build

Most reporting problems start with weak data modeling.

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2. Relationships and Fact & Dimension Tables



Tables, Fields, and Relationships

The Building Blocks of a Power BI Model

A Power BI data model is built using tables, fields, and relationships.

Main Building Blocks

Element	Meaning	Example
Table	A collection of related records	Sales Transactions
Field / Column	A specific attribute inside a table	Revenue, Date, Customer ID
Row	One record in a table	One sales transaction
Relationship	A connection between two tables	Sales[Customer ID] -> Customers[Customer ID]

Why Relationships Matter: Relationships allow filters to work across tables. For example, selecting Corporate Customers filters related sales transactions.

Relationships help Power BI understand how business data fits together.

Transaction Data vs Reference Data

Two Common Types of Business Tables

In Power BI modeling, business data is usually divided into transaction data and reference data.

Type	Description	Example
Transaction Data	Records business events or activities	Sales orders, invoices, service requests, payments
Reference Data	Describes people, products, places, or categories	Customers, products, regions, employees, dates

How They Work Together: The transaction table records what happened. The reference tables explain who, what, where, and when.

Transaction data tells us what happened; reference data gives it business meaning.

What is a Fact Table?

The Table That Records Business Events

A fact table contains measurable business activities or transactions. It usually answers the question: What happened?

Common Examples of Fact Tables

Business Area	Fact Table Example
Sales	Sales Transactions
Finance	Invoice Payments
HR	Employee Attendance
Operations	Service Requests
Marketing	Campaign Responses

Typical Fact Table Columns

Column Type	Example
Transaction ID	T001, T002
Date	Sales Date
Reference IDs	Customer ID, Product ID
Measures	Revenue, Quantity, Cost, Profit

Fact tables store the numbers we want to analyze, such as sales, quantity, cost, profit, or performance results.

What is a Dimension Table?

The Table That Describes Business Context

A dimension table contains descriptive information that helps explain and categorize the facts. It usually answers: Who? What? Where? When? Which category?

Common Examples of Dimension Tables

Dimension Table	Describes
Customer	Customer name, segment, city, industry
Product	Product name, category, brand, cost
Date	Day, month, quarter, year
Region	Country, city, territory
Employee	Employee name, department, role

Typical Dimension Table Columns

Column Type	Example
Key Column	Customer ID, Product ID
Descriptive Columns	Name, Category, Segment, City
Grouping Columns	Region, Industry, Department
Time Attributes	Month, Quarter, Year

Dimension tables help users slice, filter, and understand the numbers stored in the fact table.

What are Relationships in Power BI?

Connecting Tables Together

A relationship connects two tables using a common column.

Example

Sales Transactions	Relationship	Customer Master
Customer ID	->	Customer ID
Revenue		Customer Name
Date		Segment

Why Relationships Matter

- Filter data across tables
- Calculate accurate totals
- Connect facts with business context
- Analyze data from multiple perspectives

Relationships help Power BI understand how tables are connected

Primary Key and Foreign Key

Understanding Key Fields

Relationships are built using two types of keys:

Key Type	Meaning	Example
Primary Key	A unique value in a reference table	Customer ID in Customer Master
Foreign Key	A matching value in a transaction table	Customer ID in Sales Transactions

Example

Sales Transactions	Customer Master
Customer ID = C001	Customer ID = C001
Customer ID = C002	Customer ID = C002

The primary key identifies one record; the foreign key connects transactions to that record.

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03

3. Creating Relationships between Tables



Types of Relationships

Relationships connect tables based on common fields (keys) and enable data to flow between tables for accurate analysis and reporting.

Types:

Relationship Type	Description	Example
One-to-One (1:1)	Each record in Table A matches exactly one record in Table B.	Employee Table ↔ Employee Details Table
One-to-Many (1:*)	One record in Table A can relate to many records in Table B. Most common relationship type.	Customers → Orders
Many-to-One (*:1)	The reverse view of One-to-Many. Many records in one table relate to a single record in another table.	Orders → Customers
Many-to-Many (:)	Multiple records in both tables can relate to each other. Often requires careful modeling.	Students ↔ Courses

One-to-Many Relationships

The Most Common Power BI Relationship

A one-to-many relationship means one record in a dimension table can relate to many records in a fact table.

Example

One customer can have many sales transactions.

Customer Master	Relationship	Sales Transactions
C001 - Delta Trading	1 -> Many	T001, T008, T020
C002 - Nile Foods	1 -> Many	T002, T015

Business Meaning

This allows Power BI to calculate:

- Total sales by customer
- Revenue by segment
- Sales by city
- Profit by industry

Relationship Best Practices

- ✓ Prefer One-to-Many relationships using dimension and fact tables.
- ✓ Use unique keys in dimension tables.
- ⚠ Avoid Many-to-Many relationships unless absolutely necessary, as they can complicate calculations and impact performance.

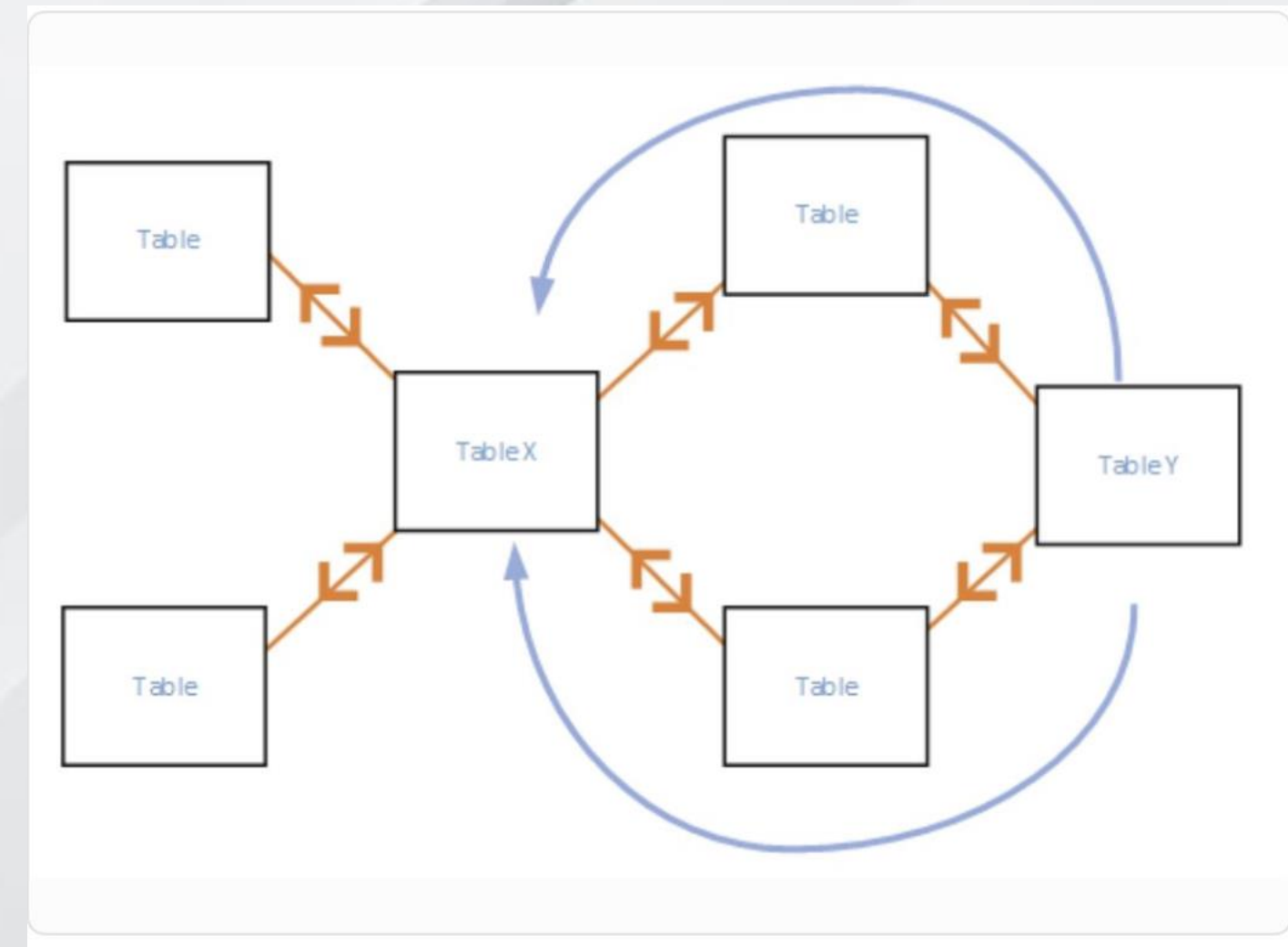
Visual Representation:

Customer (1) — (*) Orders

Product (1) — (*) Sales

Employee (1) — (1) Employee Details

Student (*) — (*) Courses



What is a Star Schema?

A Simple Structure for Organizing Data

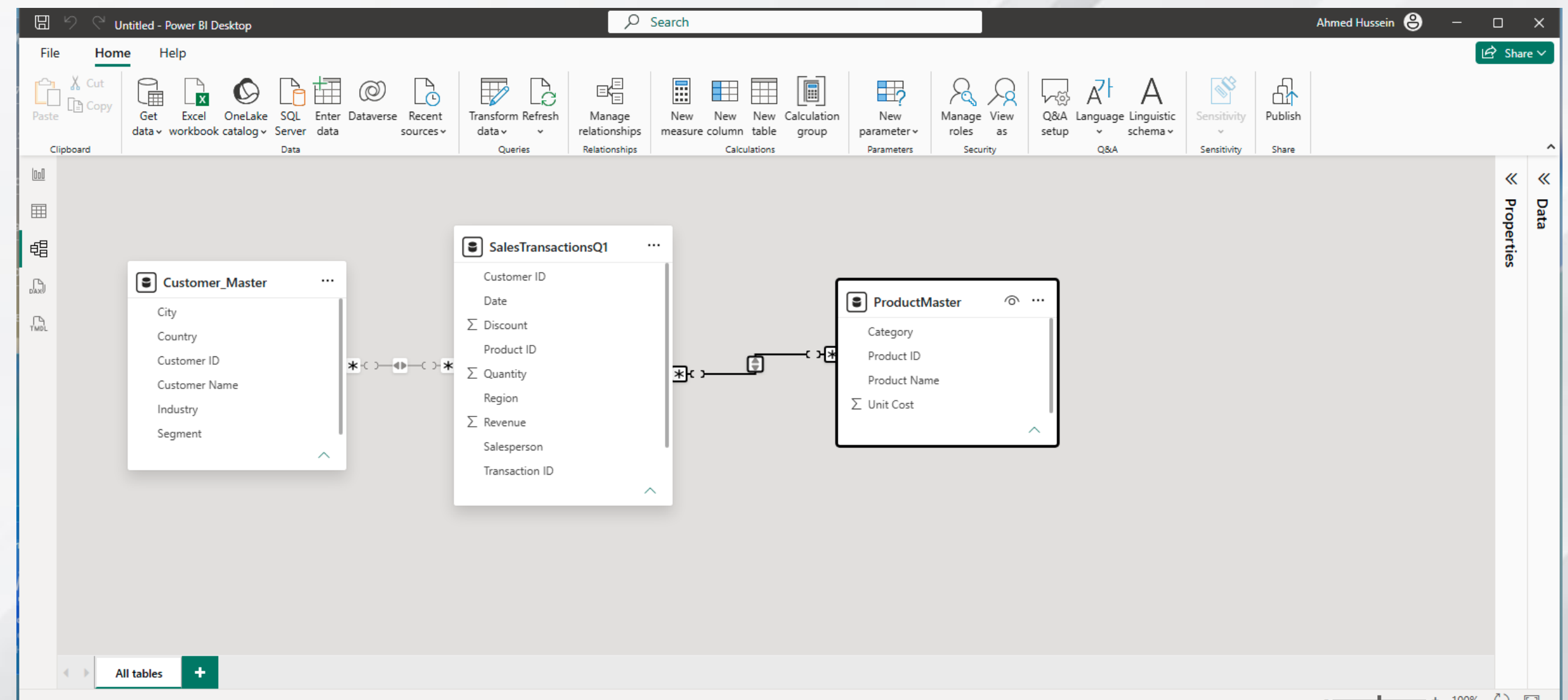
A star schema is a data model structure where one central fact table is connected to multiple dimension tables.

Star schema makes Power BI models easier to understand, faster to use, and more reliable.

Center Table
Sales Transactions

Surrounding Tables

Customers, Products,
Dates, Regions



Why Star Schema is Recommended

Benefits of a Star Schema Structure

Benefit	Why It Matters
Clear structure	Easy to understand table connections
Accurate filtering	Filters flow correctly across tables
Better performance	Reduces unnecessary duplication
Easier maintenance	Reference data is stored separately
Scalable reporting	New dimensions can be added later

Star schema is the preferred structure for clean and scalable Power BI reports.

Sales Star Schema Example

Connecting the Fact Table to Dimensions

Fact Table	Connected By	Dimension Table	Added Context
Sales Transactions	Customer ID	Customer Master	Name, Segment, City, Industry
Sales Transactions	Product ID	Product Master	Name, Category, Cost
Sales Transactions	Date	Date Table	Month, Quarter, Year
Sales Transactions	Region ID	Region Table	Territory, Country, Area

This model helps answer:

- Revenue by customer segment
- Sales by product category
- Monthly sales trends
- Profit by region

The sales fact table stores the numbers, while dimension tables provide analysis context.

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4. Modeling Features in Power BI



Power BI Desktop Overview

Get Data

Report View

Table View

Model View

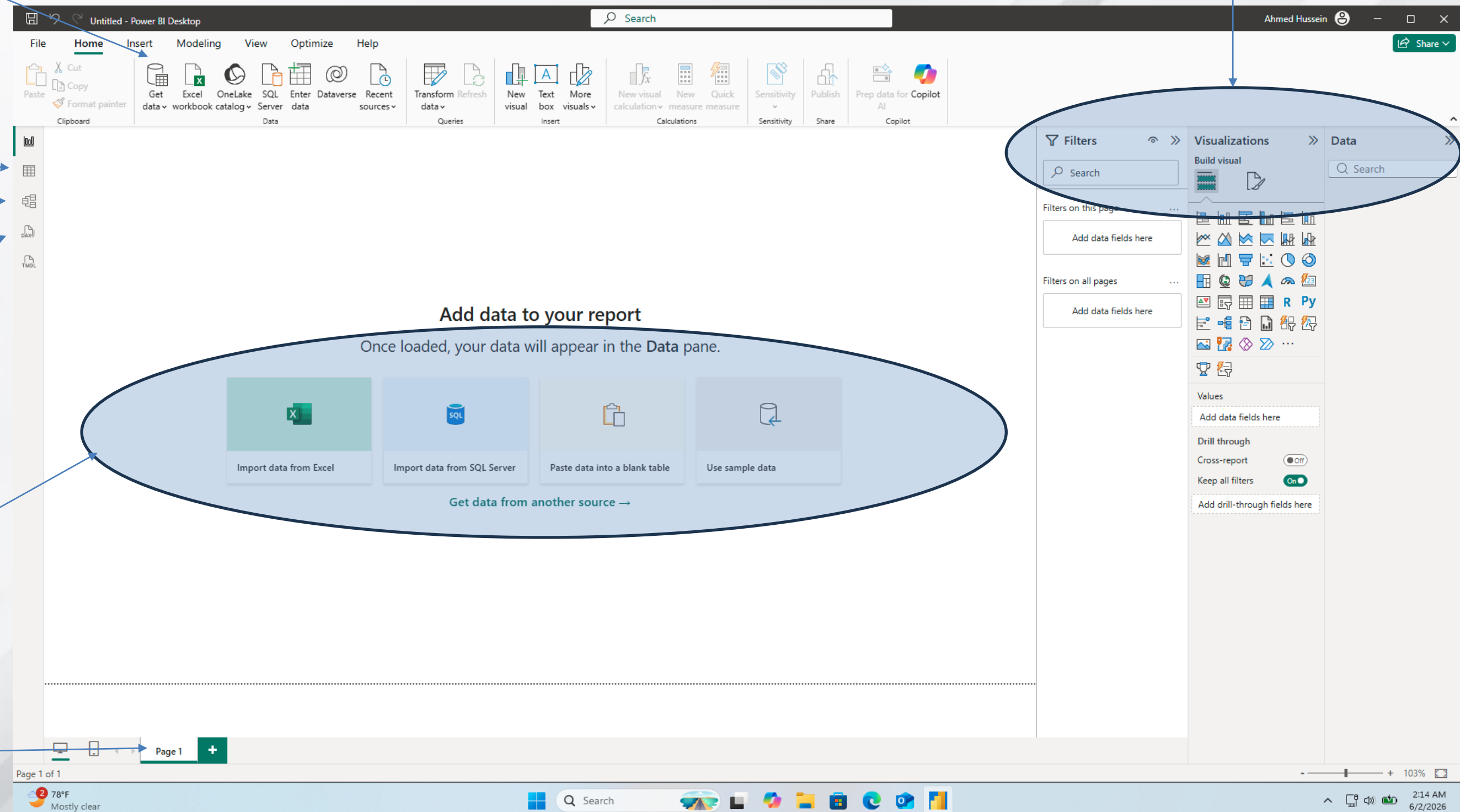
DAX Query View

Most Common Data Sources

Report Page #, Add Page

Power BI Blank Report

Panels



Desktop Navigation the Core Views



Report View

The canvas where you build visuals and interactive dashboards for end-users.



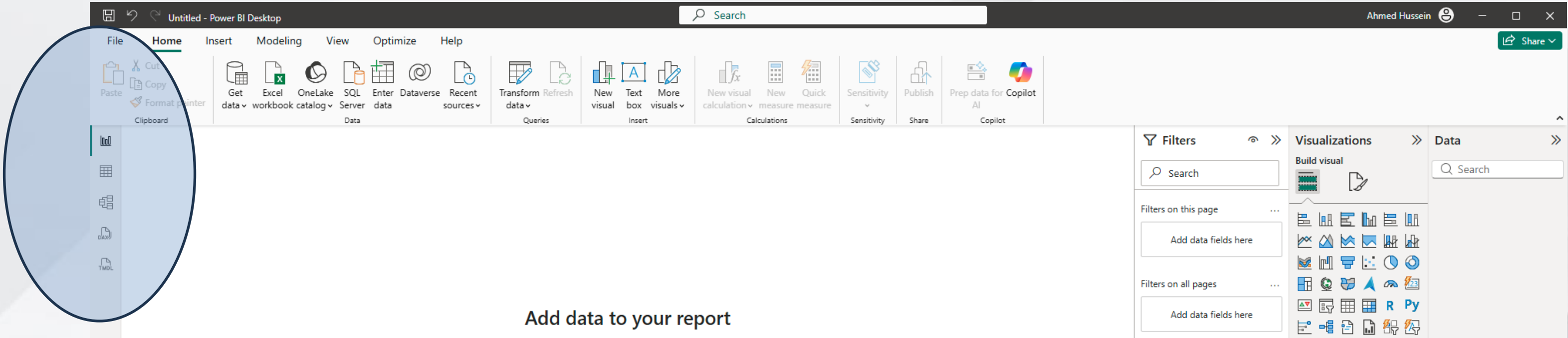
Table View

Direct data inspection area to view raw rows, columns, and apply formatting.



Model View

The 3rd icon on the left bar. This is where relationships and schemas are managed.



Model View Overview

Power BI’s Model View is where you manage tables, relationships, and the overall data model structure.

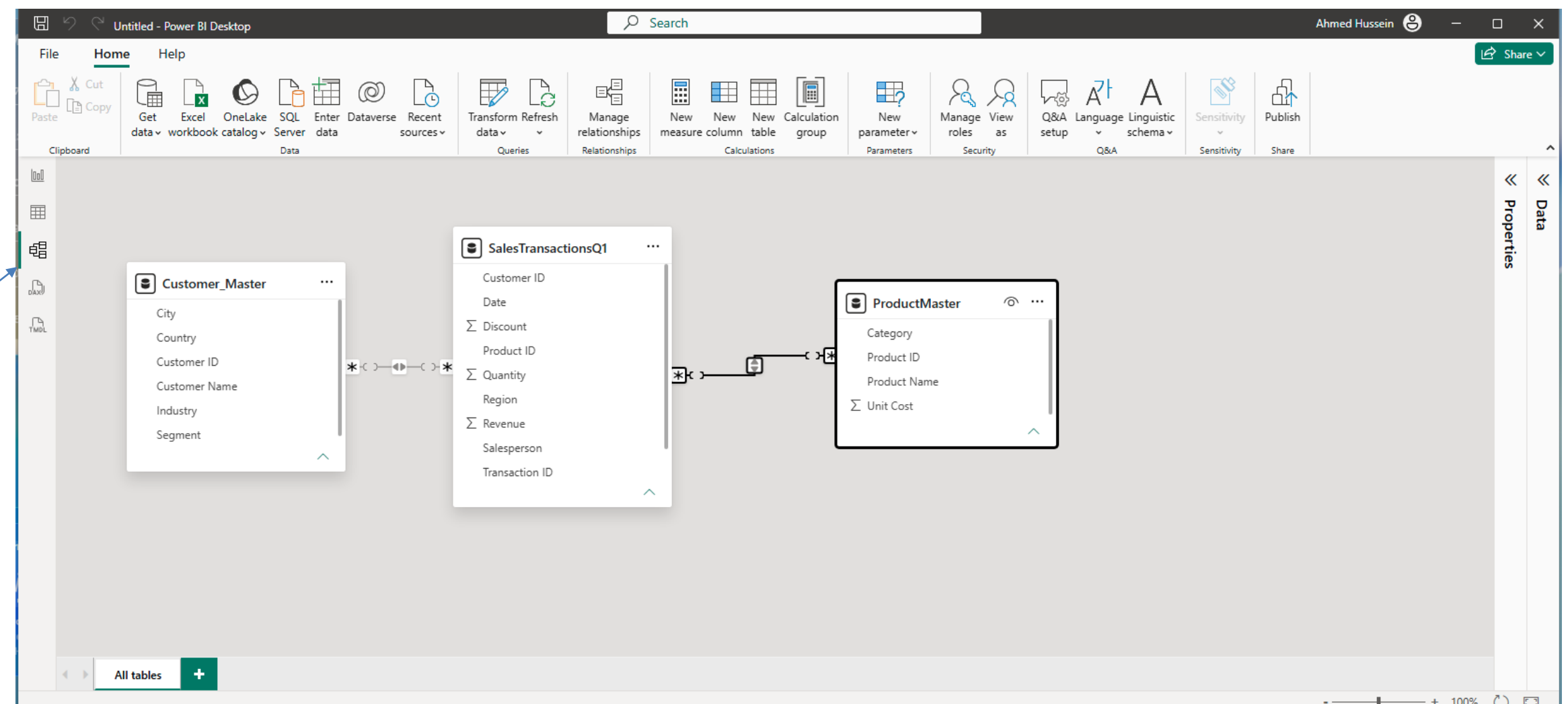
Area	Purpose
Tables	View all loaded tables
Relationships	See how tables are connected
Fields	Review columns and measures
Layout	Organize tables visually

Model View helps you see and manage how your data tables work together.

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03

Importing Data to Power BI

- After Close & Apply Power Query
- Select Model View from left Pane
- A Canva will appear with your tables in it



Most Important Model View Functions in Power BI

Function	Brief Description	Where to Find It in Model View
Manage Relationships	Reviews, creates, edits, or deletes relationships between tables.	Model View → Home tab → Manage Relationships
Create Relationship	Connects two tables using a common field such as Customer ID, Product ID, or Date.	Model View → Drag a field from one table to the matching field in another table
Cardinality	Defines the relationship type, such as One-to-Many, Many-to-One, or Many-to-Many.	Double-click relationship line → Cardinality dropdown
Cross-Filter Direction	Controls how filters move between related tables. Single direction is usually recommended.	Double-click relationship line → Cross-filter direction
Mark as Date Table	Identifies the official Date table for accurate time-based analysis.	Select Date table → Table tools → Mark as Date Table

Active vs. Inactive Relationships

Power BI can have active and inactive relationships between tables.

Type	Meaning	Example
Active Relationship	Used automatically in reports	Sales Date → Date Table
Inactive Relationship	Exists but not used by default	Delivery Date → Date Table

Only active relationships are used automatically in visuals and calculations.

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Checking Relationship Accuracy

- What to Check?

Check	Purpose
Correct matching fields	Customer ID connects to Customer ID
Same data type	Text connects to Text, Date connects to Date
Correct relationship type	Usually One-to-Many
Active relationship	Power BI uses the relationship in visuals
No missing keys	All sales records should match customers/products

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03

Validating Data After Modeling

Create simple visuals to test if relationships work correctly.

Visual	Fields Used	What It Confirms
Card	Total Revenue	Sales table is working
Bar Chart	Customer Name + Revenue	Customer relationship works
Bar Chart	Product Category + Revenue	Product relationship works
Line Chart	Month + Revenue	Date relationship works

Power BI Desktop vs. Service Editing

Capability	Power BI Desktop	Power BI Service (Web)
Relationship Editing	Full Drag-and-Drop Control	Supported (Preview Modeler)
DAX Measure Creation	Full Support & Formatting	Supported via Formula Bar
Power Query (ETL)	Built-in Advanced Editor	None (Use Dataflows separately)
Model Optimization	Analyzer Tools & Metadata	Viewing only

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Demo on Power BI Modeling Features



Exercise: Build the Sales Model

Using the modified Sales Performance dataset in this lecture:

Step	Task
1	Load Date Table
2	Open Model View in Power BI
3	Identify the fact table: Sales Transactions
4	Identify dimension tables: Customers, Products, Dates
5	Create relationships using Customer ID, Product ID, and Date
6	Validate the model using simple revenue visuals



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Exercise

Expected Output:

A connected sales data model ready for reporting.

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03**Key Points**

Data modeling connects cleaned tables for analysis.

Fact tables store measurable business activity.

Dimension tables provide context for reporting.

Relationships allow filters and calculations to work correctly.

Star schema is the recommended model structure.

Lecture 04:

- Creating Powerful Visualizations



Lecture
02

Next Lecture



Thank You