Sri Lanka Institute of Information Technology

IT3021 - Data warehousing and Business Intelligence

Year 3 Semester 2

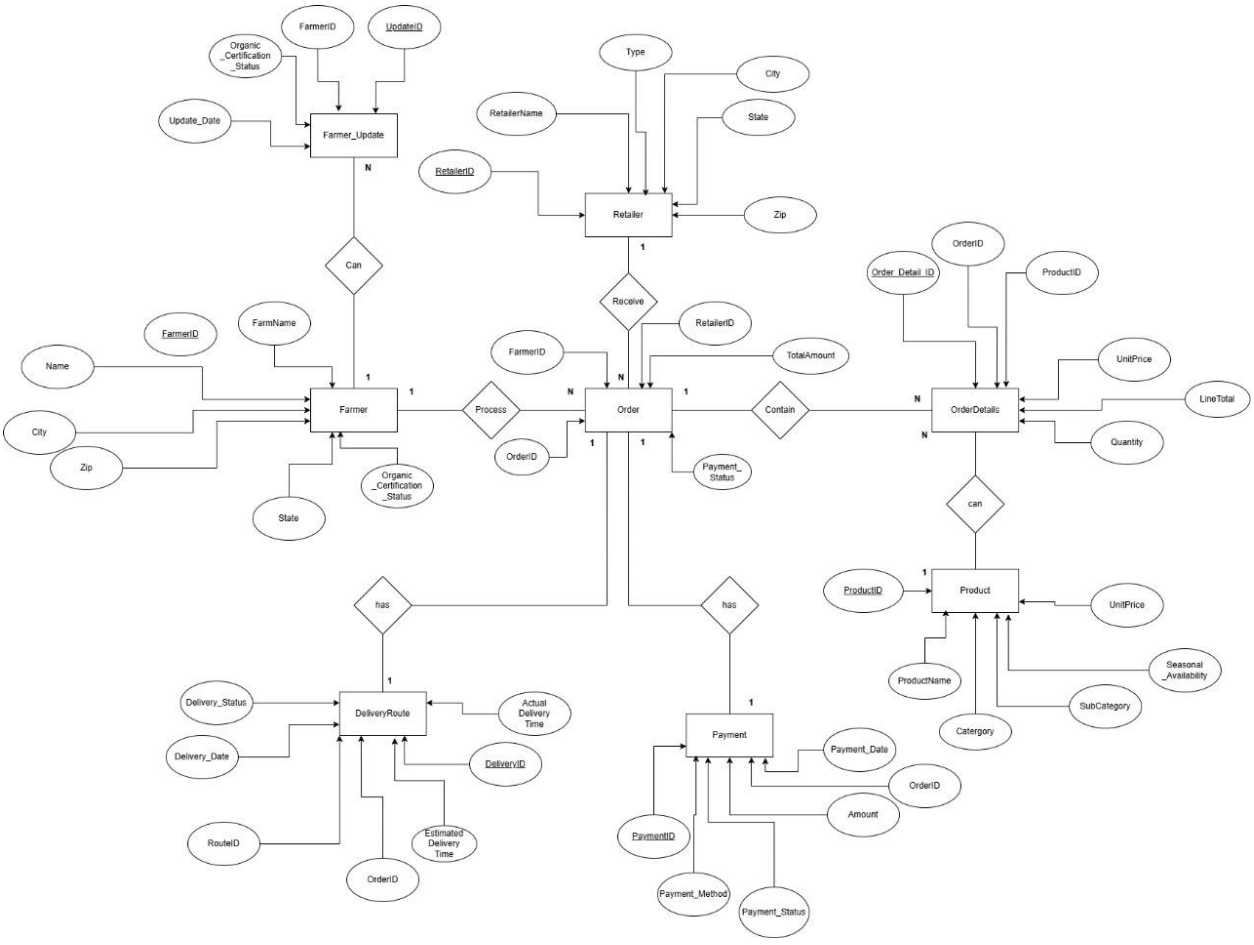
DWBI – Assignment 02

Prepared by: Nishadi Jayarathna.

Step 1: Data source for the assignment 2

The data source is the FarmToTableDW data warehouse from Assignment 1, tracking organic produce delivery in 2024. It uses a star schema with OrderSalesFact (measures: TotalAmount, Quantity, PaymentMethod) and five dimensions: FarmerDim (Type 1 SCD: OrganicCertificationStatus, City, FarmName, FarmSize, Name), ProductDim (Type 1 SCD: SeasonalAvailability, UnitPrice), RetailerDim, DateDim, and DeliveryDim (Type 1 SCD: ActualDeliveryTime, DeliveryDate, EstimatedDelivery). Data is sourced from Excel (Farmers.xlsx, Products.xlsx, Retailers.xlsx), TXT (Orders.txt, OrderDetails.txt), and CSV (DeliveryRoutes.csv, Payments.csv, FarmerUpdates.csv, AccmTxnUpdates.csv), integrated via SSIS ETL. It supports analytics like sales, delivery efficiency, and payment trends with hierarchies (e.g., State → City → Farmer).

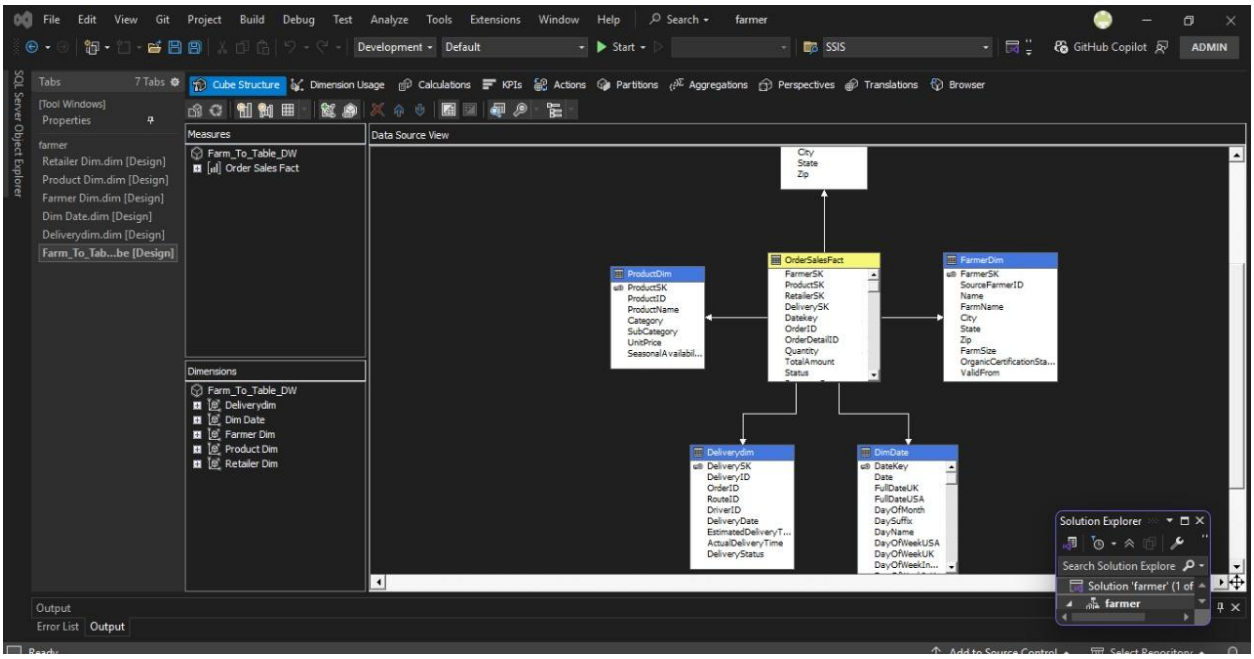
ER Diagram:



Step 2: SSAS Cube implementation

An SSAS cube named *SalesCube* was created using SQL Server Analysis Services (Multidimensional Model) in Visual Studio with SSDT. The cube uses the *FarmToTableDW* data warehouse as its data source. The *OrderSalesFact* table provides measures (TotalAmount, Quantity), and the dimensions (*FarmerDim*, *ProductDim*, *RetailerDim*, *DateDim*, *DeliveryDim*) are connected via foreign keys. A Date Hierarchy (Year → Quarter → Month → Day) was implemented in the *DateDim* dimension to enable drill-down analysis. The cube was successfully deployed and processed, allowing for multidimensional analysis of sales, delivery efficiency, and payment trends.

Cube:

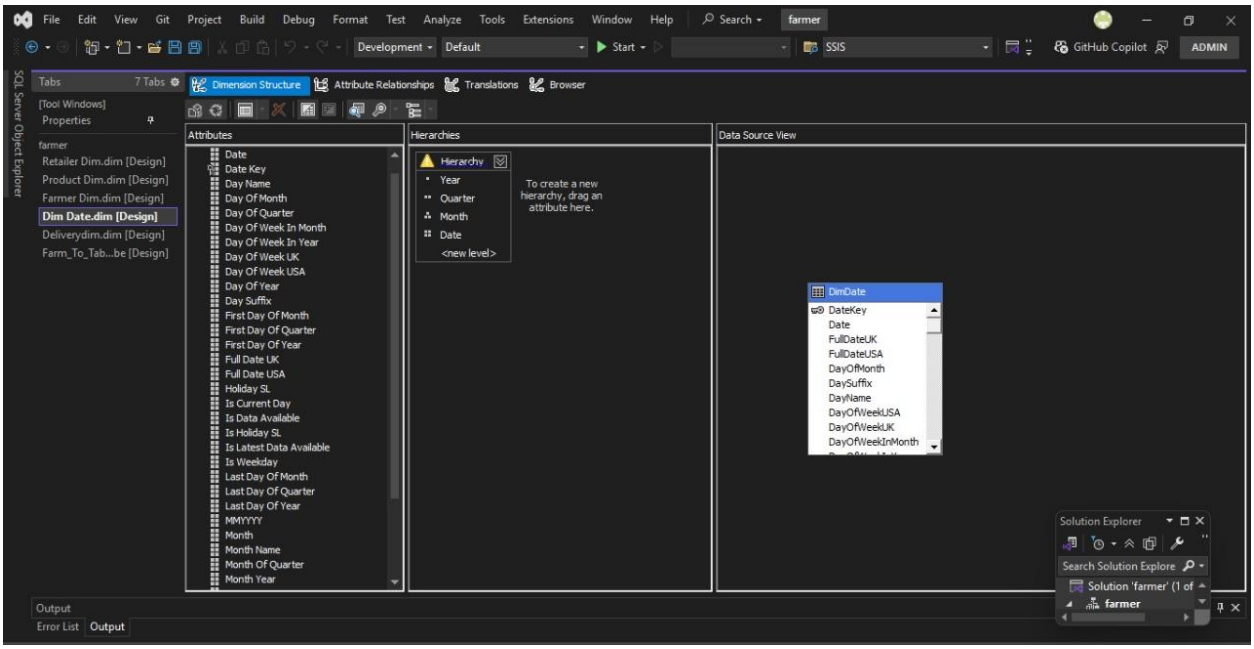


Dimensions:

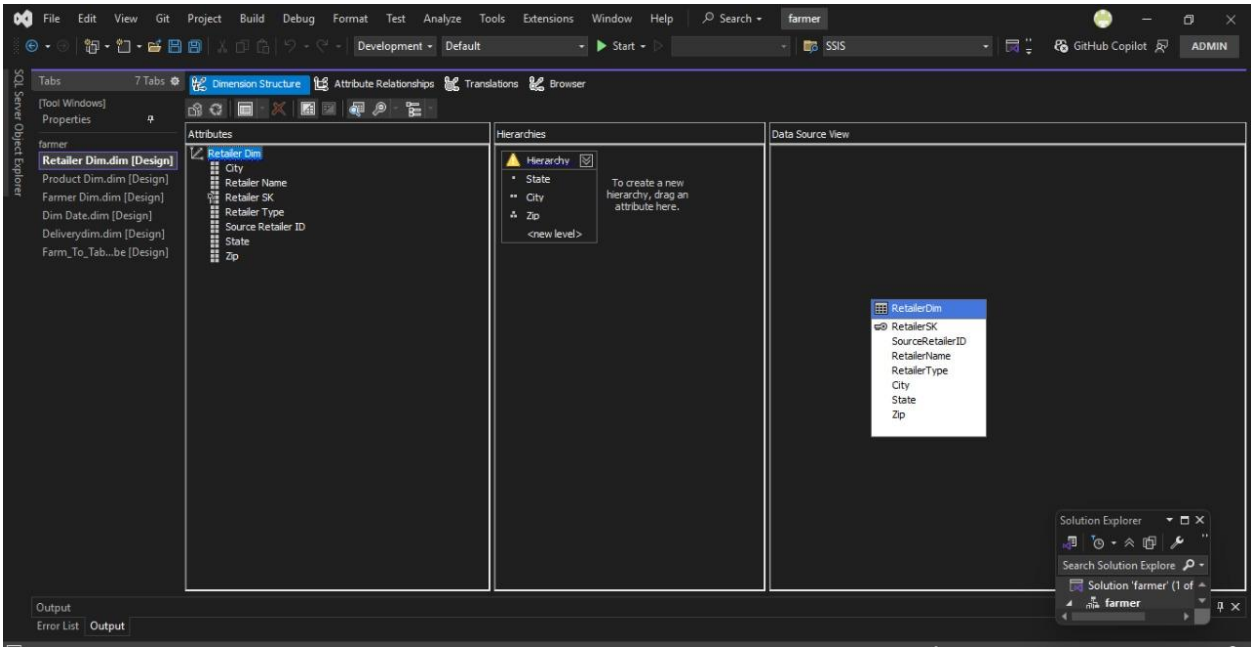

Measures
Farm_To_Table_DW
Order Sales Fact
Dimensions
Farm_To_Table_DW
Deliverydim
Edit Deliverydim
Attributes
Dim Date
Farmer Dim
Product Dim
Retailer Dim

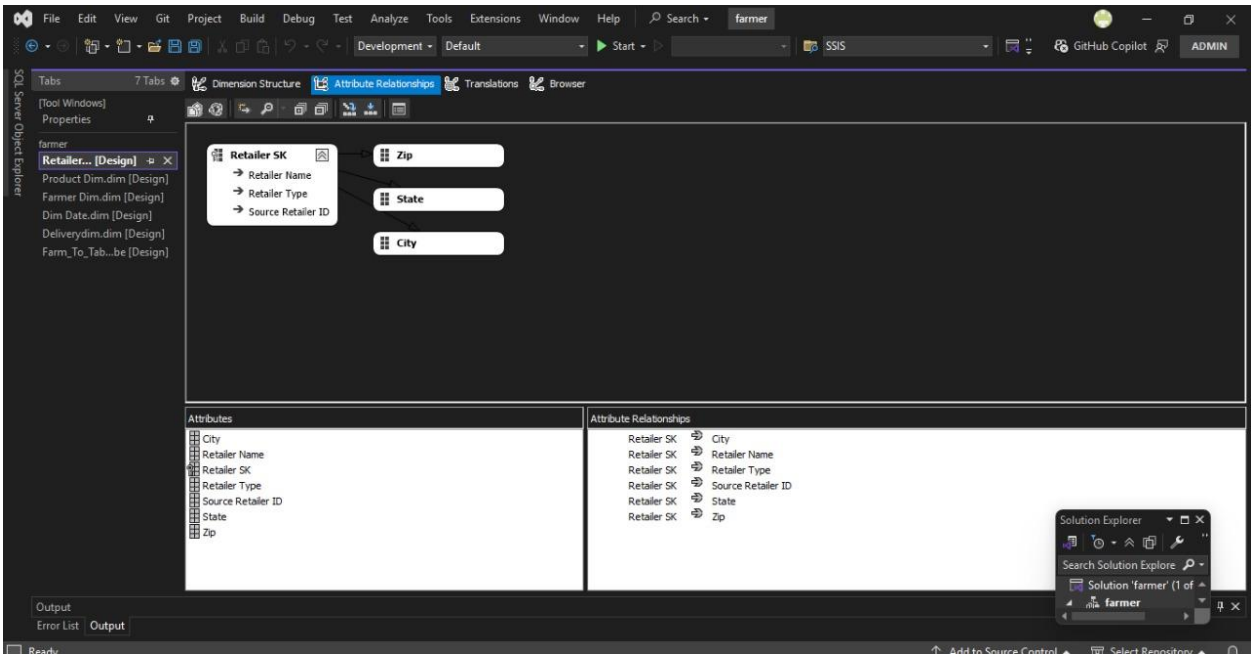
Hierarchies:

Date Hierarchy
Year → Quarter → Month → Day



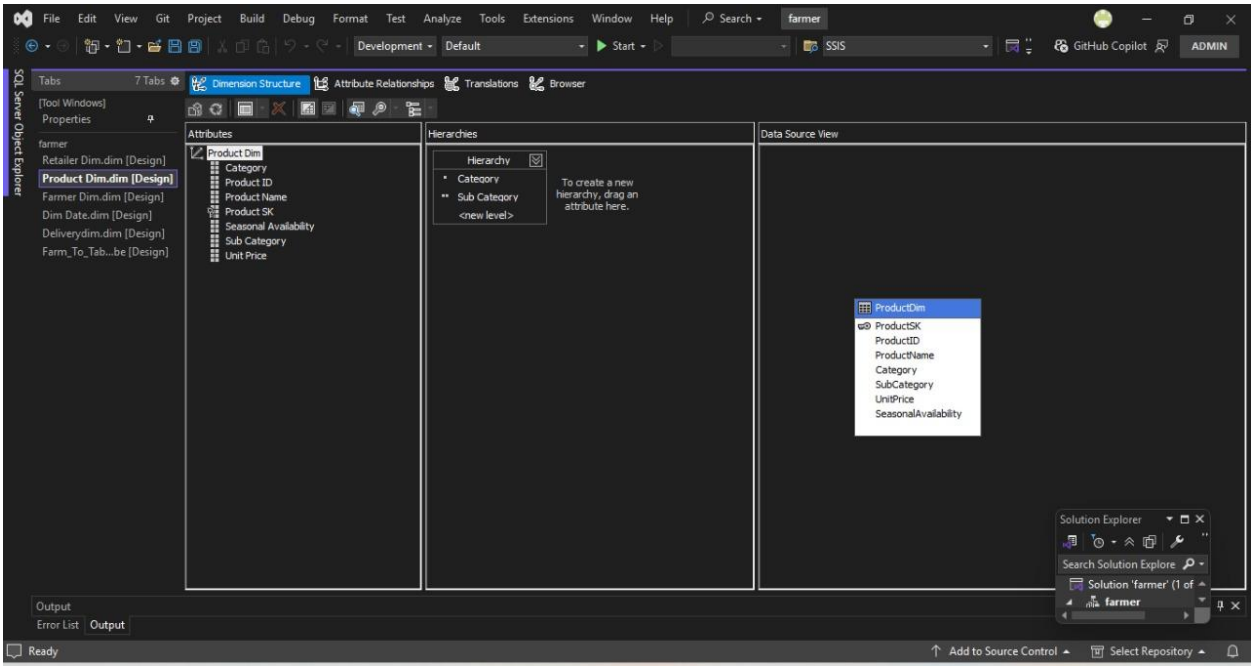
Retailer Dim - Location Hierarchy
State → City → Zip

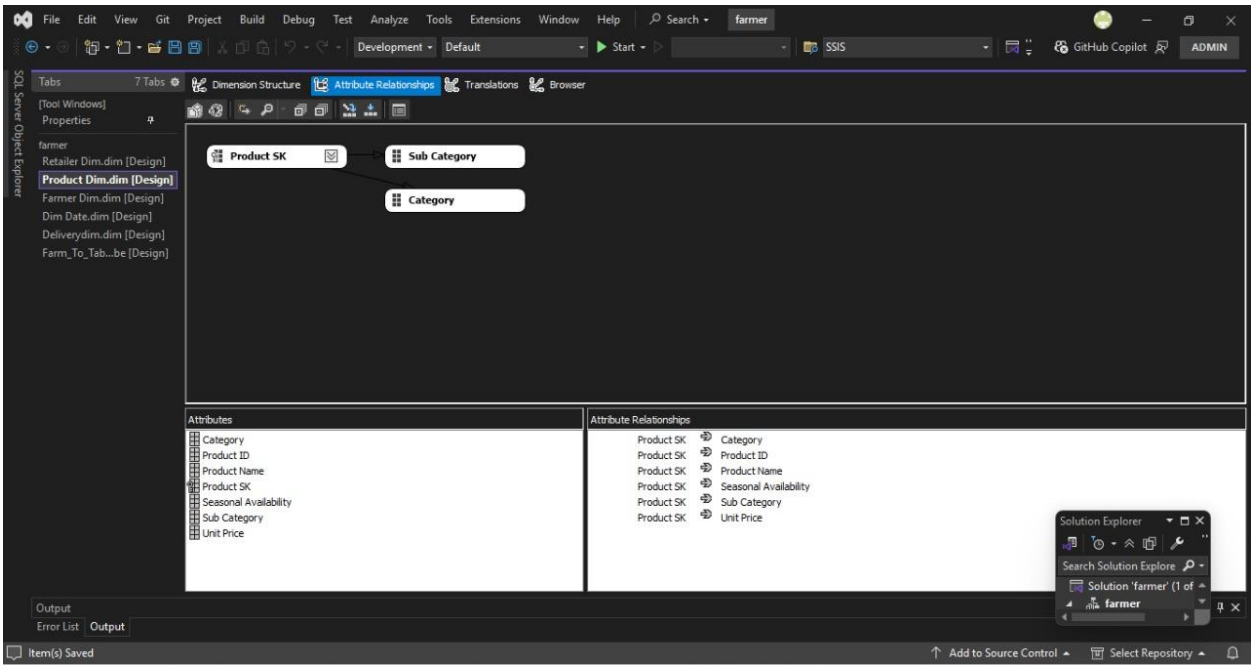




Product Hierarchy

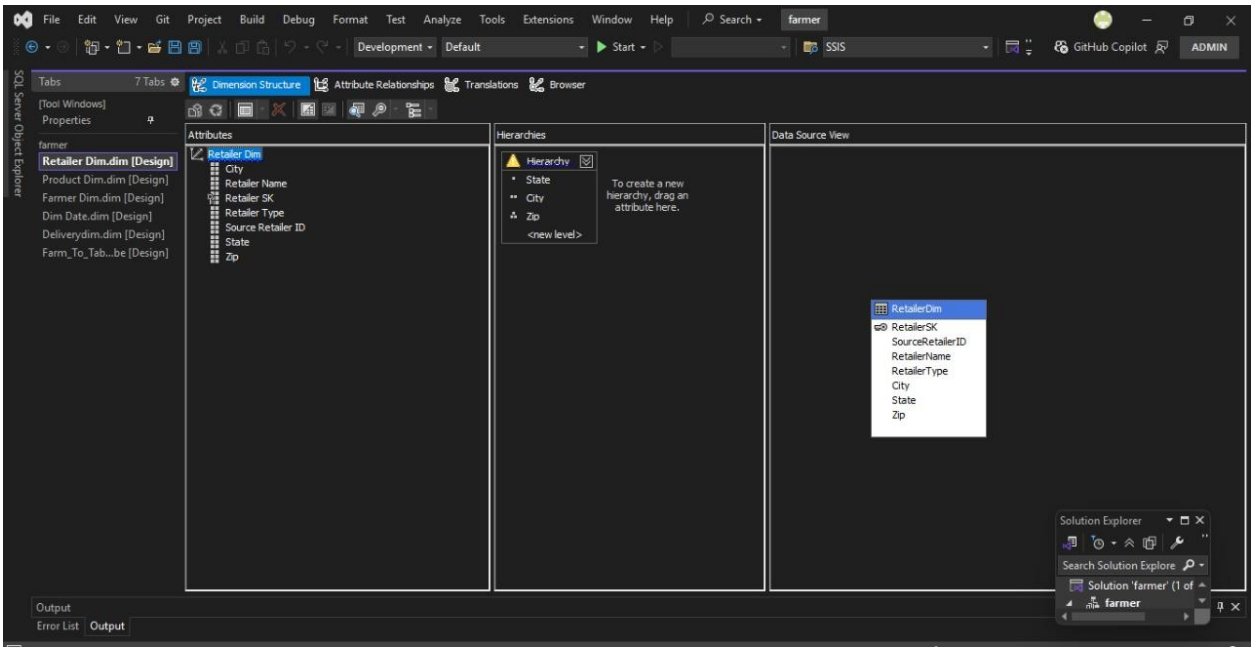
Category → Subcategory

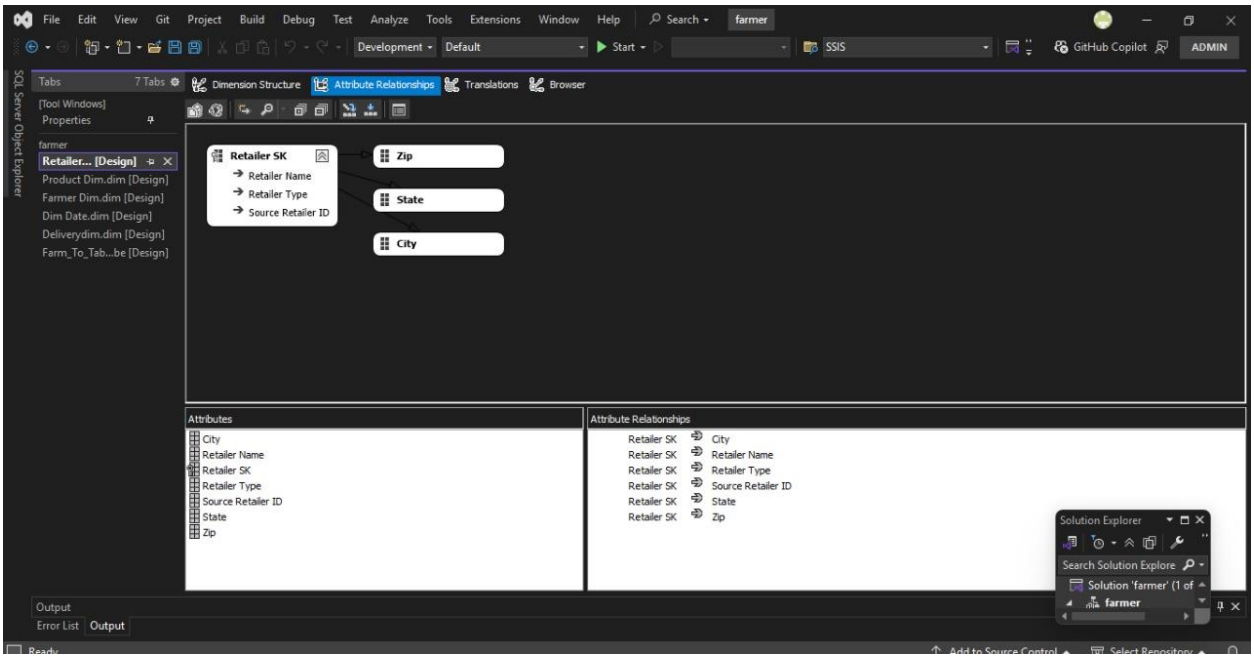




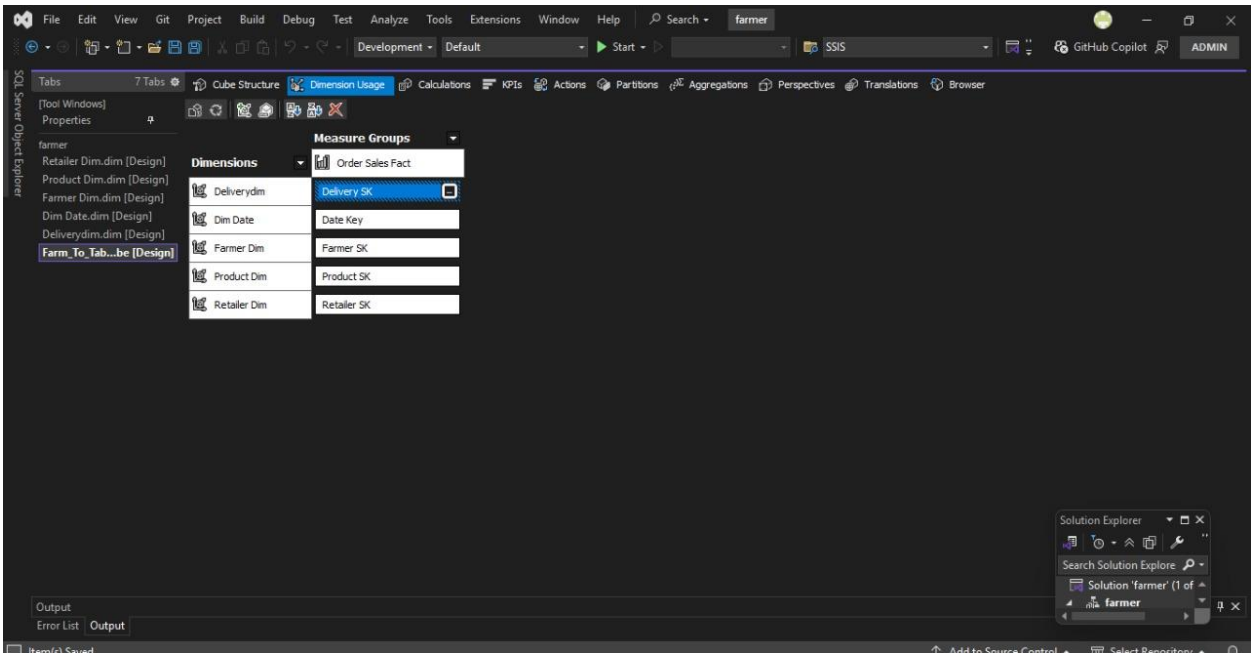
Retailer Hierarchy

State → City → Zip



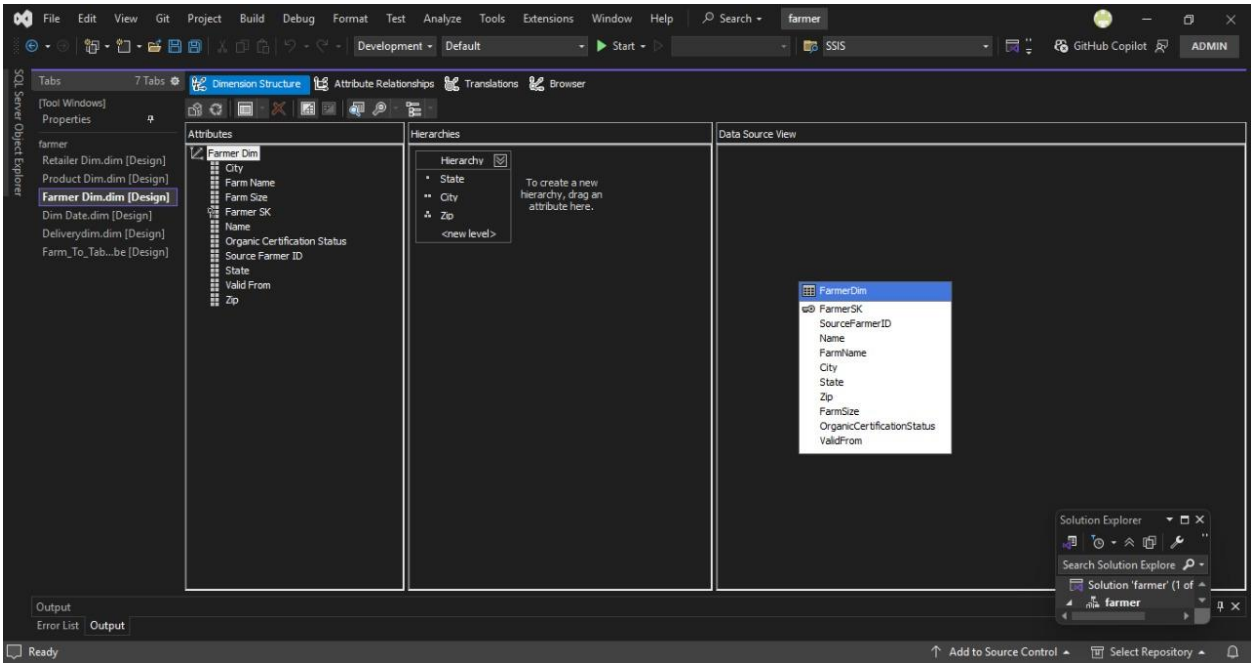


Dimension Usage

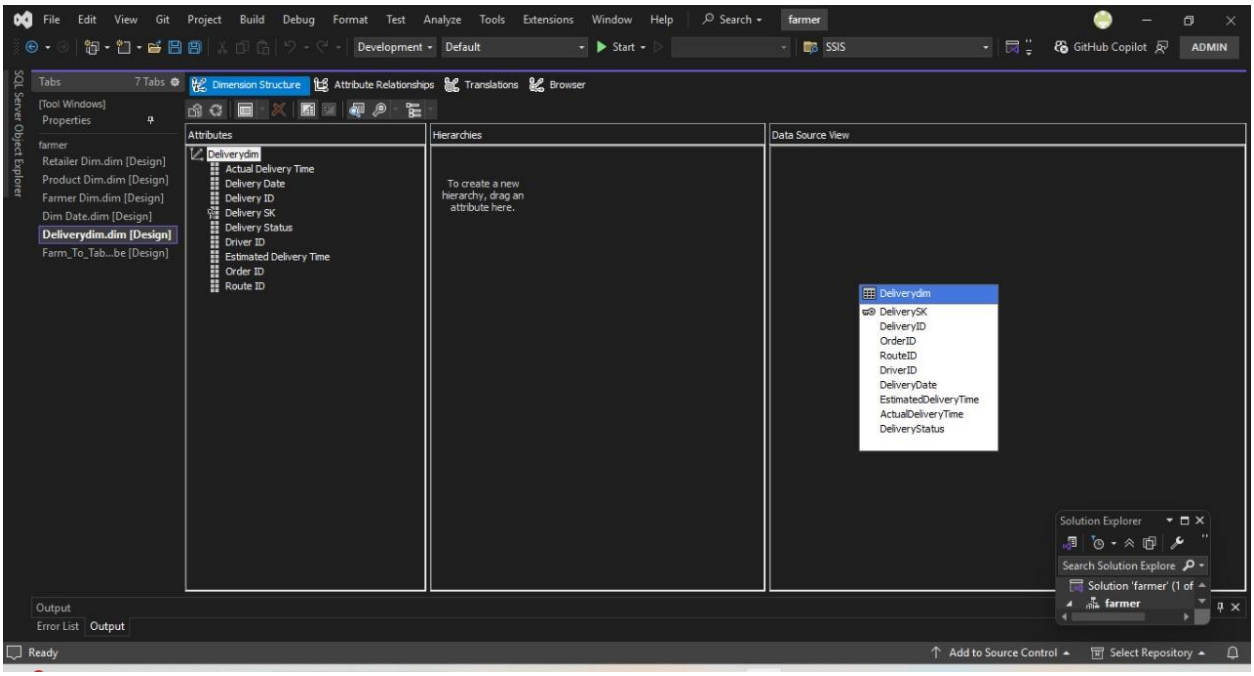


Farmer Dimension

State → City → Zip



Delivery Dimension



Step 3: Demonstration of OLAP operations

1. Connected to SSAS: **Data** > **Get Data** > **From Analysis Services**, used server (localhost), selected FarmToTableDW cube.
2. Tested in ConnectionTest sheet with PivotTable (Sum of TotalAmount, ProductDim.Category, DateDim.Year), then deleted.

Roll-Up (RollUp Sheet)

- PivotTable: Sum of TotalAmount (Values), ProductDim.Category (Rows), DateDim.Month (Columns), then replaced Month with DateDim.Quarter to aggregate.
- PivotChart: Clustered Column, titled "Roll-Up: Sales by Category and Quarter".
- Outcome: Aggregated sales from Month to Quarter.

Drill-Down (DrillDown Sheet)

- PivotTable: Sum of TotalAmount (Values), ProductDim.Category (Rows), DateDim.Quarter (Columns), then added ProductDim.SubCategory (Rows) and replaced Quarter with DateDim.Month.
- PivotChart: Clustered Column, titled "Drill-Down: Sales by SubCategory and Month".
- Outcome: Detailed sales by SubCategory and Month.

Slice (Slice Sheet)

- PivotTable: Sum of TotalAmount (Values), ProductDim.Category (Rows), DateDim.Quarter (Columns), FarmerDim.OrganicCertificationStatus (Filters, set to "Certified").
- PivotChart: Clustered Column, titled "Slice: Sales by Category for Certified Farmers".
- Outcome: Filtered sales for Certified farmers.

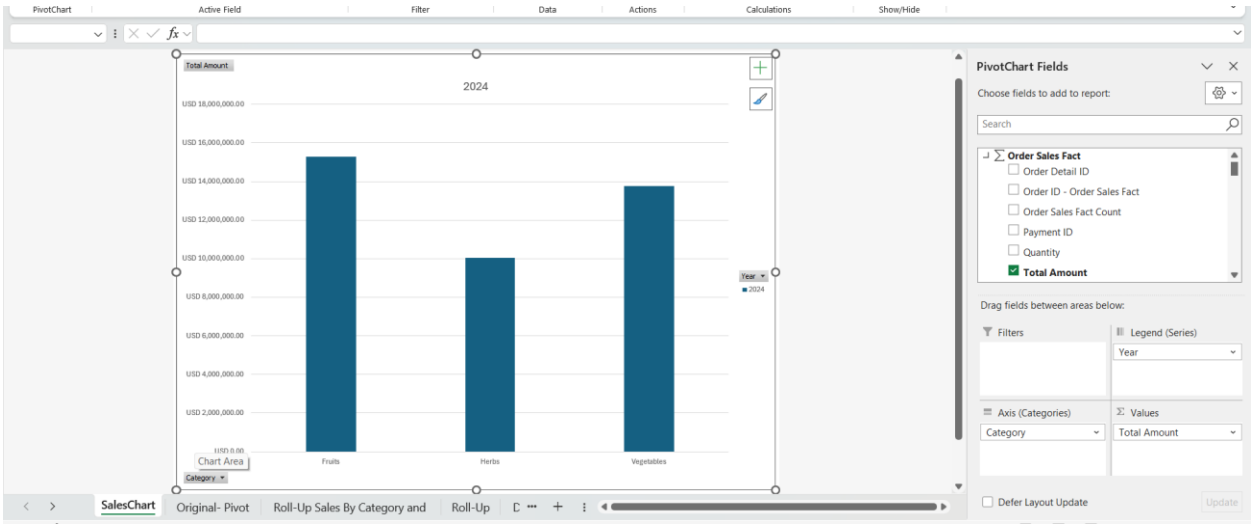
Dice (Dice Sheet)

- PivotTable: Sum of TotalAmount (Values), ProductDim.Category (Rows), DateDim.Month (Columns), Filters: ProductDim.Category (“Vegetables”, “Fruits”), DateDim.Month (January–March), RetailerDim.Type (“Grocery”).
- PivotChart: Clustered Column, titled “Dice: Sales for Vegetables/Fruits in Q1 for Grocery Retailers”.
- Outcome: Focused subset of sales data.

Pivot (Pivot Sheet)

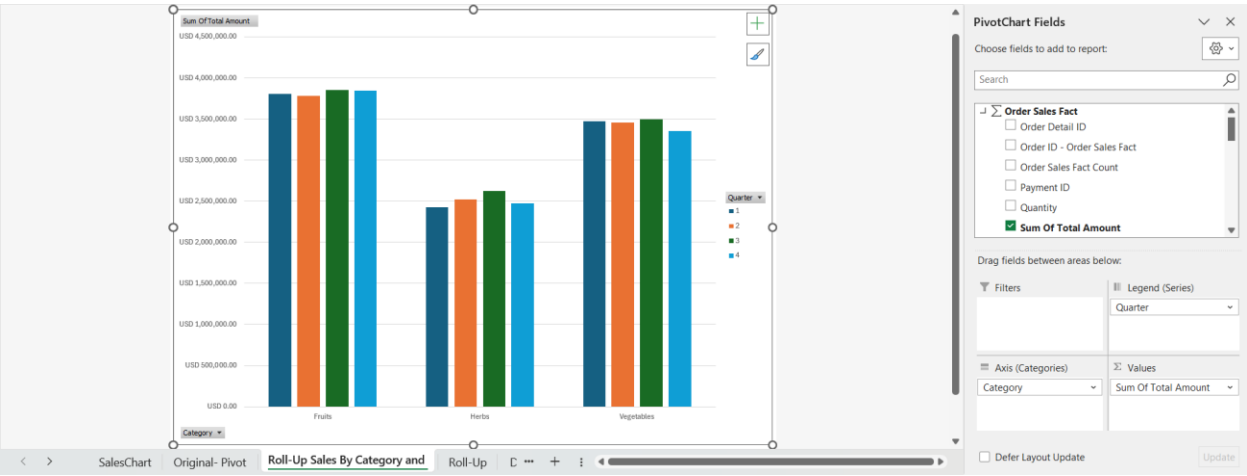
- PivotTable: Sum of TotalAmount (Values), ProductDim.Category (Rows), DateDim.Month (Columns), then swapped to DateDim.Month (Rows), ProductDim.Category (Columns), added RetailerDim.State (Rows).
- PivotChart: Stacked Bar, titled “Pivot: Sales by Month and State”.
- Outcome: Reoriented sales perspective.

Pivot (Pivot Sheet)



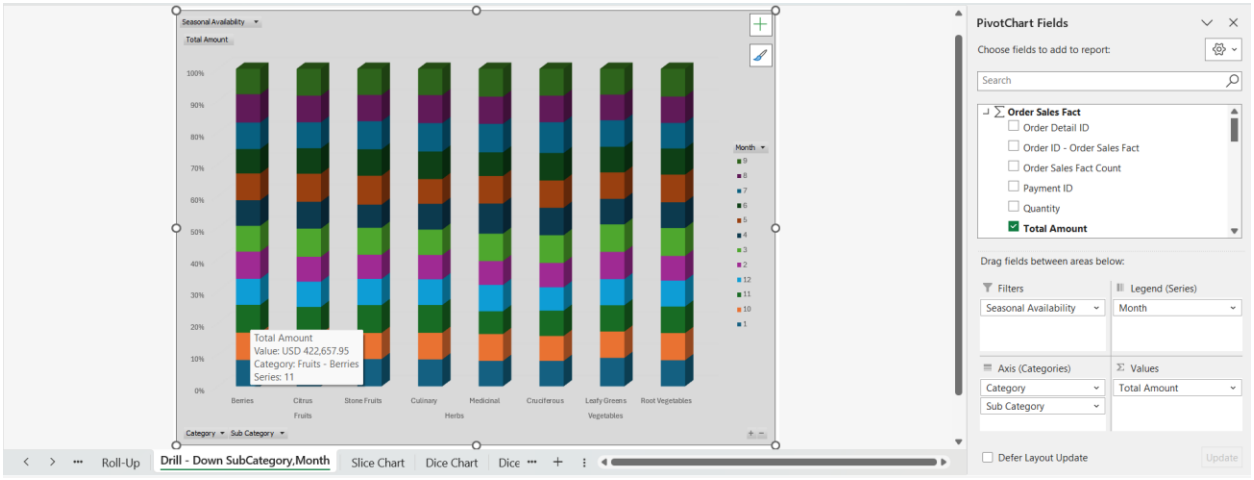
Total Amount	Column Labels	
Row Labels	2024	Grand Total
Fruits	USD 15,290,356.58	USD 15,290,356.58
Herbs	USD 10,054,113.47	USD 10,054,113.47
Vegetables	USD 13,777,455.24	USD 13,777,455.24
Grand Total	USD 39,121,925.29	USD 39,121,925.29

Roll-Up (RollUp Sheet)



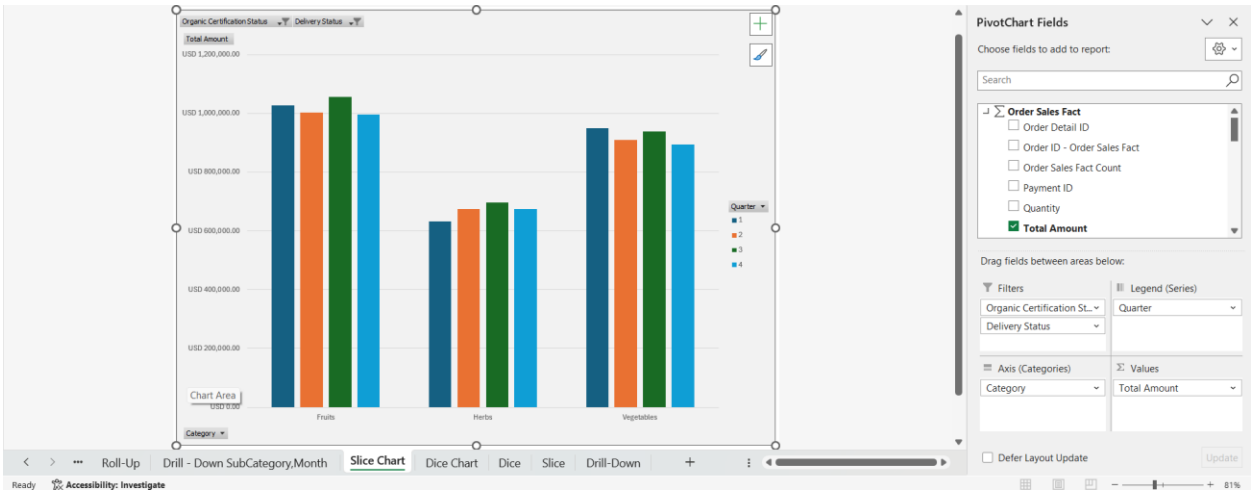
Sum Of Total Amount	Column Labels				
Row Labels	1	2	3	4	Grand Total
Fruits	USD 3,805,523.75	USD 3,786,757.03	USD 3,854,459.64	USD 3,843,616.16	USD 15,290,356.58
Herbs	USD 2,427,458.46	USD 2,519,551.11	USD 2,629,107.40	USD 2,477,996.50	USD 10,054,113.47
Vegetables	USD 3,470,547.77	USD 3,457,167.70	USD 3,495,617.90	USD 3,354,121.87	USD 13,777,455.24
Grand Total	USD 9,703,529.98	USD 9,763,475.84	USD 9,979,184.94	USD 9,675,734.53	USD 39,121,925.29

Drill-Down (Drill-Down Sheet)



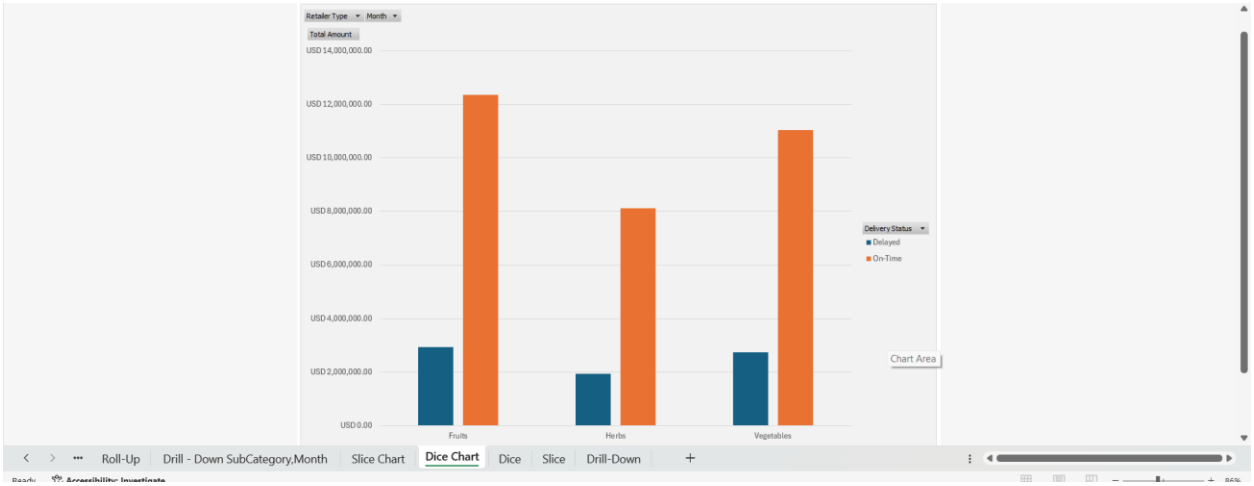
Seasonal Availability	All												
Total Amount	Column Labels												
Row Labels	1	10	11	12	2	3	4	5	6	7	8	9	Grand Total
Fruits	USD 1,282,120.99	USD 1,279,979.84	USD 1,320,211.54	USD 1,243,424.78	USD 1,223,020.48	USD 1,300,382.28	USD 1,217,973.93	USD 1,344,499.66	USD 1,224,283.44	USD 1,291,567.41	USD 1,299,838.10	USD 1,263,054.13	USD 15,290,356.58
Berries	USD 400,961.58	USD 416,193.43	USD 422,657.95	USD 396,590.86	USD 414,110.23	USD 392,134.89	USD 389,268.31	USD 407,315.93	USD 372,274.96	USD 403,403.18	USD 430,168.11	USD 387,389.62	USD 4,832,469.05
Citrus	USD 467,167.00	USD 465,292.21	USD 474,067.59	USD 448,175.33	USD 441,402.04	USD 497,577.73	USD 476,964.62	USD 496,865.96	USD 450,585.55	USD 460,139.71	USD 470,500.13	USD 477,243.75	USD 5,625,981.62
Stone Fruits	USD 413,992.41	USD 398,494.20	USD 423,486.00	USD 398,658.59	USD 367,508.21	USD 410,669.66	USD 351,741.00	USD 440,317.77	USD 401,422.93	USD 428,024.52	USD 399,169.86	USD 398,420.76	USD 4,831,905.91
Herbs	USD 831,567.72	USD 845,377.40	USD 809,373.89	USD 823,245.21	USD 764,130.82	USD 831,759.92	USD 877,163.97	USD 823,126.64	USD 819,260.50	USD 898,325.79	USD 874,751.29	USD 856,030.32	USD 10,054,113.47
Culinary	USD 471,122.71	USD 464,915.05	USD 486,564.93	USD 450,142.78	USD 425,954.89	USD 443,960.22	USD 450,248.24	USD 433,247.80	USD 482,929.05	USD 495,616.04	USD 490,249.20	USD 460,609.88	USD 5,555,560.79
Medicinal	USD 360,445.01	USD 380,462.35	USD 322,808.96	USD 373,102.43	USD 338,175.93	USD 387,799.70	USD 426,915.73	USD 389,878.84	USD 336,331.45	USD 402,709.75	USD 384,502.09	USD 395,420.44	USD 4,498,552.68
Vegetables	USD 1,160,024.49	USD 1,133,990.47	USD 1,129,551.54	USD 1,090,579.86	USD 1,108,304.46	USD 1,202,218.82	USD 1,137,885.78	USD 1,175,098.47	USD 1,144,183.45	USD 1,200,080.85	USD 1,134,355.59	USD 1,161,181.46	USD 13,777,455.24
Cruciferous	USD 365,718.70	USD 358,925.31	USD 364,157.85	USD 335,834.74	USD 350,394.90	USD 399,120.69	USD 394,283.62	USD 392,677.97	USD 394,921.12	USD 442,476.63	USD 382,095.04	USD 386,418.56	USD 4,567,025.13
Leafy Greens	USD 455,033.13	USD 421,285.07	USD 420,134.21	USD 417,547.98	USD 436,665.63	USD 439,777.48	USD 408,826.39	USD 422,788.88	USD 409,368.43	USD 424,670.62	USD 409,866.86	USD 412,807.21	USD 5,078,771.89
Root Vegetables	USD 339,272.66	USD 353,780.09	USD 345,259.48	USD 337,197.14	USD 321,243.93	USD 363,320.65	USD 334,775.77	USD 359,631.62	USD 339,893.90	USD 332,933.60	USD 342,393.69	USD 361,955.69	USD 4,131,658.22
Grand Total	USD 3,273,713.20	USD 3,259,347.71	USD 3,259,136.97	USD 3,157,249.85	USD 3,095,455.76	USD 3,334,361.02	USD 3,233,023.68	USD 3,342,724.77	USD 3,187,727.39	USD 3,389,974.05	USD 3,308,944.98	USD 3,280,265.91	USD 39,121,925.29

Slice (Slice Sheet)



	A	B	C	D	E	F
1	Organic Certification Status	Certified				
2	Delivery Status	On-Time				
3						
4	Total Amount	Column Labels				
5	Row Labels	1	2	3	4	Grand Total
6	Fruits	USD 1,028,089.94	USD 1,003,865.58	USD 1,057,022.28	USD 996,029.63	USD 4,085,007.43
7	Herbs	USD 631,710.39	USD 674,243.98	USD 695,902.35	USD 674,516.38	USD 2,676,373.10
8	Vegetables	USD 949,644.28	USD 908,939.71	USD 938,798.20	USD 895,244.29	USD 3,692,626.48
9	Grand Total	USD 2,609,444.61	USD 2,587,049.27	USD 2,691,722.83	USD 2,565,790.30	USD 10,454,007.01
10						
11						
12						
13						
14						
15						
16						
17						
18						

Dice (Dice Sheet)



	A	B	C	D	E	F	G	H	I	J
1										
2	Retailer Type	All								
3	Month	All								
4										
5	Total Amount	Column Labels								
6	Row Labels	Delayed	On-Time	Grand Total						
7	Fruits	USD 2,932,912.46	USD 12,357,444.12	USD 15,290,356.58						
8	Herbs	USD 1,923,741.72	USD 8,130,371.75	USD 10,054,113.47						
9	Vegetables	USD 2,726,897.37	USD 11,050,557.87	USD 13,777,455.24						
10	Grand Total	USD 7,583,551.55	USD 31,538,373.74	USD 39,121,925.29						
11										
12										
13										
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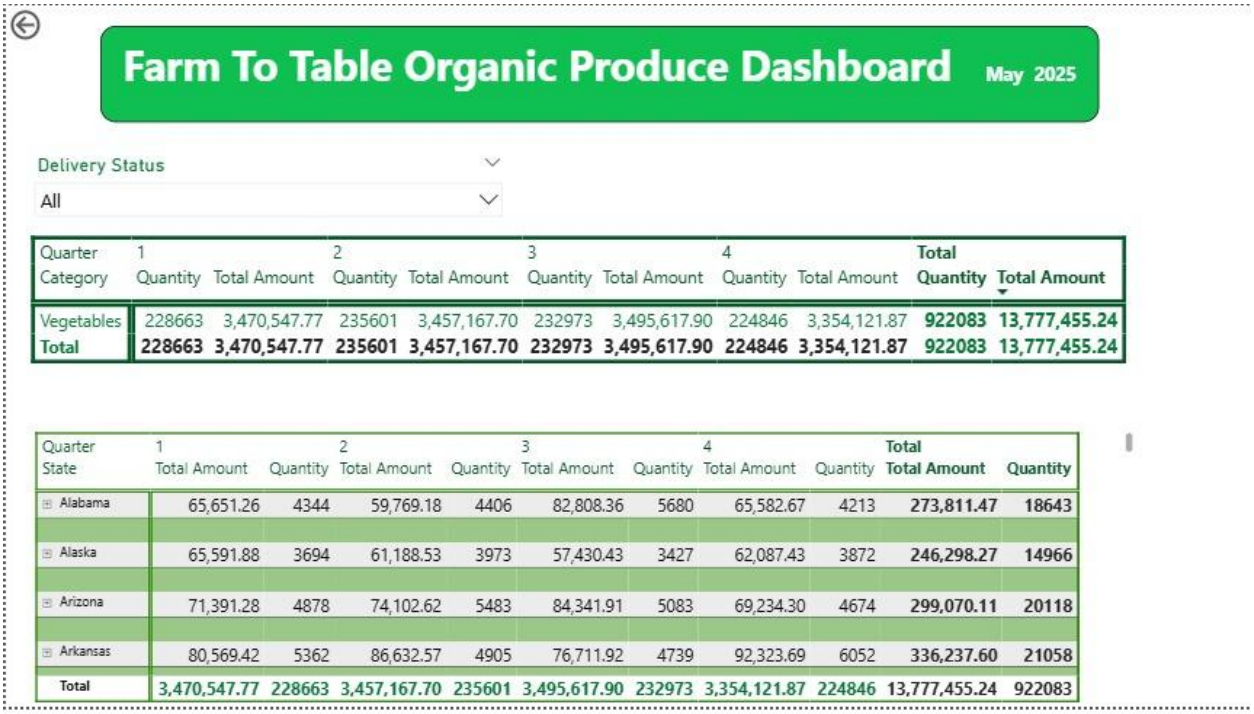
Step 4: PowerBI Reports

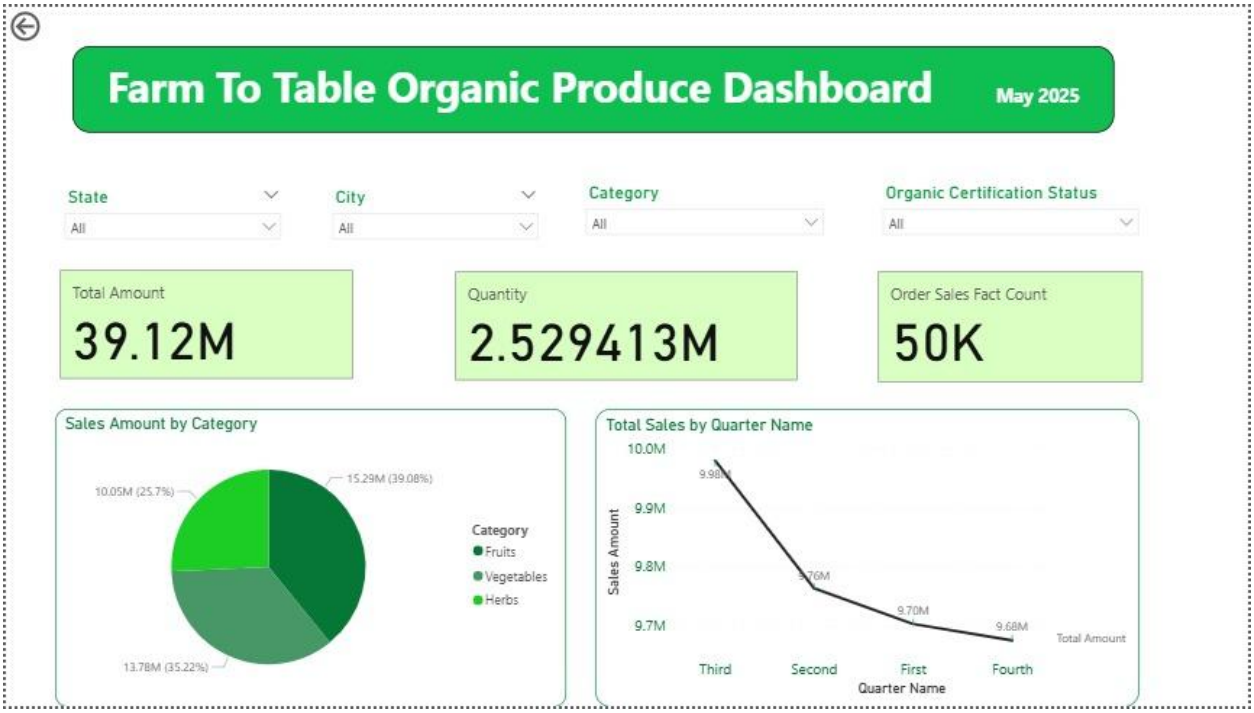
Report 1



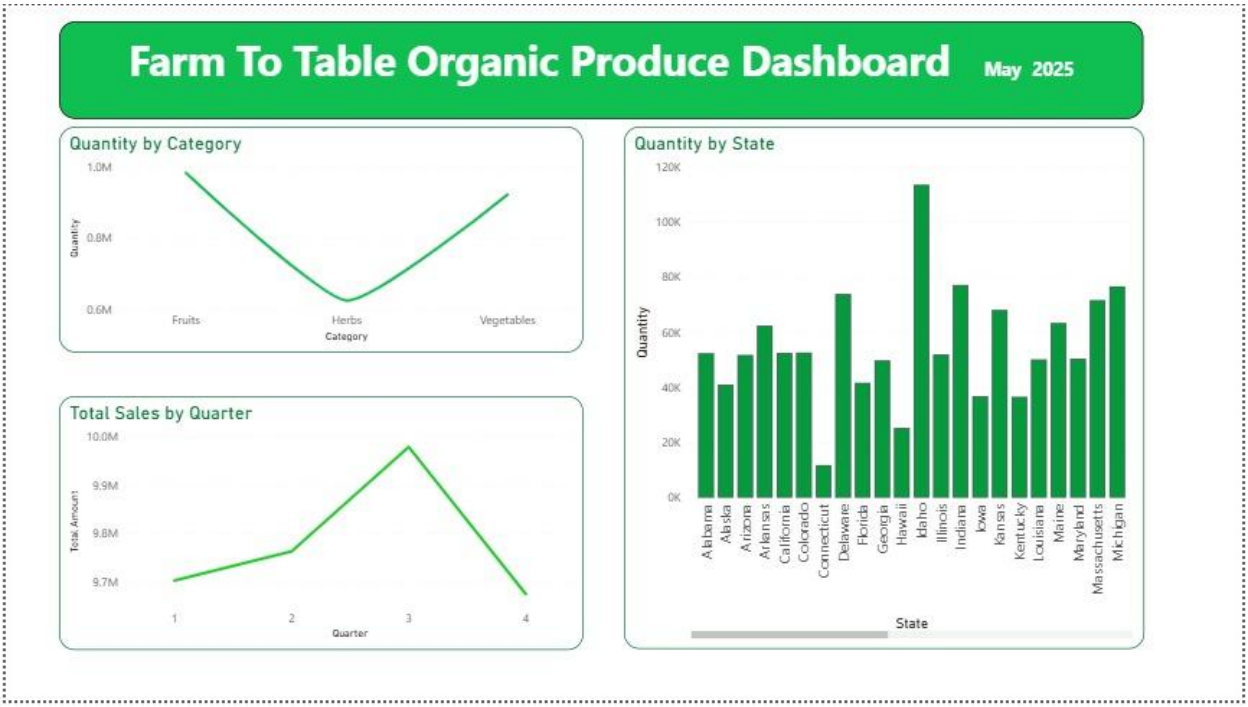
Quarter / Category	1 Quantity	1 Total Amount	2 Quantity	2 Total Amount	3 Quantity	3 Total Amount	4 Quantity	4 Total Amount	Total Quantity	Total Total Amount
Vegetables	228663	3,470,547.77	235601	3,457,167.70	232973	3,495,617.90	224846	3,354,121.87	922083	13,777,455.24
Total	**228663**	**3,470,547.77**	**235601**	**3,457,167.70**	**232973**	**3,495,617.90**	**224846**	**3,354,121.87**	**922083**	**13,777,455.24**

Quarter / State	1 Total Amount	1 Quantity	2 Total Amount	2 Quantity	3 Total Amount	3 Quantity	4 Total Amount	4 Quantity	Total Total Amount	Total Quantity
Alabama	65,651.26	4344	59,769.18	4406	82,808.36	5680	65,582.67	4213	273,811.47	18643
Alaska	65,591.88	3694	61,188.53	3973	57,430.43	3427	62,087.43	3872	246,298.27	14966
Arizona	71,391.28	4878	74,102.62	5483	84,341.91	5083	69,234.30	4674	299,070.11	20118
Arkansas	80,569.42	5362	86,632.57	4905	76,711.92	4739	92,323.69	6052	336,237.60	21058
Total	**3,470,547.77**	**228663**	**3,457,167.70**	**235601**	**3,495,617.90**	**232973**	**3,354,121.87**	**224846**	**13,777,455.24**	**922083**

Report 2



Report 3


Farm To Table Organic Produce Dashboard
May 2025
Quantity by Category
1.0M
0.8M
0.6M
Quantity
Fruits
Herbs
Vegetables
Category
Total Sales by Quarter
10.0M
9.9M
9.8M
9.7M
Total Amount
1
2
3
4
Quarter
Quantity by State
120K
100K
80K
60K
40K
20K
0K
Quantity
Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
Florida
Georgia
Hawaii
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
State

Report 1: Matrix Visual for Detailed Tabular Data

- Data Preparation: Connected Power BI to the *FarmToTableDW* data warehouse, importing *OrderSalesFact*, *ProductDim*, *RetailerDim*, and *DateDim* tables. Ensured relationships were correctly defined (e.g., *OrderSalesFact* linked to *ProductDim* via ProductSK, *RetailerDim* via RetailerSK).
- Modeling: Verified the star schema model in Power BI, with *OrderSalesFact* as the fact table and dimensions joined via foreign keys. No additional DAX was needed for this report.
- Visual Design:
    - Added a Matrix visual to the canvas.
    - Configured the Matrix: Dragged *ProductDim.Category* and *ProductDim.SubCategory* to Rows for hierarchical grouping, *DateDim.Year* to Columns, and *OrderSalesFact.TotalAmount* and *OrderSalesFact.Quantity* to Values.
    - Formatting:
        - Values: Set font size to 12, formatted TotalAmount as Currency.
        - Row Headers: Enabled Stepped Layout in the Format Visual pane → Row headers section for better hierarchy display.
        - Column Headers: Applied bold text and center-aligned via Format Visual pane → Column headers.
        - Totals: Enabled Row Subtotals and Column Subtotals in the Format Visual pane → Subtotals to show totals for Categories and Years.
    - Published the report to Power BI Service for online access.

Report 2: Multiple Slicers with Cascading Filters and Charts

- Data Preparation: Used the same *FarmToTableDW* dataset, ensuring *FarmerDim*, *ProductDim*, *RetailerDim*, *DateDim*, and *OrderSalesFact* were imported. Added *DeliveryDim* for delivery-related insights.
- Modeling: Created relationships between tables (e.g., *OrderSalesFact* to *FarmerDim* via FarmerSK). To enable cascading filters, ensured a hierarchical relationship (e.g., *RetailerDim.State* → *RetailerDim.City*).
- Visual Design:
    - Added two slicers:
        - First slicer for *RetailerDim.State*.
        - Second slicer for *RetailerDim.City*, set to filter dynamically based on the State selection (cascading filter enabled via Power BI's default relationship behavior).
    - Added visuals:
        - A pie chart showing *OrderSalesFact.Quantity* by *ProductDim.Category*.
        - A bar chart displaying *OrderSalesFact.TotalAmount* by *FarmerDim.OrganicCertificationStatus*.
        - A line chart for *OrderSalesFact.TotalAmount* over *DateDim.Month*.
    - Ensured slicers interacted with all visuals by configuring the interaction settings (Edit Interactions in Power BI).
    - Published to Power BI Service.

Report 3: Drill-Down Report for Hierarchical Exploration

- Data Preparation: Imported *OrderSalesFact* and *DateDim* from *FarmToTableDW*, ensuring *DateDim* included Year, Quarter, Month, and Day columns.
- Modeling: Used the Date Hierarchy (Year → Quarter → Month → Day) already defined in *DateDim* from the SSAS cube (*SalesCube*). Linked *OrderSalesFact.DateKey* to *DateDim.DateID*.
- Visual Design:
    - Added a clustered column chart with *DateDim.Year* on the Axis, *OrderSalesFact.TotalAmount* on Values.
    - Enabled drill-down by adding the Date Hierarchy (Year → Quarter → Month → Day) to the Axis, allowing users to drill from Year to Day.
    - Added a second visual (e.g., a line chart) showing *OrderSalesFact.Quantity* over *DateDim.Month* for additional context.
    - Tested drill-down functionality by clicking the drill-down icon and navigating through the hierarchy.
    - Published to Power BI Service.

Report 4: Drill-Through Report for Detailed Navigation

- Data Preparation: Used *OrderSalesFact*, *FarmerDim*, *ProductDim*, and *RetailerDim* from *FarmToTableDW*.
- Modeling: Ensured relationships were set (e.g., *OrderSalesFact.FarmerSK* to *FarmerDim.FarmerSK*).
- Visual Design:
    - Created a main page with a bar chart showing *OrderSalesFact.TotalAmount* by *FarmerDim.Name*.
    - Added a drill-through page:
        - Dragged *FarmerDim.Name* to the Drill-through fields in the Visualizations pane.
        - On the drill-through page, added a table visual with *FarmerDim.Name*, *FarmerDim.OrganicCertificationStatus*, *OrderSalesFact.TotalAmount*, and *OrderSalesFact.Quantity*.
    - Configured the drill-through: Right-clicking a farmer in the bar chart on the main page navigates to the drill-through page, filtering data for that farmer.
    - Added a back button on the drill-through page for navigation.
    - Published Power BI Service for online demonstration.