Sri Lanka Institute of Information Technology

Data Warehousing and Business Intelligence

IT3021

- Assignment 2 -

2025

Assignment 2 Report

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IT Number – IT22136824

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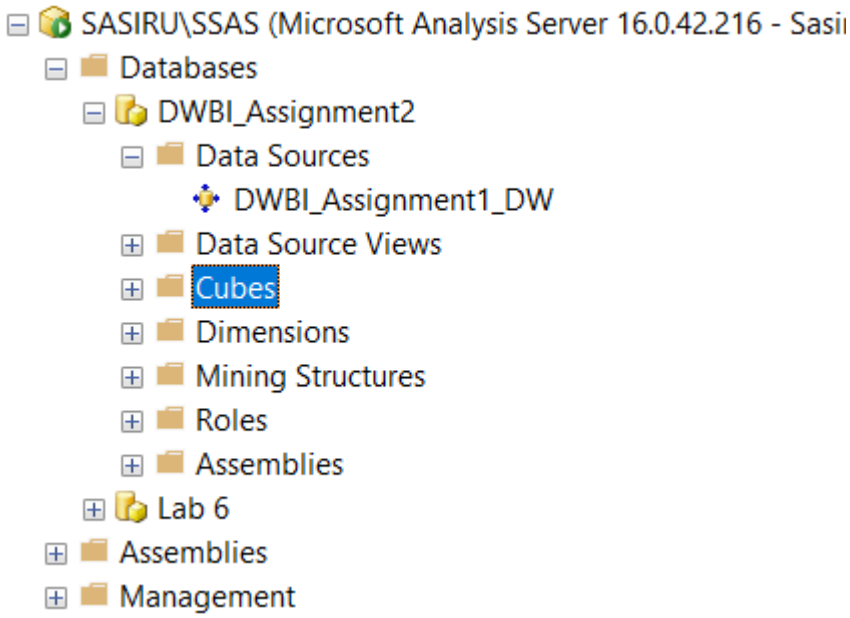
1 Data Source

1.1 Data Source Introduction

The data warehouse (**DWBI_Assignment1_DW)** which was created in assignment 1 has been used as the data source for this assignment.



The data warehouse was created using the Grocery Sales Dataset which originally had sales data for up to 5 months. Furthermore, for the rest of the months in the year, synthetic data have been used.

Snowflake schema was used, and the data warehouse contains five dimensional tables and a fact table.

- Dimensions –
    1. DimProduct - The Product Dimension Table contains product information and ProductSk acts as the surrogate key and there is a reference from DimProduct to DimProductCategory table.
    2. DimProductCategory - The ProductCategory Dimension table contains product category information. ProductCategorySk acts as the surrogate key.
    3. DimEmployee - The Employee Dimension contains employee's detail. EmployeeSk acts as the surrogate key and there is a reference from DimEmployee to DimCity table.

4. DimCustomer - The Customer Dimension contains customer details. CustomerSk acts as the surrogate key and there is a reference from DimCustomer to DimCity table.
5. DimCity - The City Dimension contains information about cities. CitySk acts as the surrogate key and there is a reference from DimCity to DimCountry tables.
6. DimCountry - The Country Dimension contains information about countries. CountrySk acts as the surrogate key.
7. DimDate - This is a common dimension. It can be role playing and static dimensions as well. DateKey acts as the surrogate key.

- Fact table –
    1. Contains all sales transactions data. There is no surrogate key and there are references to DimProduct, DimCustomer, DimEmployee and DimDate dimension tables.

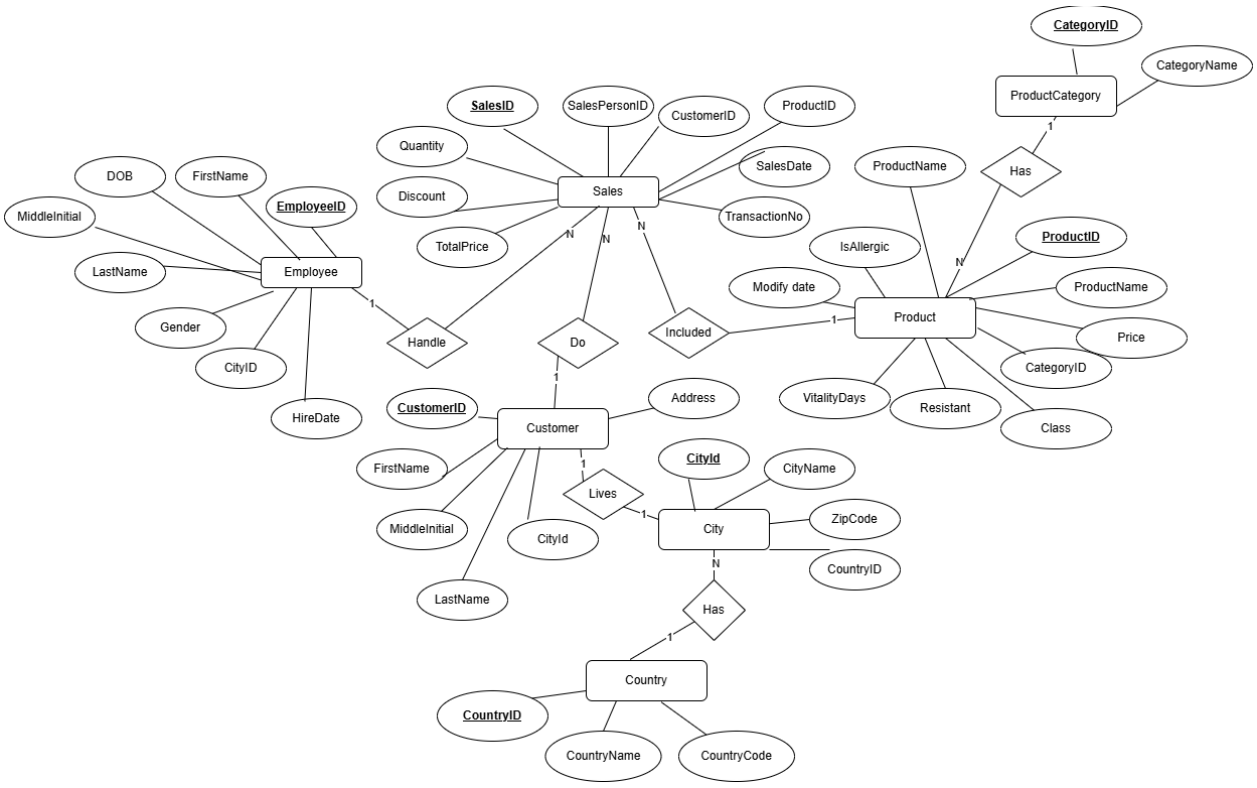


Figure 2: Data Warehouse ER

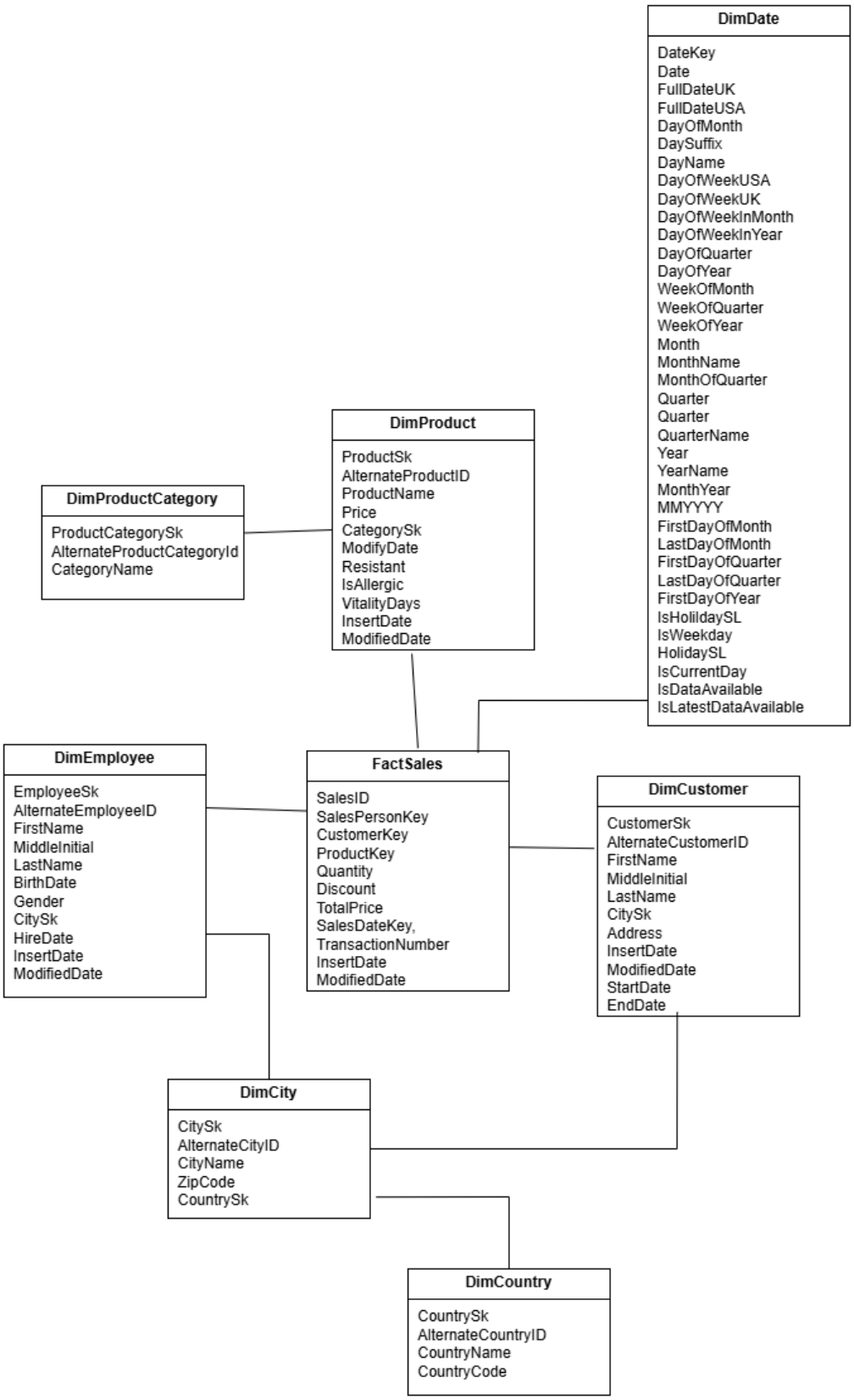


Figure 3: Implemented DW

2 SSAS Cube implementation

A SQL Server Analysis Service Project was created to develop an OLAP cube for data analysis.

The most significant parts of a cube are its dimensions and measurements.

- Dimensions – These are the dimensions that come from the data source.
- Measure group – This has a similar concept to the fact table of the data warehouse. Here all the measures of the OLAP cube are present. (eg-: Total Sales, Quantity)

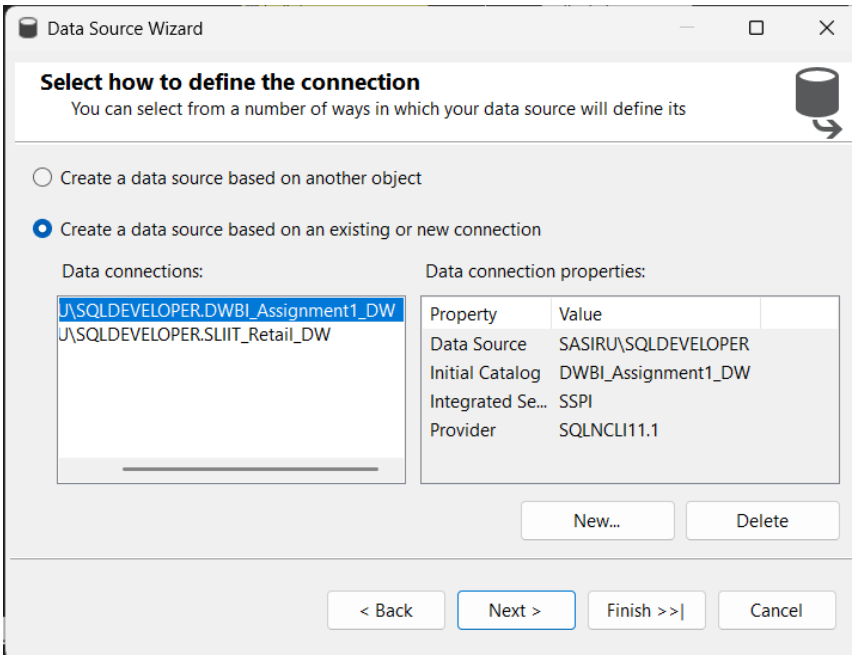
For the creation of the new project SQL Server Data Tools was used as below:

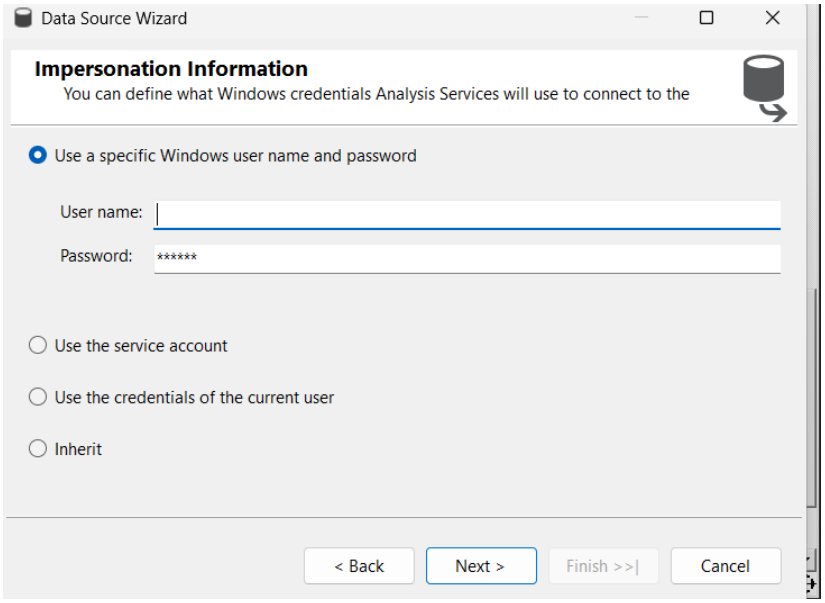
- **Analysis Services Project in visual studio was used to build the cube.**
- **SQL Analysis Services Server was configured in SSMS to deploy the cube.**
- **Windows authentication was provided.**

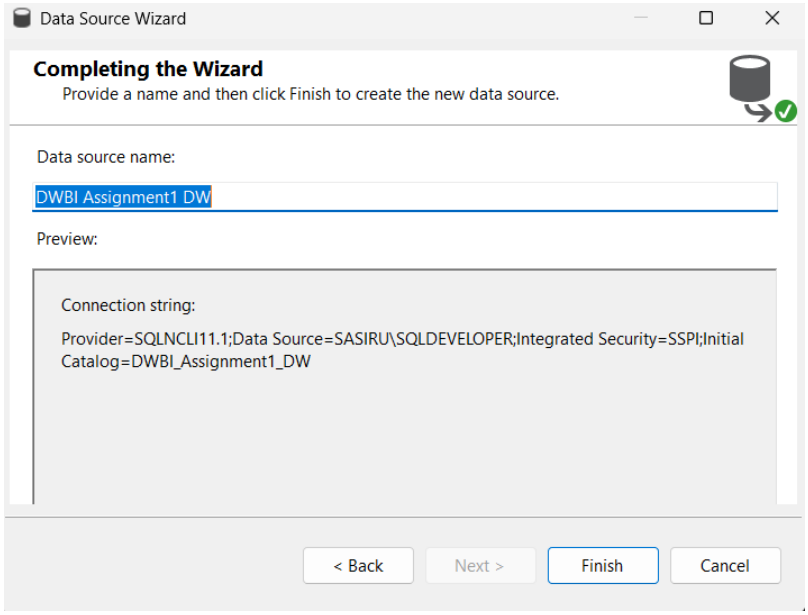
2.1 Cube Implementation

2.1.1 Creating the Data Source

A data warehouse has been chosen as the data source by connecting the data warehouse, (**DWBI_Assignment1_DW** through the SQL Server Management Studio. The service account mode was used in connecting to the SSMS.



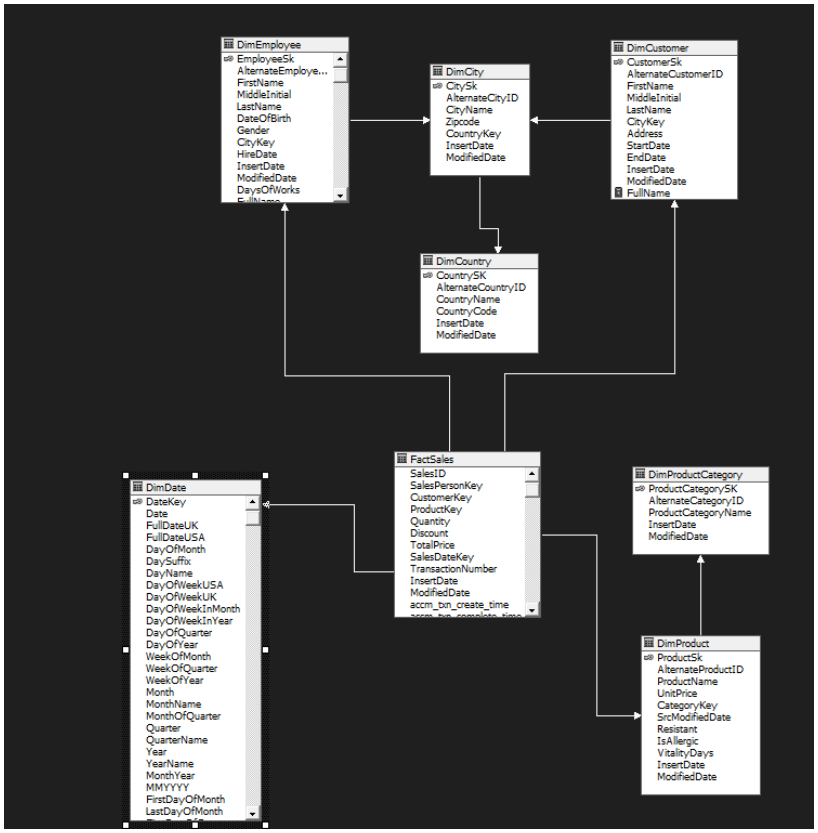


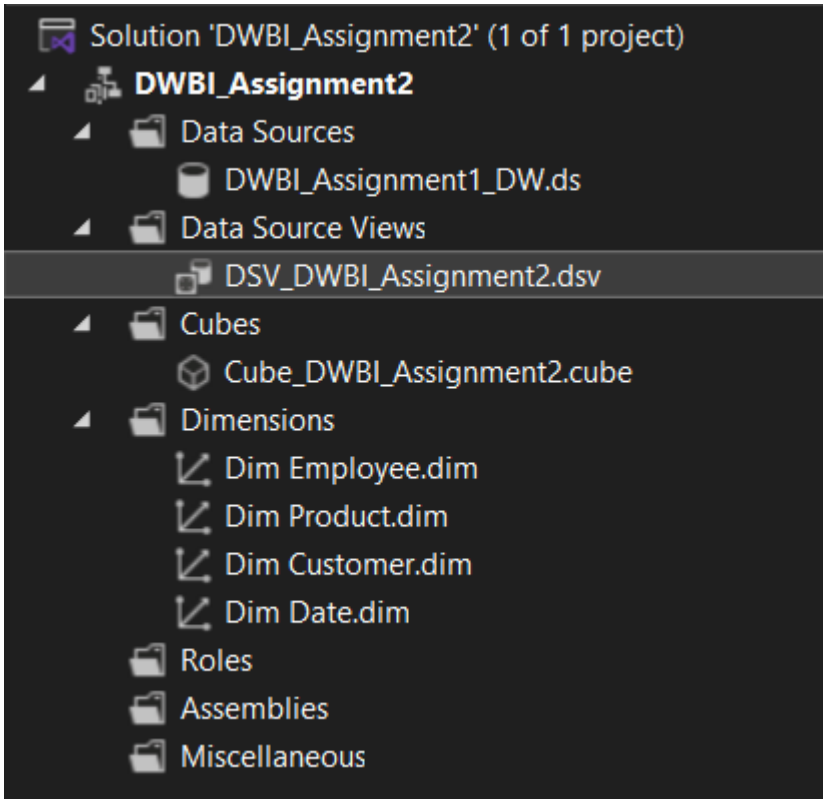


2.1.2 Creating the Data Source View

The analysis service can access only the data tables that are present in the data source view. Hence, we create the data source view using the data source that was created above.

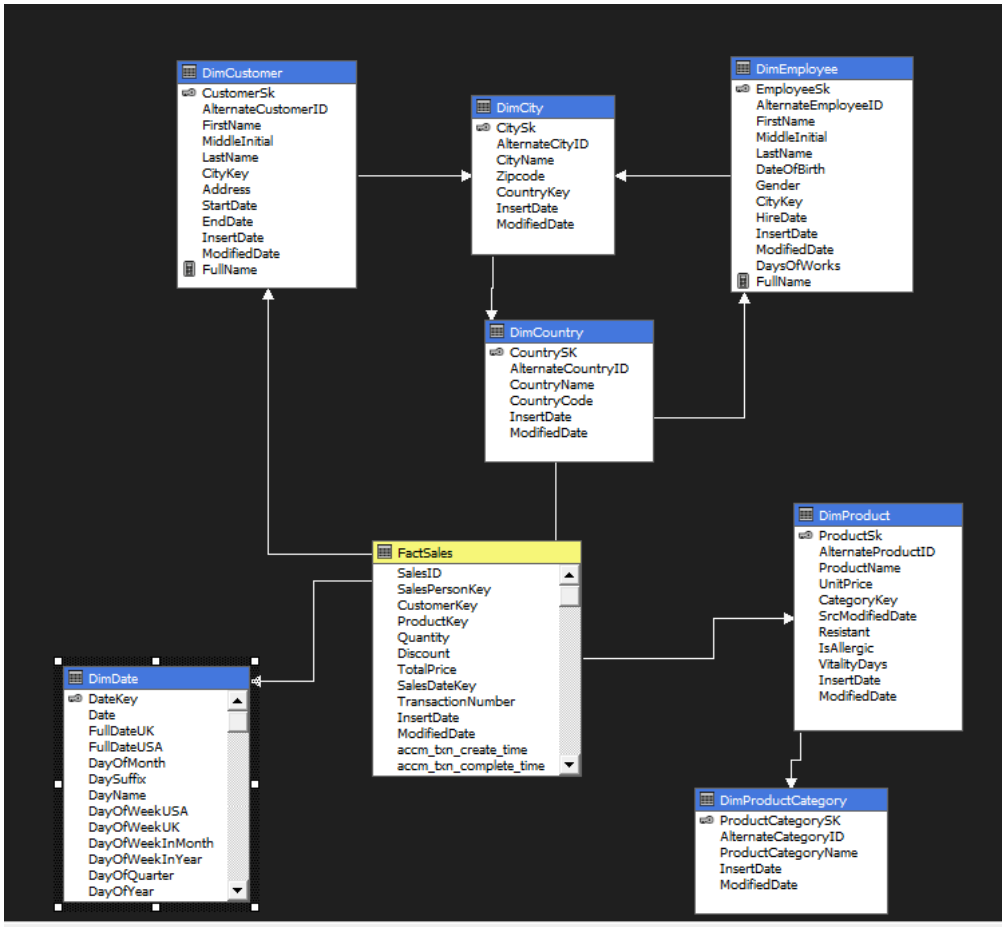
Using the data source view the created data source was selected, then the utilizing relations are selected, and the data source view is created by giving a proper name.


DimEmployee
EmployeeSk
AlternateEmploye...
FirstName
MiddleInitial
LastName
DateOfBirth
Gender
CityKey
HireDate
InsertDate
ModifiedDate
DaysOfWorks
DimCity
CitySk
AlternateCityID
CityName
Zipcode
CountryKey
InsertDate
ModifiedDate
DimCustomer
CustomerSk
AlternateCustomerID
FirstName
MiddleInitial
LastName
CityKey
Address
StartDate
EndDate
InsertDate
ModifiedDate
FullName
DimCountry
CountrySK
AlternateCountryID
CountryName
CountryCode
InsertDate
ModifiedDate
DimDate
DateKey
Date
FullDateUK
FullDateUSA
DayOfMonth
DaySuffix
DayName
DayOfWeekUSA
DayOfWeekUK
DayOfWeekInMonth
DayOfWeekInYear
DayOfQuarter
DayOfYear
WeekOfMonth
WeekOfQuarter
WeekOfYear
Month
MonthName
MonthOfQuarter
Quarter
QuarterName
Year
YearName
MonthYear
MMYYYY
FirstDayOfMonth
LastDayOfMonth
FactSales
SalesID
SalesPersonKey
CustomerKey
ProductKey
Quantity
Discount
TotalPrice
SalesDateKey
TransactionNumber
InsertDate
ModifiedDate
accm_txn_create_time
DimProductCategory
ProductCategorySK
AlternateCategoryID
ProductCategoryName
InsertDate
ModifiedDate
DimProduct
ProductSk
AlternateProductID
ProductName
UnitPrice
CategoryKey
SrcModifiedDate
Resistant
IsAllergic
VitalityDays
InsertDate
ModifiedDate


Solution 'DWBI_Assignment2' (1 of 1 project)
DWBI_Assignment2
Data Sources
DWBI_Assignment1_DW.ds
Data Source Views
DSV_DWBI_Assignment2.dsv
Cubes
Cube_DWBI_Assignment2.cube
Dimensions
Dim Employee.dim
Dim Product.dim
Dim Customer.dim
Dim Date.dim
Roles
Assemblies
Miscellaneous

2.1.3 Creating the Cube

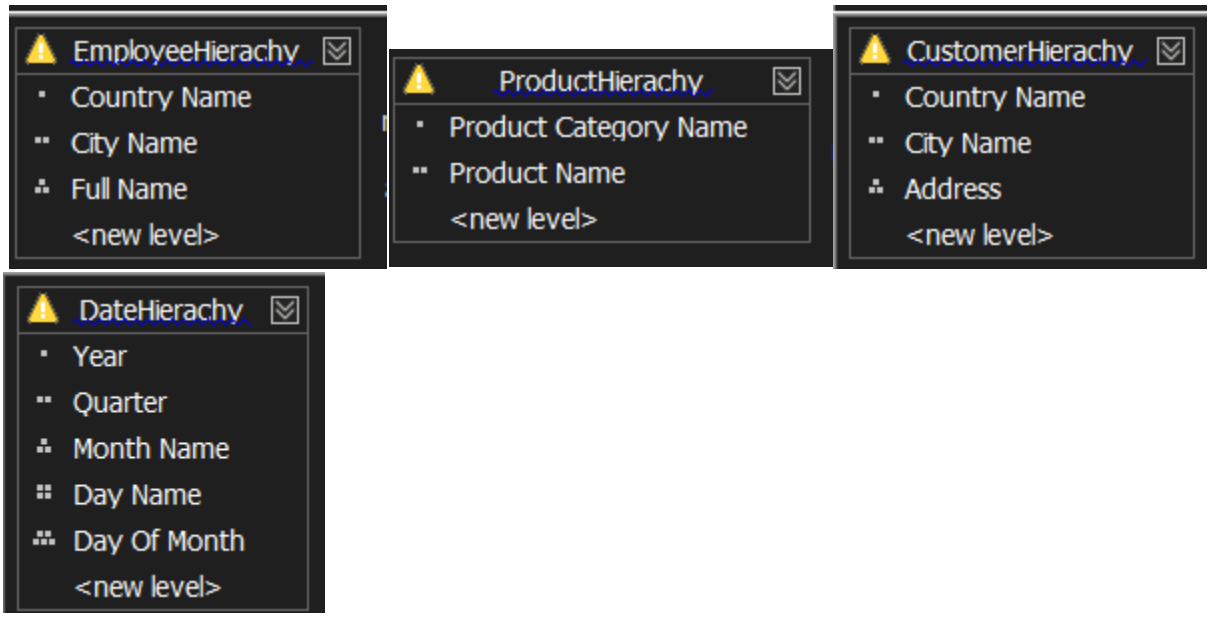
The data source view created in the last step has been used to develop the cube. In the cube wizard, use the existing tables option was selected first. Next, Fact Sales was selected for measure group table. Moreover, dimension tables were selected. Finally, the cube was given a proper name.



2.1.4 Creating Hierarchies and Dimension Structures

After the cube has been created, the dimensions will be present in the **Dimension's** directory of the solution explorer. Then the attributes of the dimensions must be selected by dragging and dropping them into the attribute's column from the Data Source View column. Similarly, the hierarchies can be setup by dragging and dropping the hierarchy attributes from the attributes column into the hierarchy column in the same window. The **Top-level** attribute should be added first in the hierarchy. E.g.-: Year > Quarter > Month > Week > Day

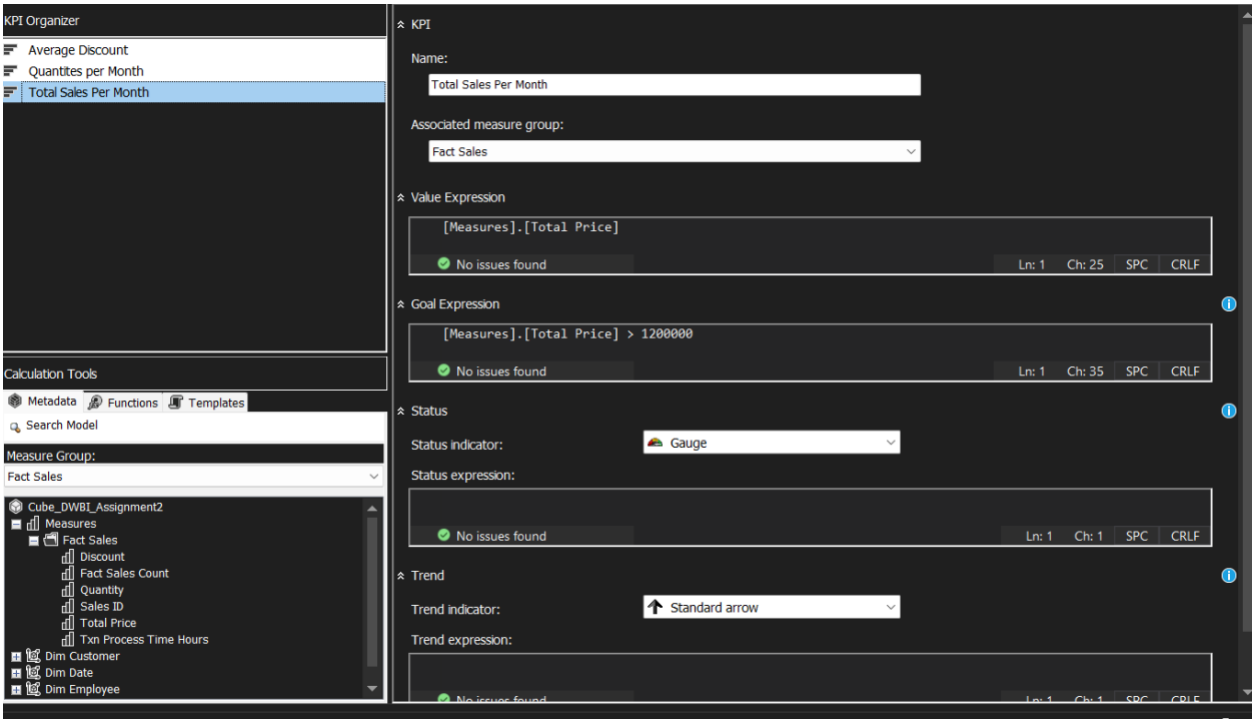
This process is repeated for all dimensions.



2.1.5 Creating KPIs

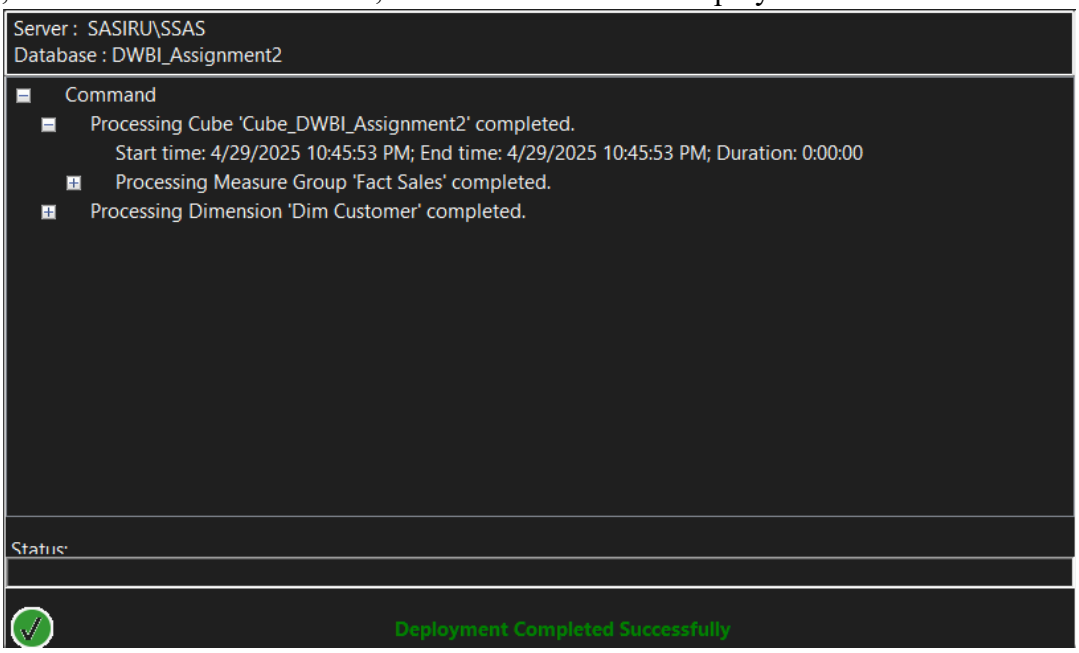
KPIs or Key Performance Indicators, are a quantitative assessment of performance for a specific objective. KPIs provide teams with objectives to aspire towards, milestones to measure progress, and insights to help everyone in the organization make better decisions.

In this scenario KPIs have been created for Total Sales, Quantities sold and discounts.



2.1.6 Deploying the Cube

Finally, after all the above was done, the finalized cube was deployed.



3 Demonstration of OLAP Operations

Online Analytical Processing (OLAP) is a technology designed for efficient querying and analysis of multidimensional data, enabling users to gain insights from large volumes of data stored across various databases.

There are 5 main OLAP operations:

1. Drill Down – Provides detailed data by navigating from less detailed data to more detailed data, allowing users to view data at a finer granularity.

2. Roll Up – Aggregates data by climbing up a hierarchy summarizing data at higher level.

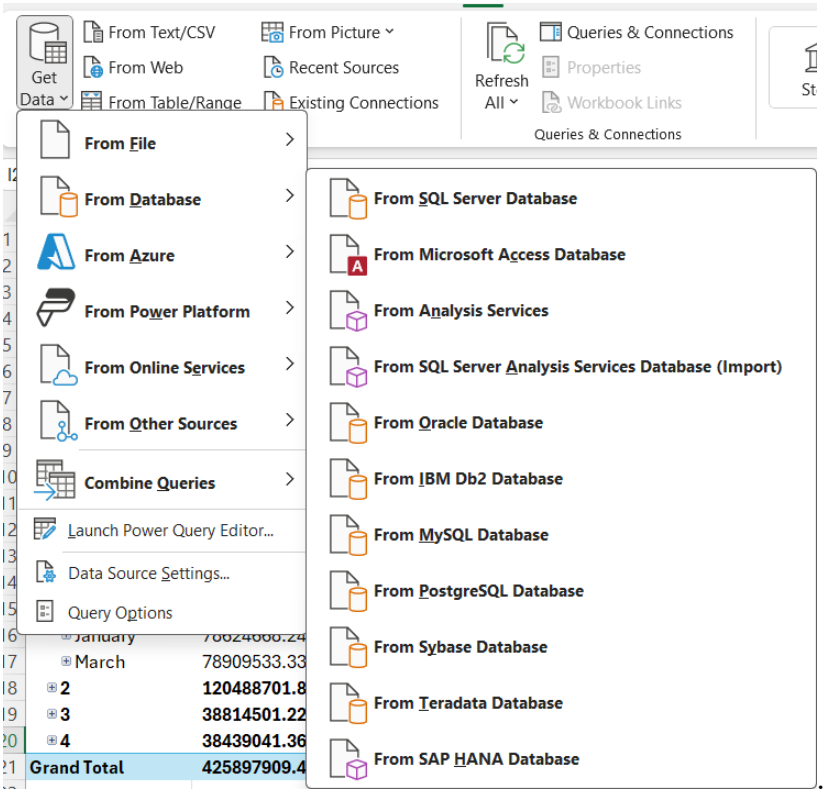
3. Slice – Extracts a subset of the data cube by fixing a single dimension, resulting a new sub cube.

4. Dice – Selects a sub cube by specifying ranges of multiple dimensions.

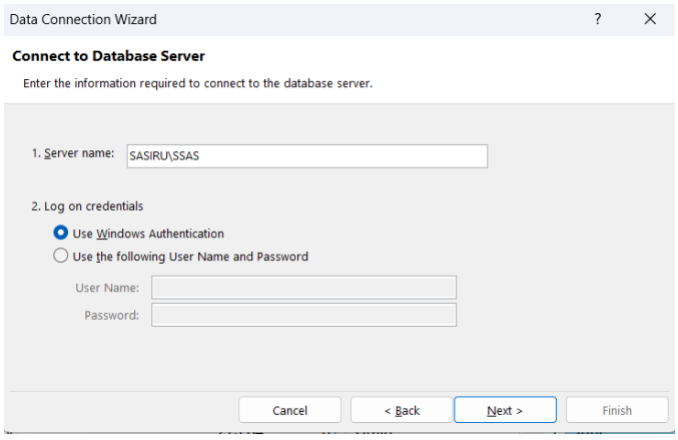
5. Pivot – This acts as a rotation operation, allowing users to rotate the data axes to provide an alternative presentation of data.

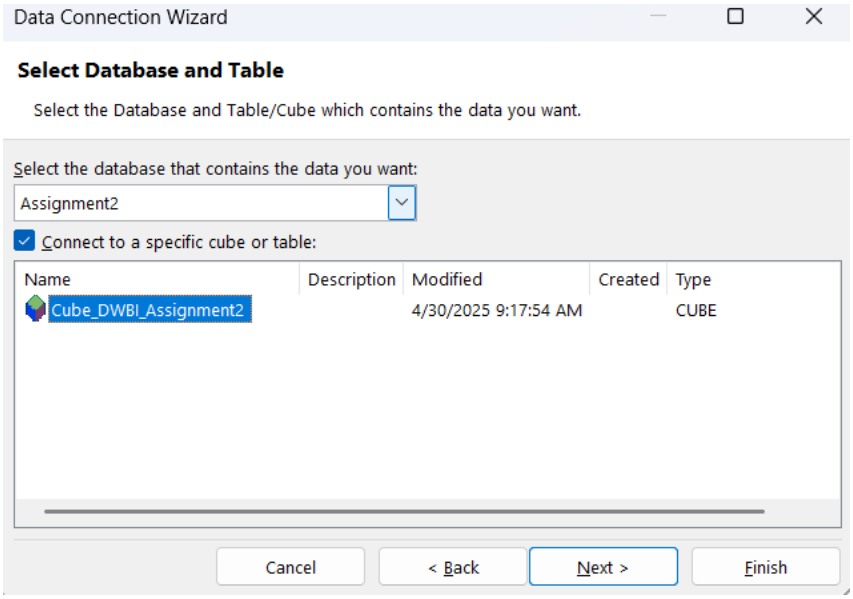
3.1 Connecting to the SSAS Cube

To apply the OLAP operations we must connect an Excel Workbook to the data in the cube. For this project, **Data Tab** in excel was used.



Data Tab > Get Data > From Database > From Analysis Services





3.2 OLAP Operations Demonstration Excel Report

3.2.1 Roll Up

Here the roll up operation is done for total sales and quantities have been rolled up according to customer hierarchy.

Row Labels	Total Price	Quantity
Aaron Avila	13159.02	195
Aaron Barry	5869.33	144
Aaron Berry	2826.45	63
Aaron Black	1737.27	28
Aaron Bray	6778.13	157

3.2.2 Drill Down

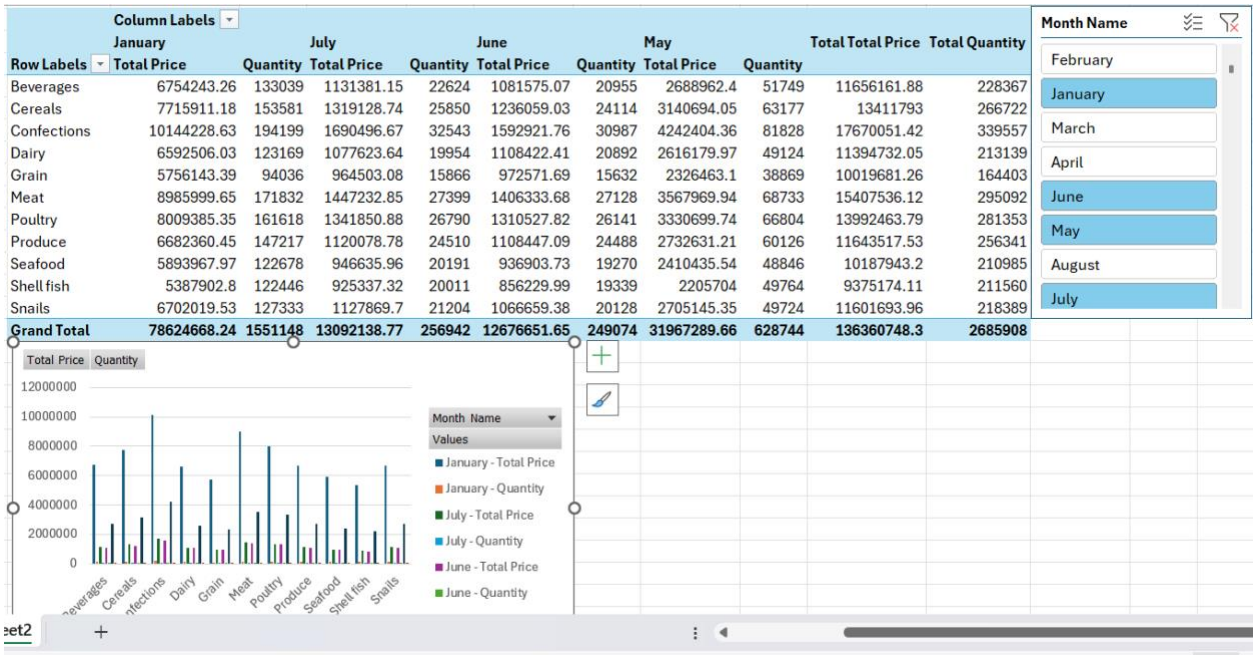
Here the drill down has been done for measures according to Customer and Year. When drilling down according to customer, for each customer, what products he/she had bought can be found. Furthermore, when drilling down according to date, in which quarter, in which month, on which weekday, and on which day can be found for analysis.

Row Labels	Total Price	Quantity
Aaron Avila	**13159.02**	**195**
Bar Mix - Pina Colada, 355 Ml	595.44	18
Beef - Inside Round	1787.76	18
Beef Ground Medium	984.42	18
Cookies Cereal Nut	1212.3	18
Crab - Dungeness, Whole	22.68	18
Hinge W Undercut	1474.2	18
Ice Cream Bar - Oreo Cone	1717.38	18
Lettuce - Spring Mix	1620.36	18
Pasta - Cheese / Spinach Bauletti	664.44	12
Smirnoff Green Apple Twist	1707.72	21
Wanton Wrap	1372.32	18
Aaron Barry	**5869.33**	**144**
Aaron Berry	**2826.45**	**63**
Aaron Black	**1737.27**	**28**
Apricots Fresh	163.38	3
Juice - Lime	275.34	3
Otomegusa Dashi Konbu	512.1	10
Rice - Long Grain	207.09	3
Soup Knorr Chili With Beans	287.1	3
Table Cloth 120 Round White	40.62	3
Yoghurt Tubes	251.64	3
Aaron Bray	**6778.13**	**157**

Row Labels	Total Price	Quantity
2018	**425897909.4**	**8383576**
1	**228155665**	**4496336**
February	70621463.42	1393547
Friday	**10109685.4**	**200160**
16	2571511.92	51171
2	2548015.75	49581
23	2493828.23	49304
9	2496329.5	50104
Monday	**10028987.77**	**198808**
12	2552572.69	50560
19	2548117.33	49766
26	2454734.99	49189
5	2473562.76	49293
Saturday	**10161356.89**	**198294**
Sunday	**10106598.34**	**200688**
Thursday	**10060483.66**	**198377**
Tuesday	**10035343.41**	**198545**
Wednesday	**10119007.95**	**198675**
January	78624668.24	1551148
March	78909533.33	1551641
2	**120488701.8**	**2366702**
April	75844760.53	1488884
June	12676651.65	249074
May	31967289.66	628744
3	**38814501.22**	**764158**
4	**38439041.36**	**756380**

3.2.3 Slice

Slicing has been done to obtain total sales and quantities of all product categories by Month.



Row Labels	January Total Price	January Quantity	July Total Price	July Quantity	June Total Price	June Quantity	May Total Price	May Quantity	Total Total Price	Total Quantity
Beverages	6754243.26	133039	1131381.15	22624	1081575.07	20955	2688962.4	51749	11656161.88	228367
Cereals	7715911.18	153581	1319128.74	25850	1236059.03	24114	3140694.05	63177	13411793	266722
Confections	10144228.63	194199	1690496.67	32543	1592921.76	30987	4242404.36	81828	17670051.42	339557
Dairy	6592506.03	123169	1077623.64	19954	1108422.41	20892	2616179.97	49124	11394732.05	213139
Grain	5756143.39	94036	964503.08	15866	972571.69	15632	2326463.1	38869	10019681.26	164403
Meat	8985999.65	171832	1447232.85	27399	1406333.68	27128	3567969.94	68733	15407536.12	295092
Poultry	8009385.35	161618	1341850.88	26790	1310527.82	26141	3330699.74	66804	13992463.79	281353
Produce	6682360.45	147217	1120078.78	24510	1108447.09	24488	2732631.21	60126	11643517.53	256341
Seafood	5893967.97	122678	946635.96	20191	936903.73	19270	2410435.54	48846	10187943.2	210985
Shell fish	5387902.8	122446	925337.32	20011	856229.99	19339	2205704	49764	9375174.11	211560
Snails	6702019.53	127333	1127869.7	21204	1066659.38	20128	2705145.35	49724	11601693.96	218389
Grand Total	**78624668.24**	**1551148**	**13092138.77**	**256942**	**12676651.65**	**249074**	**31967289.66**	**628744**	**136360748.3**	**2685908**

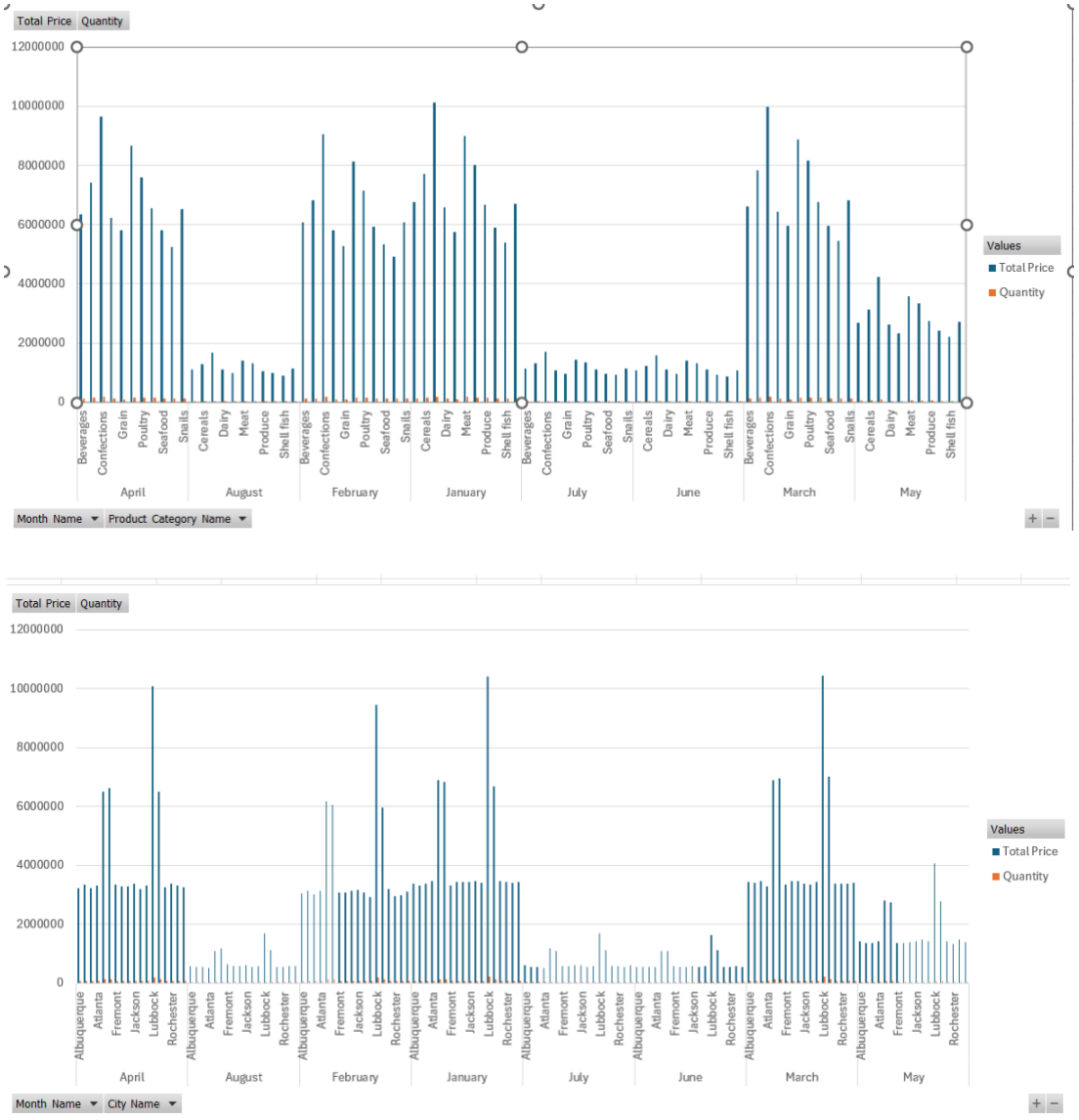
3.2.4 Dice

Here dicing is done to get a sub-cube which can be used to visualize the measures according to the selected city and month.

City Name	Albuquerque	
Month Name	May	
Row Labels	**Total Price**	**Quantity**
Aaron Wyatt	**2615.5**	**50**
Rosemary - Primerba, Paste	1556.5	25
Wine - Wyndham Estate Bin 777	1059	25
Abel Bradley	**562.8**	**6**
Wine - Gato Negro Cabernet	562.8	6
Abel Huber	**16.73**	**7**
Beef - Striploin Aa	16.73	7
Alberto Ayala	**620.8**	**16**
Sauce - Rosee	620.8	16
Alejandro Rivers	**2286.07**	**36**
Ecolab - Lime - A - Way 4/4 L	280.93	13
Rambutan	2005.14	23
Alfred Salinas	**1.36**	**2**
Sole - Dover, Whole, Fresh	1.36	2
Alicia Hughes	**210.24**	**8**
Onions - Vidalia	210.24	8
Alisa Beasley	**28.56**	**4**
Appetizer - Mini Egg Roll, Shrimp	28.56	4
Alisha Beltran	**892.92**	**12**
Cheese - Wine	892.92	12
Alisha Dickson	**925.2**	**20**
Milk - 1%	925.2	20
Alisha Jefferson	**955.51**	**19**

3.2.5 Pivot

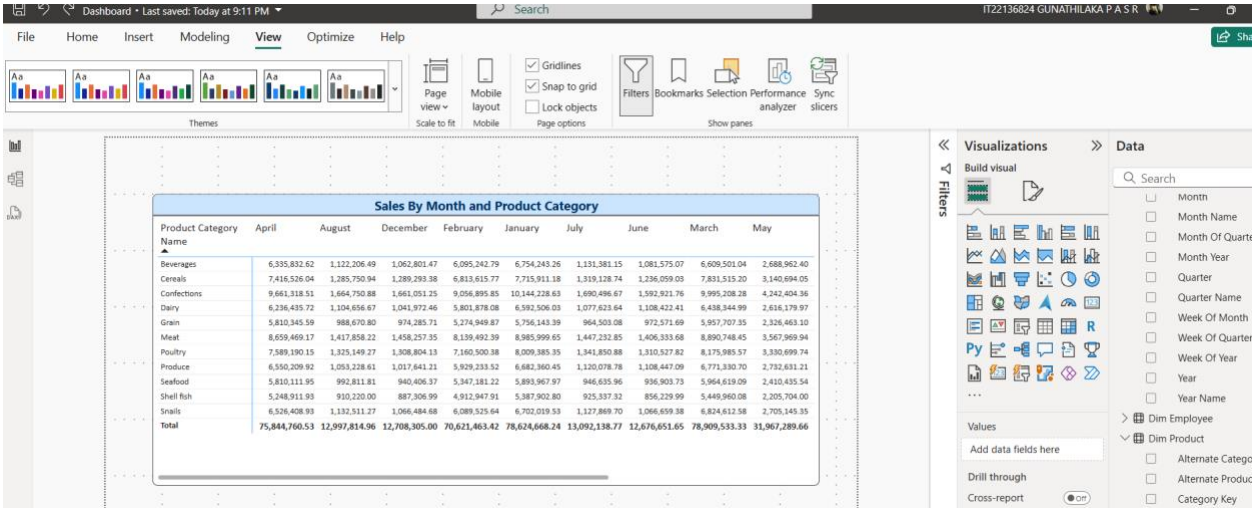
Here the sub-cube has been pivoted among the year, city and product category dimensional axis accordingly to get a newer views of the total sales from various perspectives. First the total sales are seen according to Month and Product Category. Next, total sales are seen according to Month and City.



4 Power BI Reports

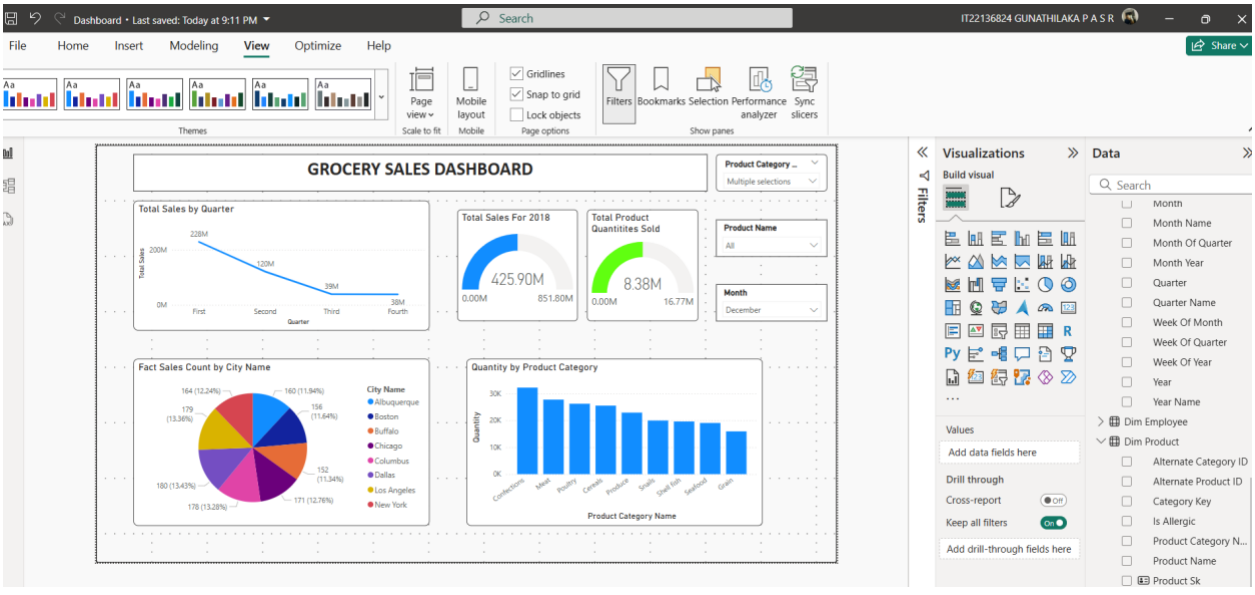
4.1 Report with Matrix Visualization

A matrix is like a table, except it is set up to display data in columns and rows, with aggregated data at the intersections.



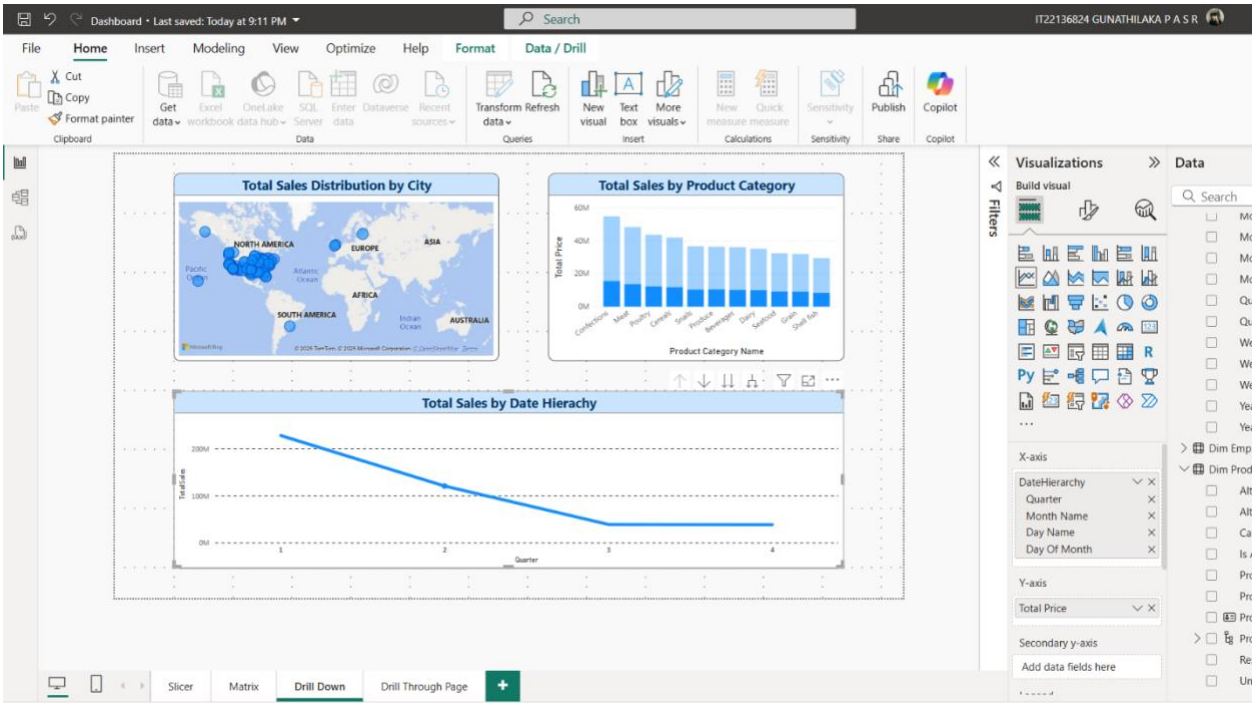
4.2 Report with Slicers (Cascading slicers)

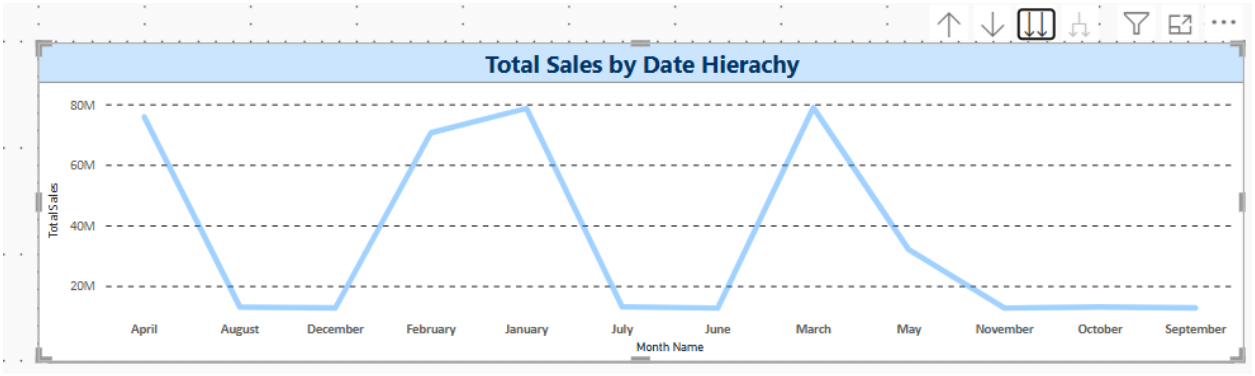
Slicer is an interactive visual that filters data displayed in reports and dashboards. It allows users to filter visuals by selecting values from slicers.

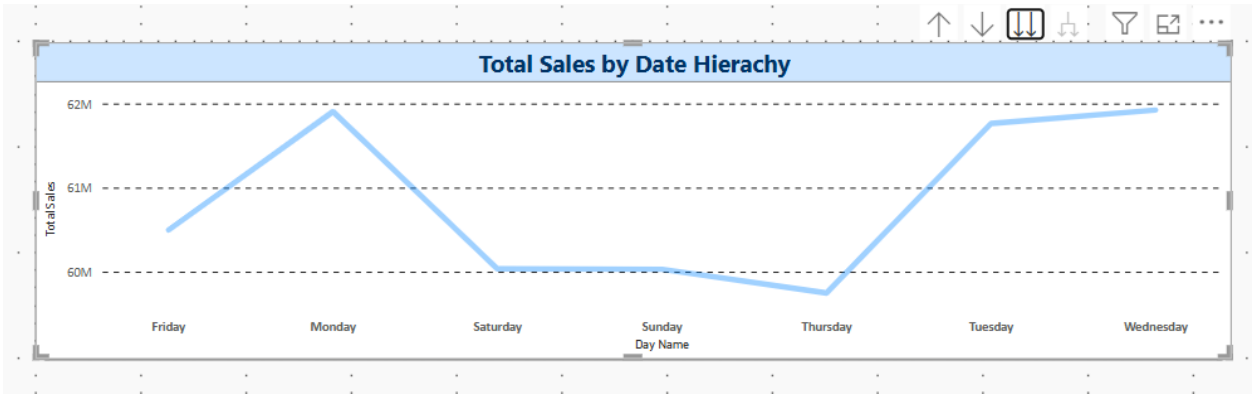


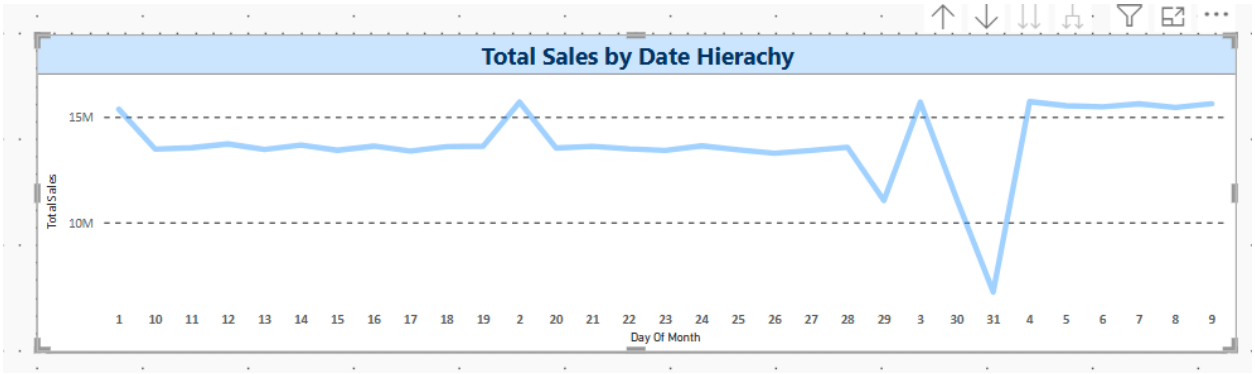
4.3 Report with Drill Down

Drill down has been implemented on a line chart where drill down can be done from quarter, to month, to weekday and finally to the exact date.





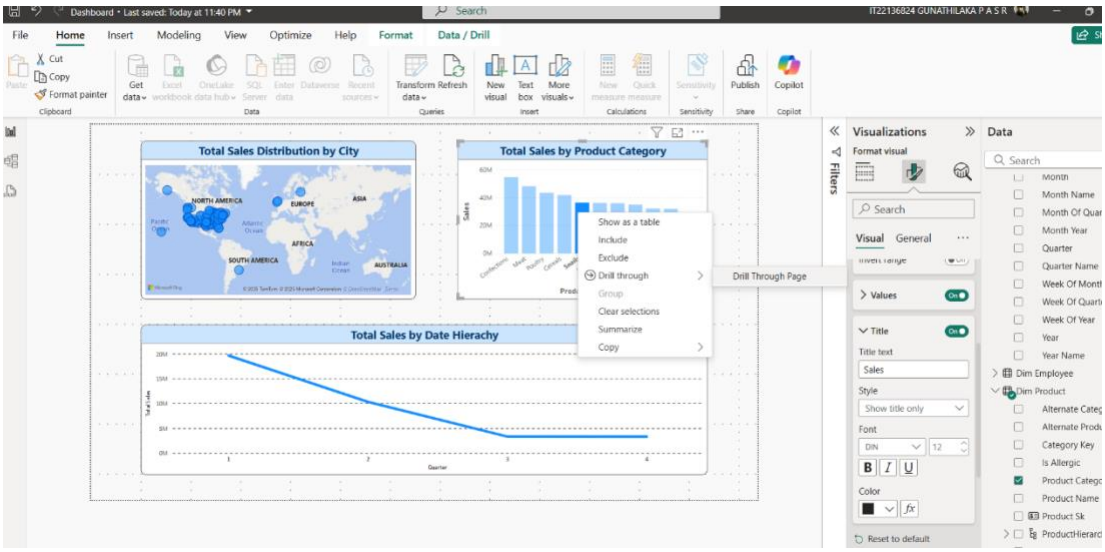




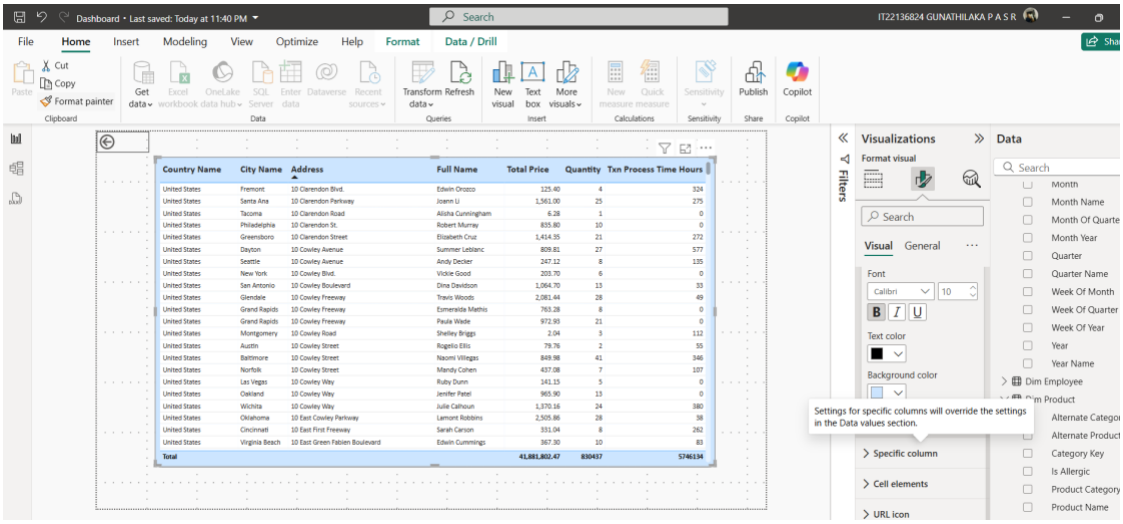
4.4 Report with drill through

A Drill-through is one that a user may get by clicking a link in another report. Drill-through reports provide more information on an item included in the initial summary report.

- The first report contains a column chart that summarizes sales by product category.
- The consumer can right click on a column bar, click drill through and select the respective drill through page which shows detailed information of sales of that product category.



Drill-through page contains information of the country, city, customer name, total price, quantity and transaction process time details.



Finally, the dashboard can be published on Power BI service and the stakeholders can analyze them to take data driven decisions.