Sri Lanka Institute of Information Technology

Assignment 2

Data Warehouse & Business Intelligence

2022

Submitted by:

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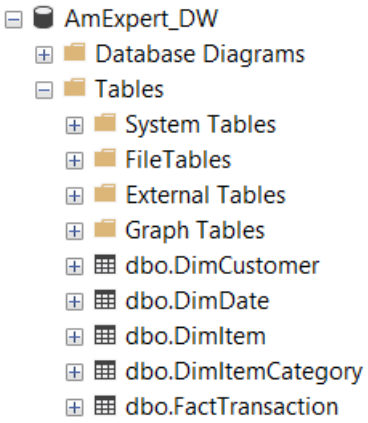
1. Data Source Introduction

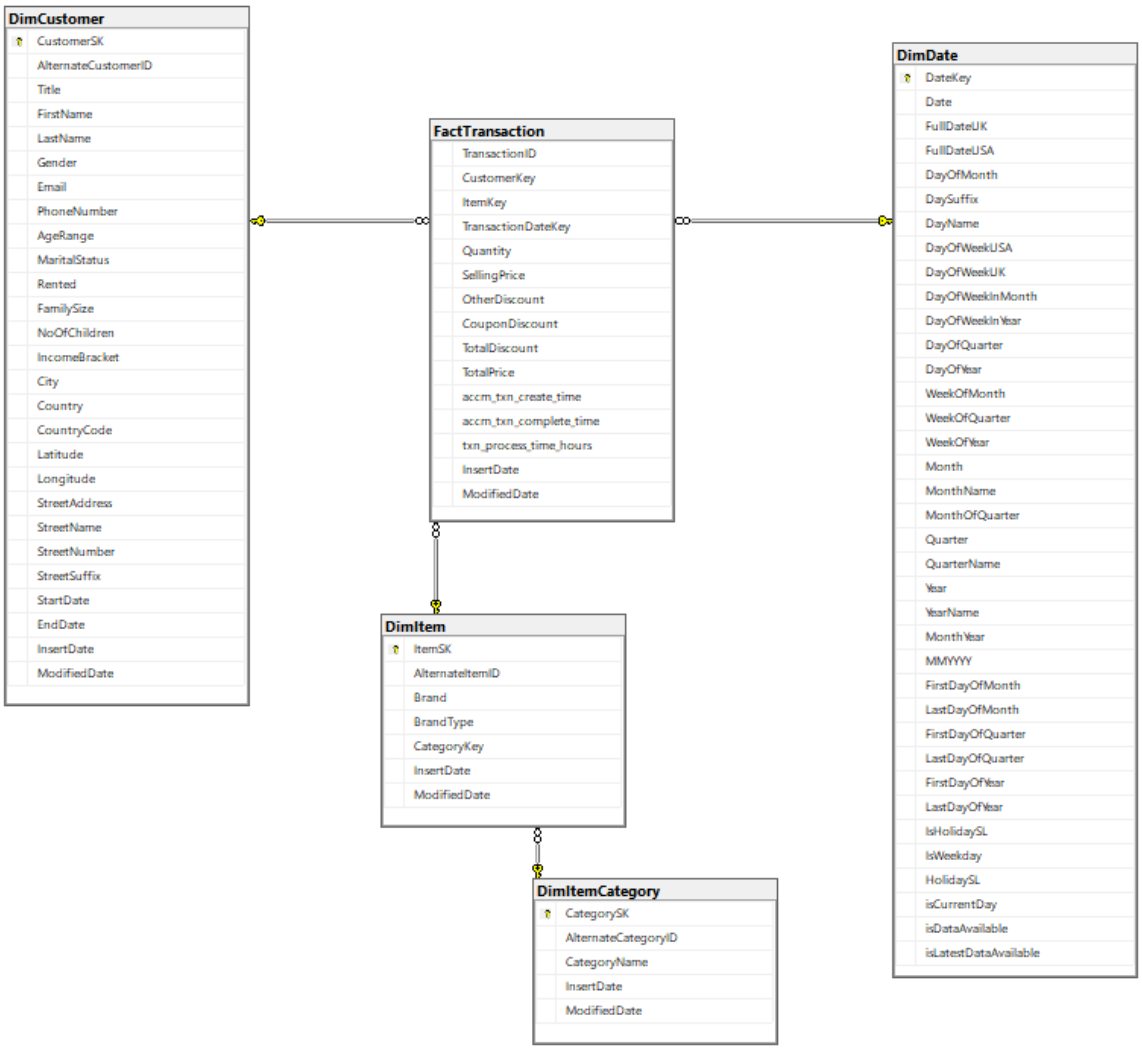
The 'AmExpert Datawarehouse', which is the data warehouse I developed on assignment one, is the data source here. It contains 1.3 million sales records from 2012 to 2013. For assignment one, I made some adjustments to the data set derived from the source.

Using my scenario, I separated my data set into four dimension tables (including the Date dimension) and one fact table. My tables were DimCustomer, DimItem, DimItemCategory, DimDate, and FactTransaction, as previously stated.

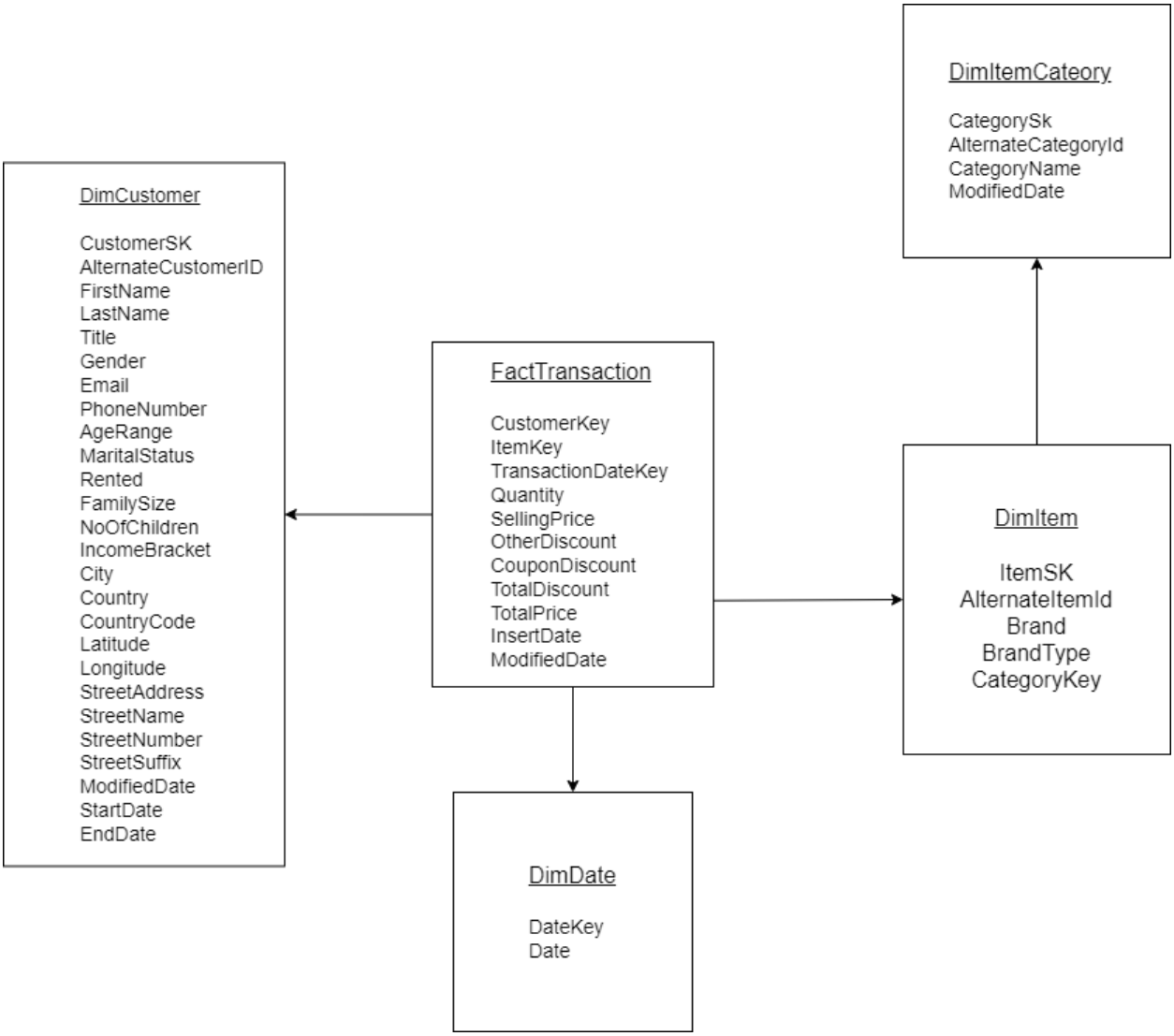
I. Data Source – AmExpert_DW



II. ER Diagram



III. Snow-flake Schema



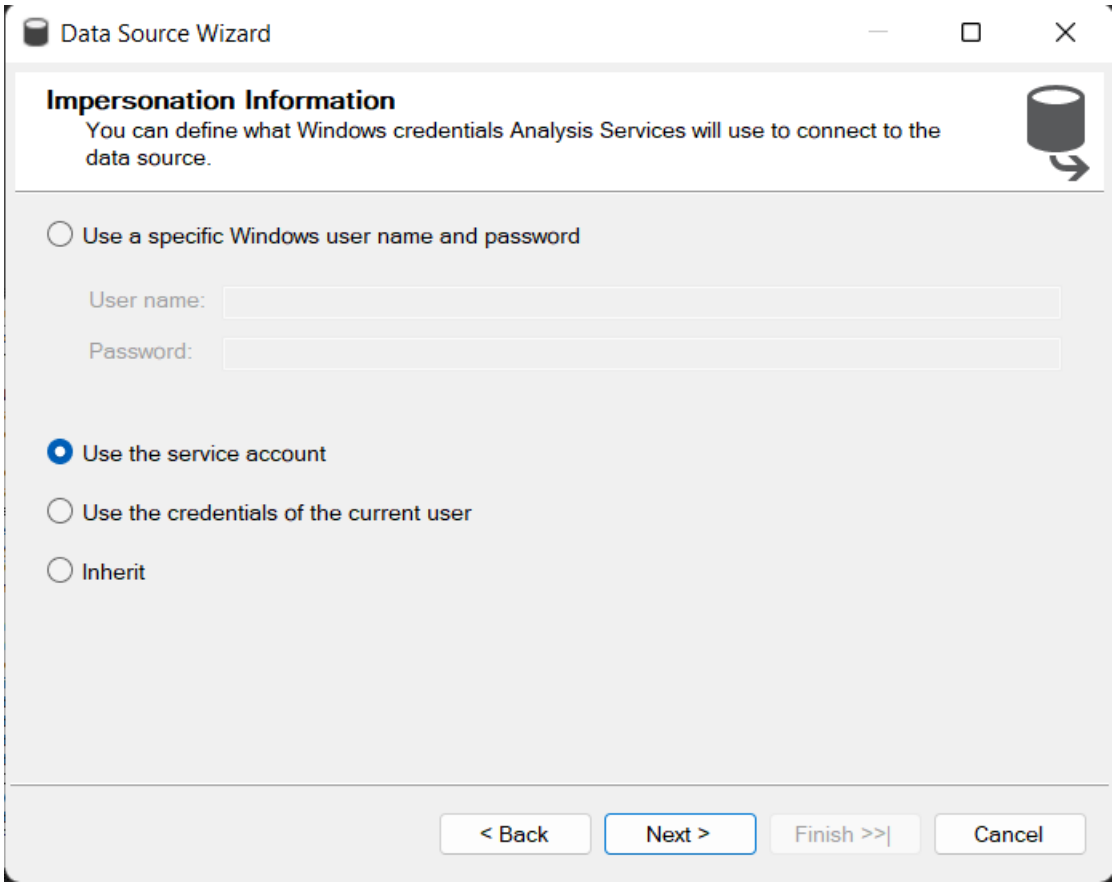
2. Cube Implementtion

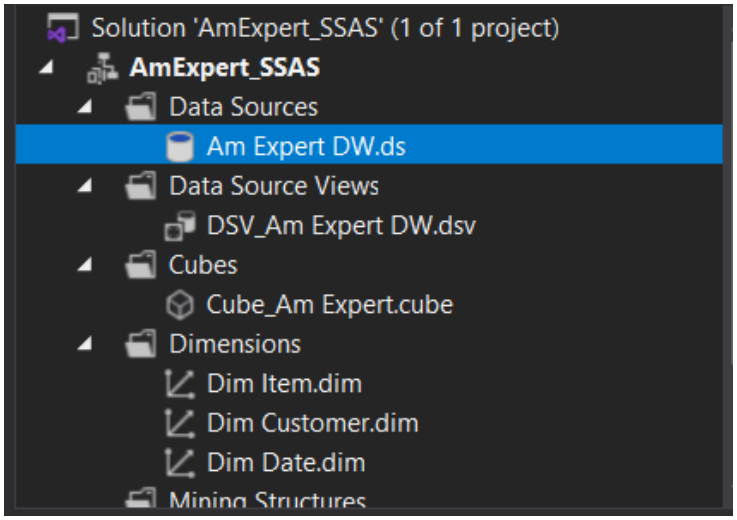
The OLAP cube is a multi-dimensional data storage mechanism. This multi-dimensional cube is used to perform analysis. I used SQL Server Data Tools in this approach. A cube's fundamental components are its dimensions and measurements. There are two major facts to consider.

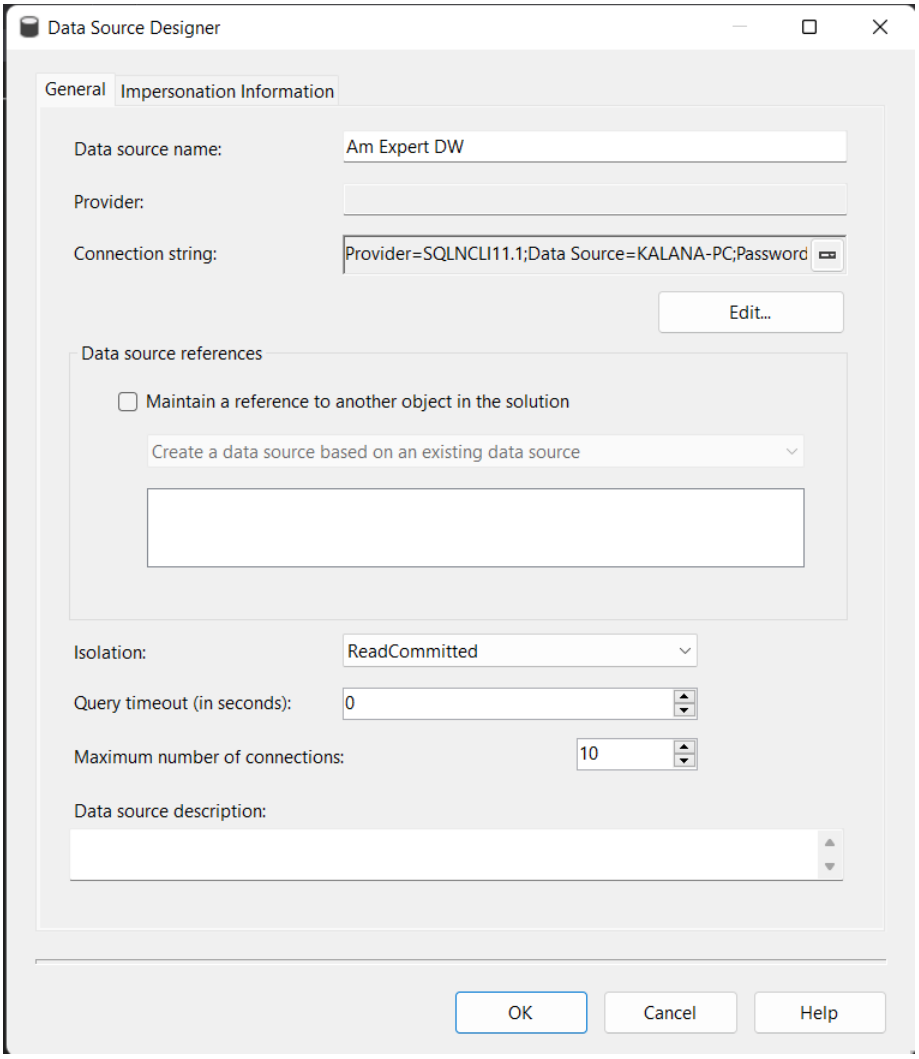
- **Dimensions:** Define the structure of the cube.
- **Measures:** Provide the end user with aggregated numerical values of interest.

2.1. Data Source Creation

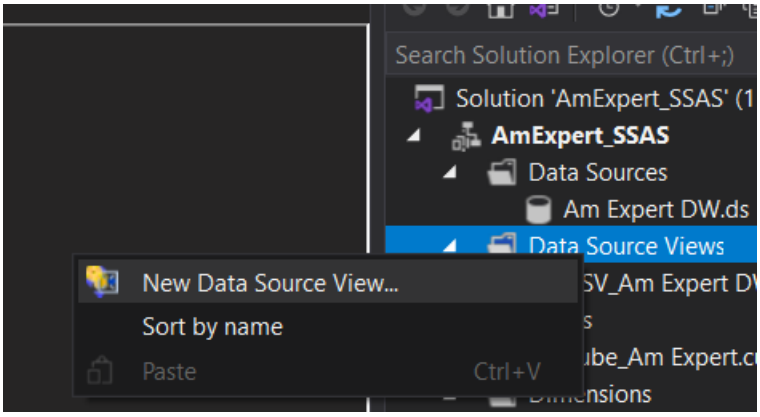
The 'AmExpert' database was connected to the data source via SQL Server Management Studio using the service account for connecting to SQL Server Management Studio.



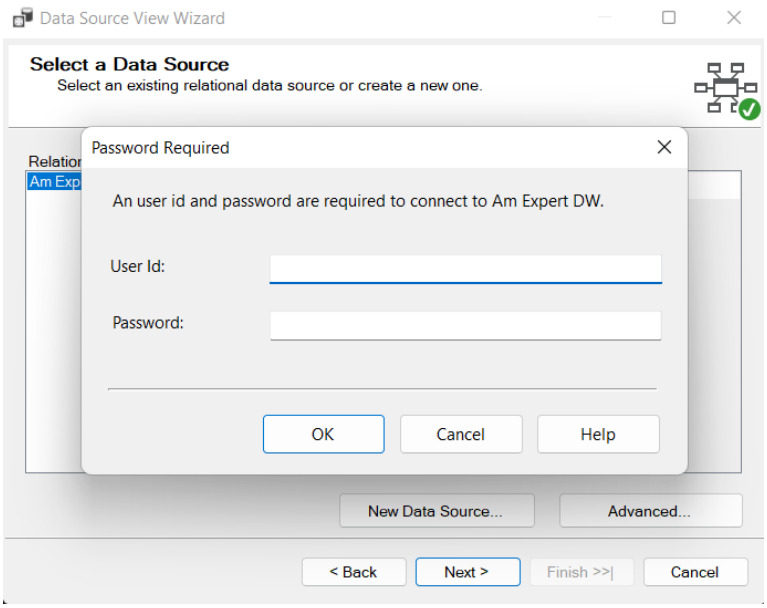

Solution 'AmExpert_SSAS' (1 of 1 project)
AmExpert_SSAS
Data Sources
Am Expert DW.ds
Data Source Views
DSV_Am Expert DW.dsv
Cubes
Cube_Am Expert.cube
Dimensions
Dim Item.dim
Dim Customer.dim
Dim Date.dim
Mining Structures


Data Source Designer
General
Impersonation Information
Data source name:
Am Expert DW
Provider:
Connection string:
Provider=SQLNCLI11.1;Data Source=KALANA-PC;Password
Edit...
Data source references
Maintain a reference to another object in the solution
Create a data source based on an existing data source
Isolation:
ReadCommitted
Query timeout (in seconds):
0
Maximum number of connections:
10
Data source description:
OK
Cancel
Help

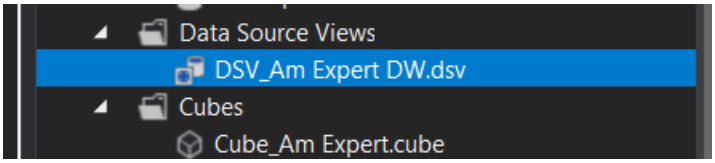
2.2. Data Source Views Creation



Right Click on the Data Source Views and select New Data Source View. And proccede with guiding

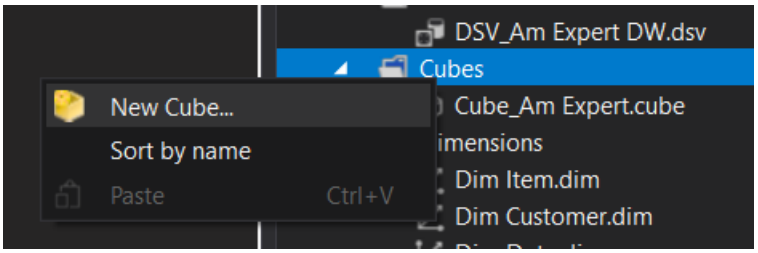


If you choose service account as connection type, this screen prompted. Enter your credentials and proccede forward

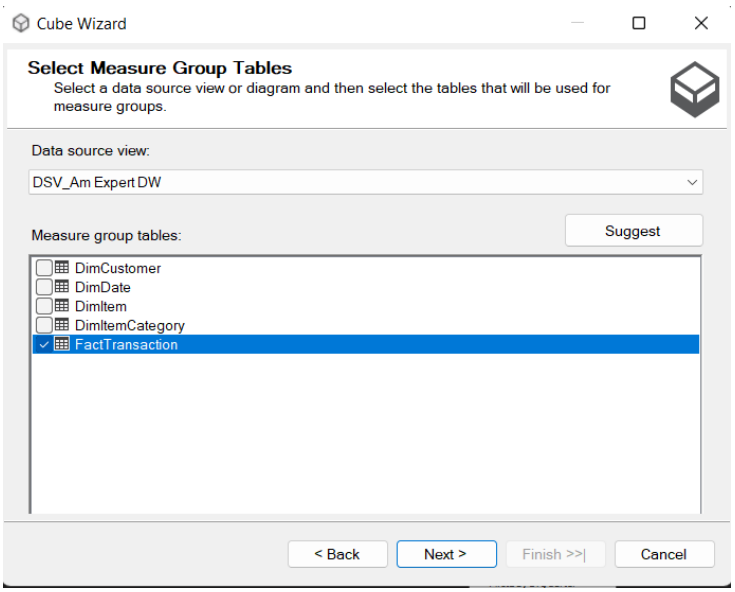


2.3. Cube Creation

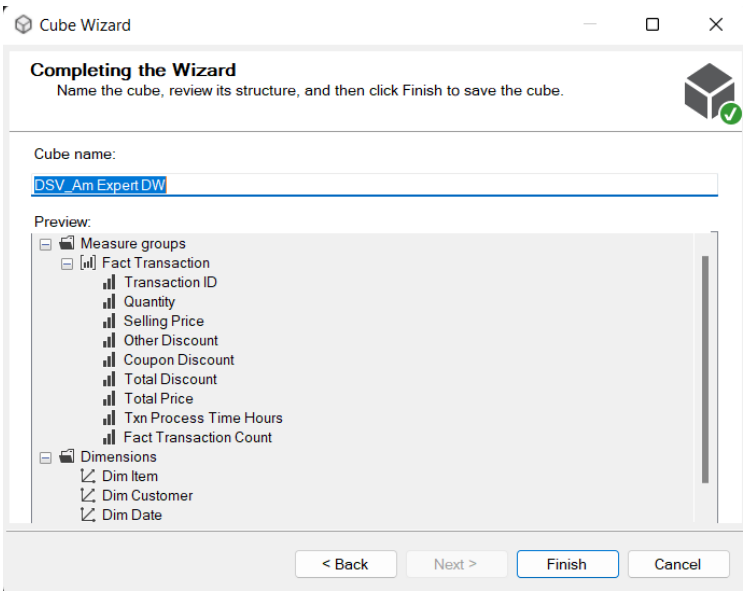
The cube was created using data source view in this case. To build the cube, we can use an existing data source. FactTransaction is a fact table that provides all of the included metrics for the analysis process. FactTransaction is a measure group, while DimDate, DimCustomer, and DimItem are dimensions.



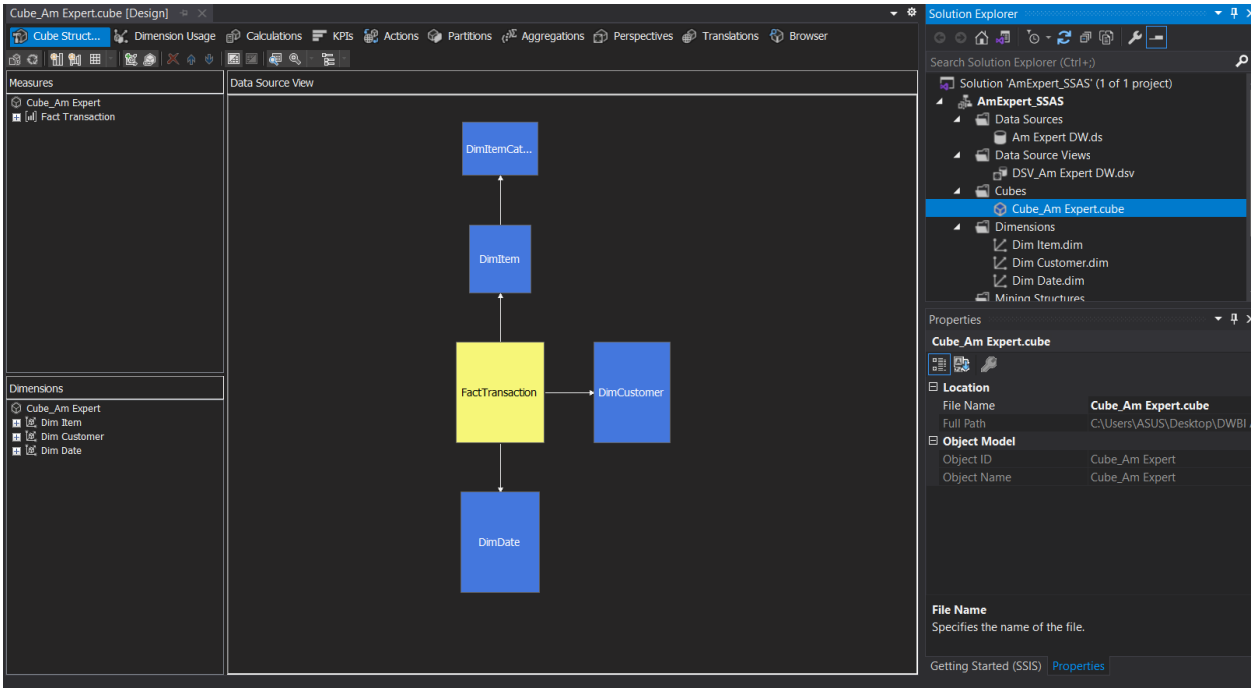
Right Click on the Cubes and select New Cube. And proccede with guiding



Select Measure Group. In our case FactTransaction and proccede forward



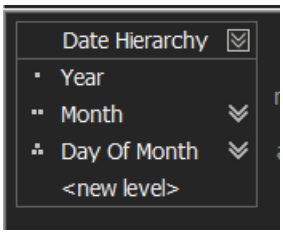
Give a name for the cube and click finish

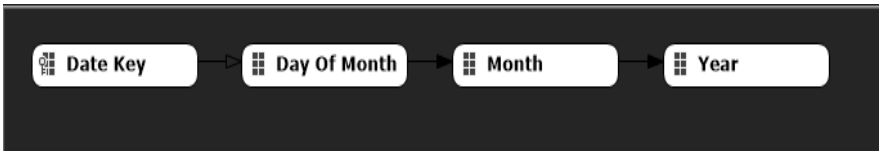


2.4. Hierarchies Creation

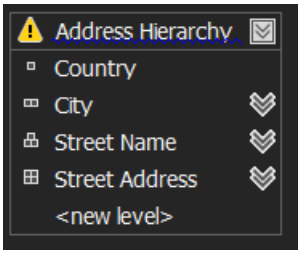
Hierarchies are used reduce complexity and normalized tables. This will use to drill down behavior

- **Date Hierarchy**



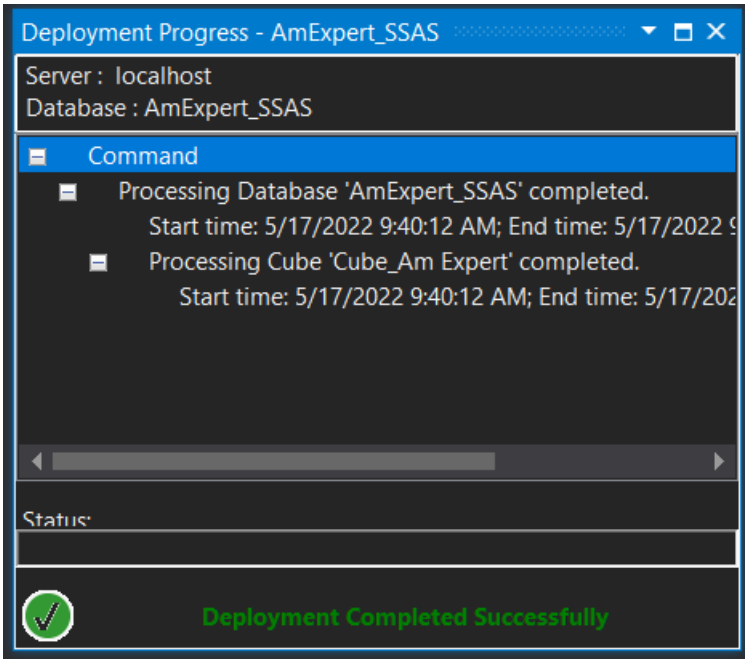


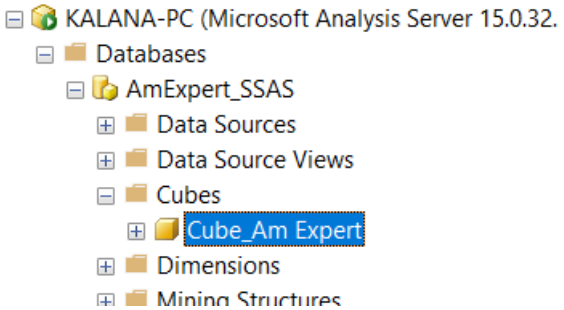
- **Address Hierarchy**



2.5. Deploy the Cube

To be used for analysis, the cube must be deployed. When you try to deploy at this point, having proper connection details will take effect. SSAS Cube will be available for analysis under the SSAS database via SSMS once it has been deployed.





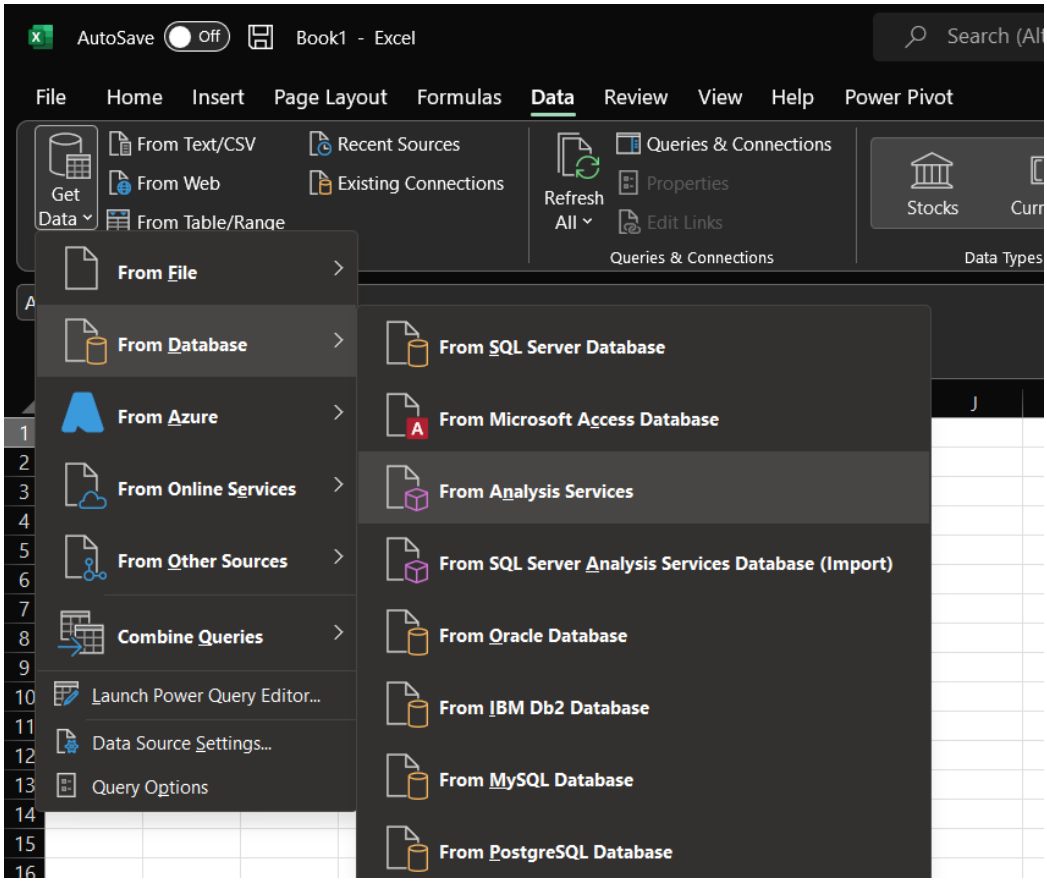
Cube after deployed into SSAS

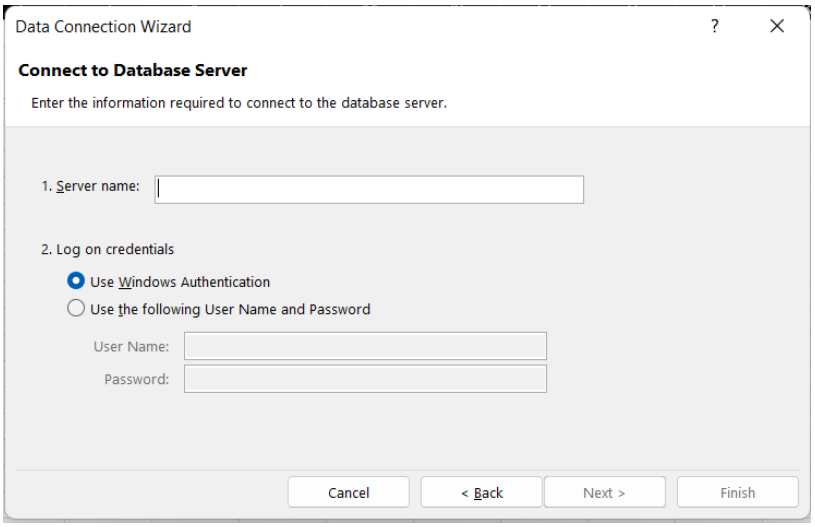
3. Demonstration of OLAP Operations

Many Business Intelligence (BI) Applications use the technology of Online Analytical Processing (OLAP). This will also provide significant data mining and trend analysis capabilities. The capacity to archive "Fast access to exchange multidimensional information" has been termed as OLAP technology.

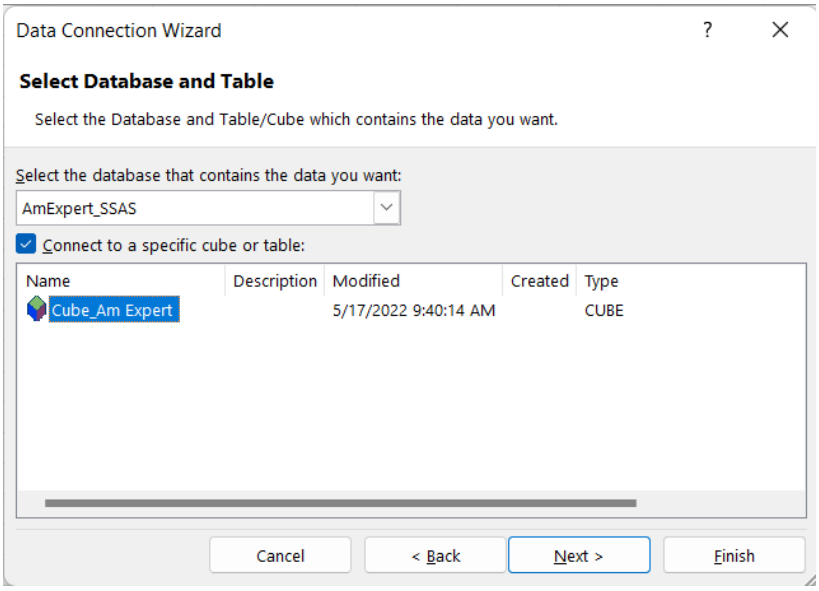
3.1. Cube Connection

Data ➔ Get Data ➔ From Database ➔ From Analysis Services

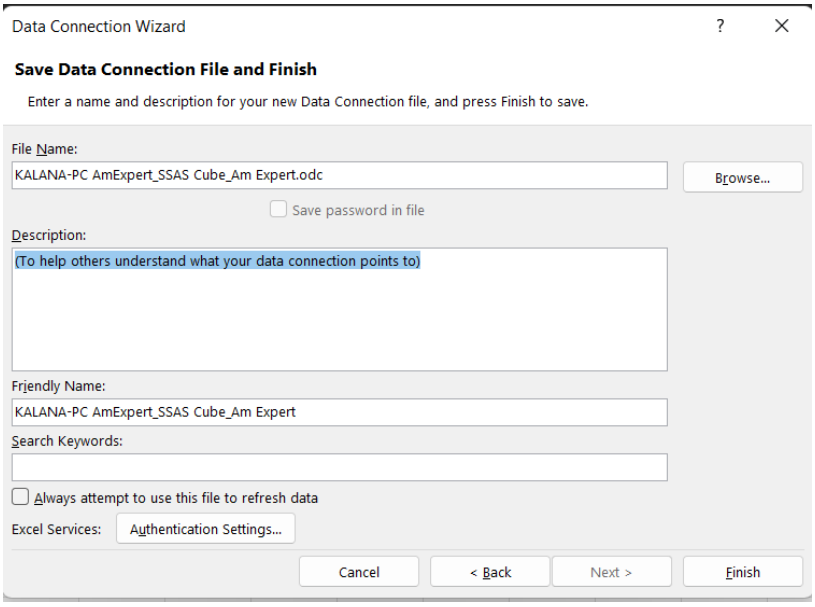




Provide server name and Login credintials



Select Database and Cube



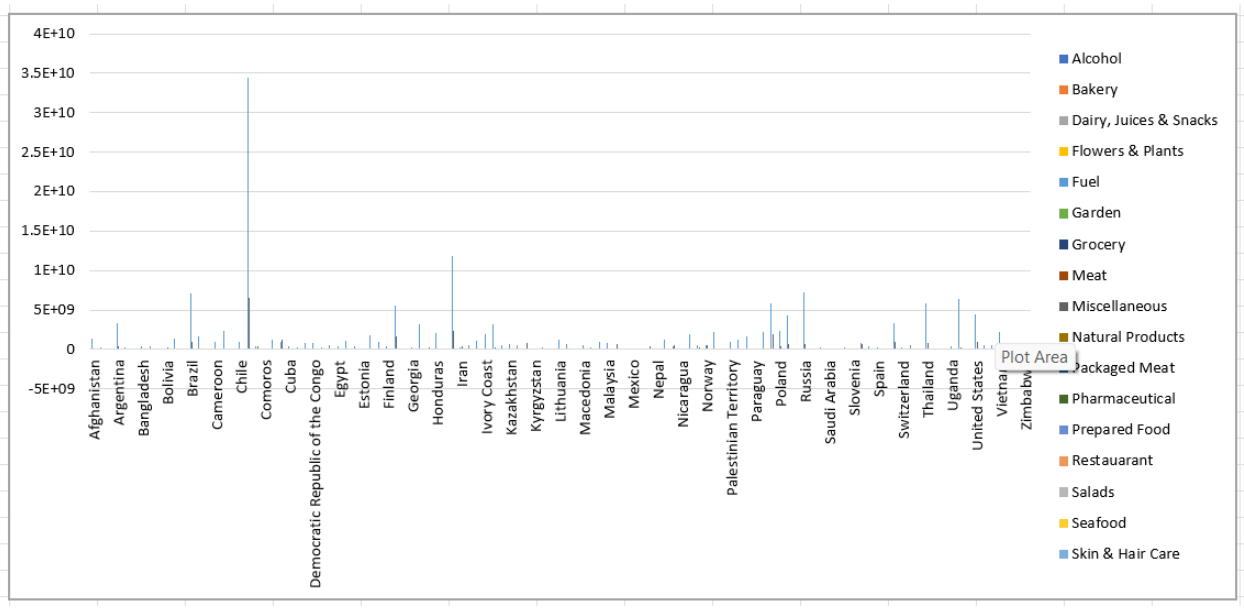
Finish Configuration

3.2. Roll Up

To aggregate data, climb up a dimension hierarchy or reduce dimensions. This is also known as aggregation or consolidation.

According to my scenario I have used category wise total sales amount in different countries by cities

Location	Product Category Name: Alcohol	Bakery	Dairy, Juices & Snacks	Flowers & Plants	Fuel	Garden
Afghanistan	427.08	39254.08	26408.98	6352.44	1346332358	568.5
Albania	1342.52	12921.49	1651.71	1940.57	246971813.2	579.89
Angola	594.14	12349.07	8175.02	2418.56	22606477.42	
Argentina	1918.48	32572.83	25068.05	5658.92	3284747067	5934.64
Armenia		12996.62	1082.51		221639682.1	
Australia		8867.9	8233.53	3417.02	46485021.73	355.84
Bangladesh		3588.37	1404.87		341638514.4	
Belarus		6057.85	9044.16	462.34	465743598.2	
Benin		5761.17	489.42		80196134.3	
Bolivia		1837.27			15751743.46	
Bosnia and Herzegovina		20625.98	9225.08	2027.12	1405895852	18214.64
Botswana	1779.56	2386.85	1613.93	355.84	20100761.79	



3.3. Drill Down

Stepping down a dimension's hierarchy allows for navigating across details. Data is broken down into smaller chunks. It's the opposite of the roll-up approach.

According to my scenario I have used category wise total sales amount in different countries by year

	Product Category Names						
Location	Alcohol	Bakery	Dairy, Juices & Snacks	Flowers & Plants	Fuel	Garden	G
⊞ Afghanistan	427.08	39254.08	26408.98	6352.44	1346332358	568.5	
⊞ Albania	1342.52	12921.49	1651.71	1940.57	246971813.2	579.89	
⊟ Angola							
⊟ 2012							
January							
February		1281.96	399.65				
March		-0.36	262.88				
April			1510.63		6708425.98		
May		287.45	1379.45				
June		889.78	297.78	142.12			
July	131.44	756.56	159.22	426.72			
August		627.97					
September		1103.15	60.2		7615836.21		
October		106.5	131.44		1488116.1		
November		497.62	163.53				
December		837.45	227.25	1565.48			
⊞ 2013	462.7	5960.99	3582.99	284.24	6794099.13		
⊞ Argentina	1918.48	32572.83	25068.05	5658.92	3284747067	5934.64	

3.4. Slice

An OLAP data cube slice represents two or more dimensional views. A slice is similar to a report or a query. Then we can ask for the information we require.

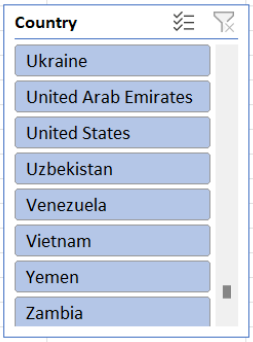
Category Name	Year 2012	2013	Grand Total
Alcohol	380116.96	216736.86	596853.82
Bakery	1645325.02	1034374.63	2679699.65
Dairy, Juices & Snacks	1923434.7	1250878.89	3174313.59
Flowers & Plants	612634.29	246813.5	859447.79
Fuel	89978296821	74129815492	1.64108E+11
Garden	105150.1	221922.98	327073.08
Grocery	64035900.28	39324573.45	103360473.7
Meat	3635415.28	2013718.4	5649133.68
Miscellaneous	15126015486	12321864879	27447880365
Natural Products	3591049.04	2128055.28	5719104.32
Packaged Meat	5603207.63	3385376.8	8988584.43
Pharmaceutical	17389289.85	10404016.52	27793306.37
Prepared Food	1251344.98	777453.71	2028798.69
Restauarant	12169.56	20278.8	32448.36
Salads	10273.67	11103.57	21377.24
Seafood	857815.97	504960.17	1362776.14
Skin & Hair Care	368874.79	226366.57	595241.36
Travel	16571.5	8698.42	25269.92
Vegetables (cut)	1354.6	9638.6	10993.2
Grand Total	**1.05206E+11**	**86513465339**	**1.91719E+11**

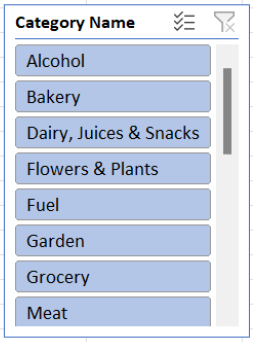
Category Name	Year 2012	2013	Grand Total
Dairy, Juices & Snacks	1923434.7	1250878.89	3174313.59
Flowers & Plants	612634.29	246813.5	859447.79
Garden	105150.1	221922.98	327073.08
Grocery	64035900.28	39324573.45	103360473.7
Natural Products	3591049.04	2128055.28	5719104.32
Grand Total	**70268168.41**	**43172244.1**	**113440412.5**

3.5. Dice

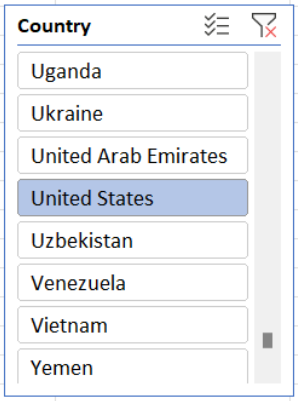
Choose two or more dimensions from a cube and create a new sub-cube by picking particular values on those dimensions. Dice operations are comparable to slice operations.

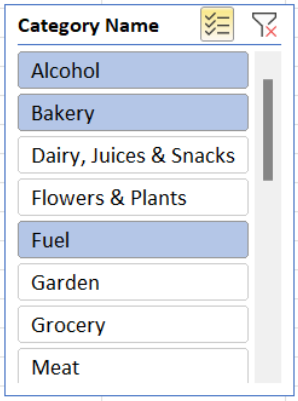
	Year		
	2012	2013	Grand Total
Afghanistan			
Alcohol	427.08		427.08
Bakery	23942.21	15311.87	39254.08
Dairy, Juices & Snacks	10232.92	16176.06	26408.98
Flowers & Plants	5641.12	711.32	6352.44
Fuel	678790351.9	667542005.7	1346332358
Garden	568.5	0	568.5
Grocery	668570.14	351992.25	1020562.39
Meat	28343.55	20975.17	49318.72
Miscellaneous	996.64	275.33	1271.97
Natural Products	41431.4	16734.73	58166.13
Packaged Meat	77843.97	37891.91	115735.88
Pharmaceutical	168491.97	137140.85	305632.82
Prepared Food	5591.23	5465.53	11056.76
Salads	196.27	268.58	464.85
Seafood	8460.78	2192.42	10653.2



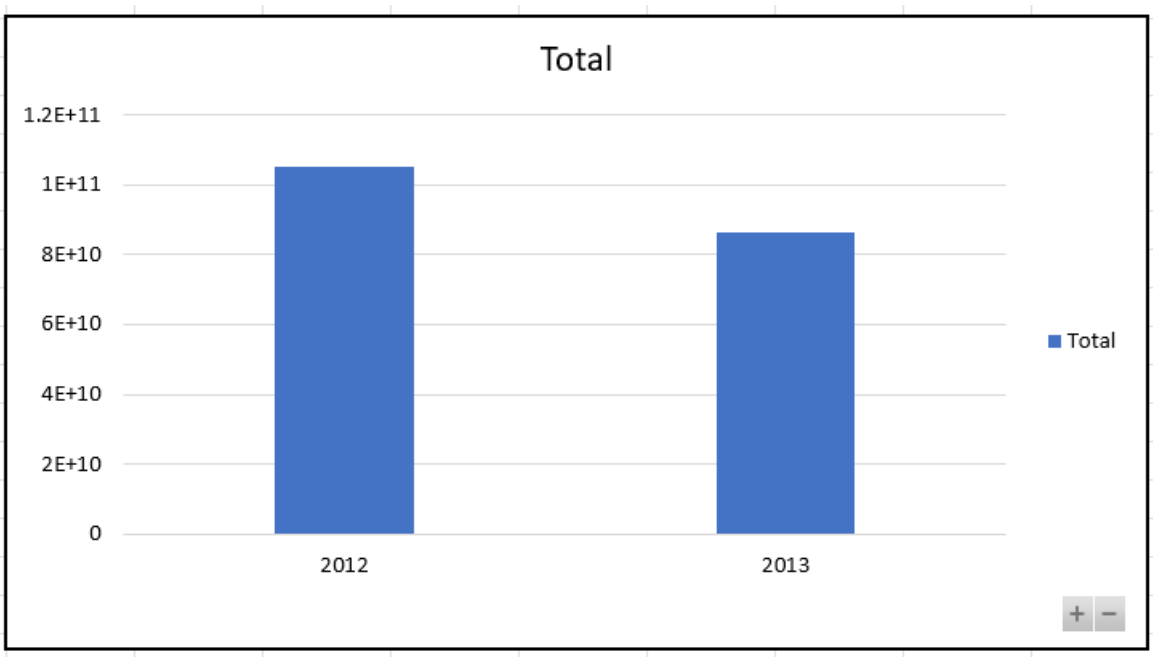


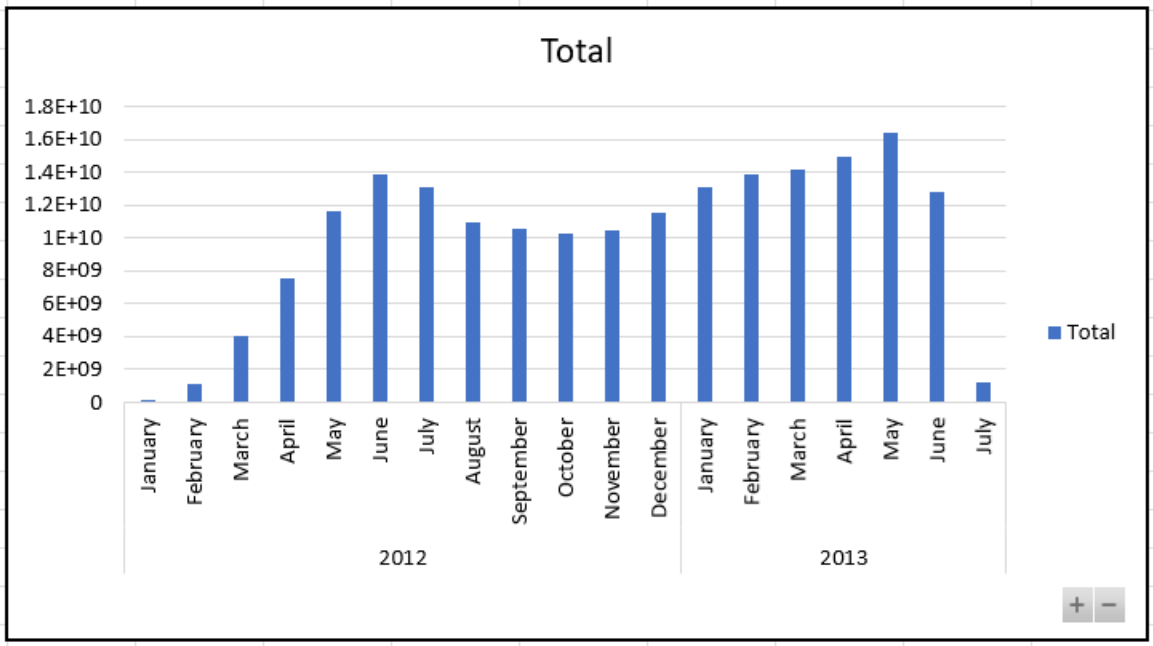
	Year		
	2012	2013	Grand Total
United States			
Alcohol	1429.77	3148.43	4578.2
Bakery	38458.04	19737.16	58195.2
Fuel	2588580385	1927727763	4516308148
Grand Total	**2588620272**	**1927750649**	**4516370921**





3.6. Pivot Chart

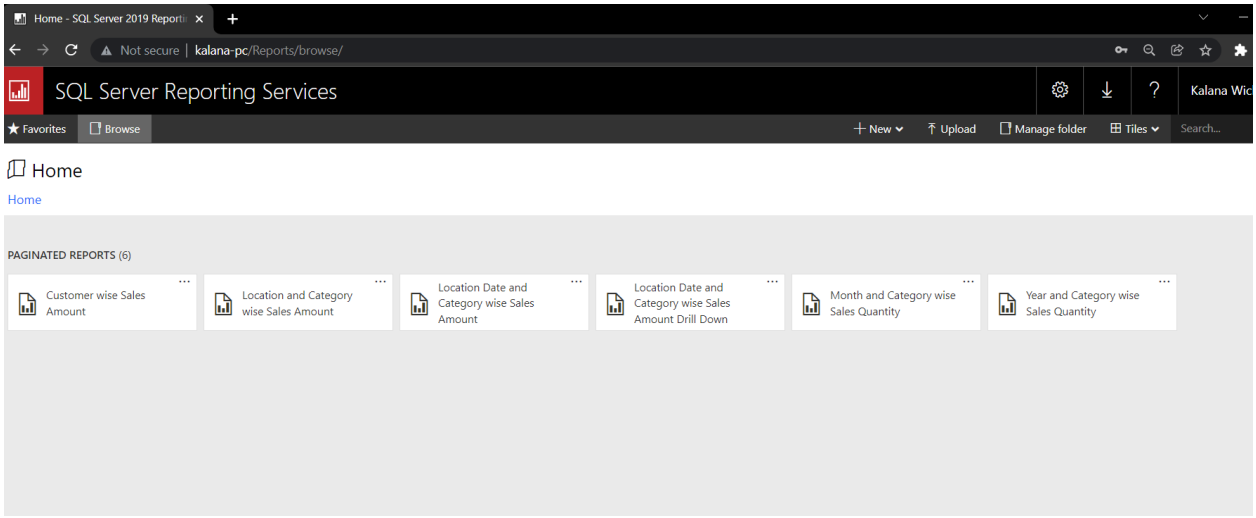




4. SQL Server Reporting Service Reports

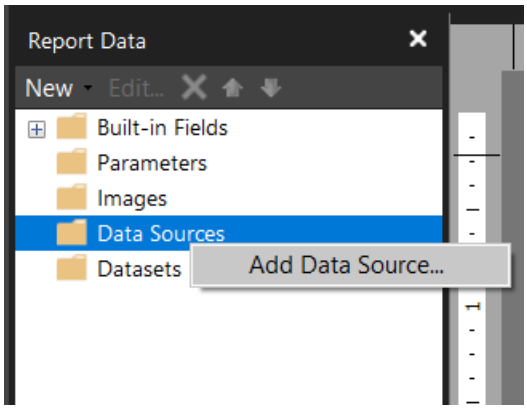
The SQL Server Reporting Service (SSRS) is a reporting tool that lets you create structured tables reports with data, photos, diagrams, and charts. The reports are stored on a server and can be run at any time using user-defined settings. The web portal of a reporting services server is a web-based experience. The portal allows you to examine the report, mobile report, KPI, and element on your report server instance. You may also use the web interface to handle a single report server instance.

For this, I used the report builder application. The Report Builder is a standalone application that you or a system administrator installs on your computer. It can be downloaded through the Microsoft Download Center, from a reporting services SharePoint site.



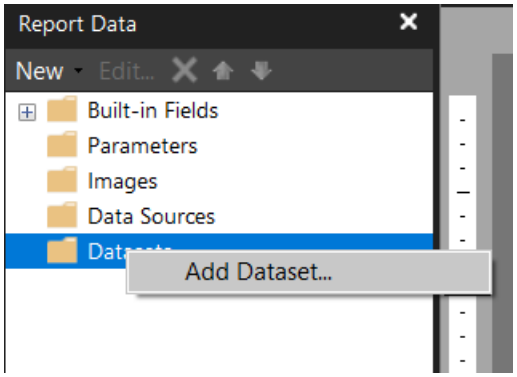
4.1. Basic Steps of Report Builder

- **Data source Creation**



Right click on the Data Sources and follow the guiding

- **Dataset Creation**



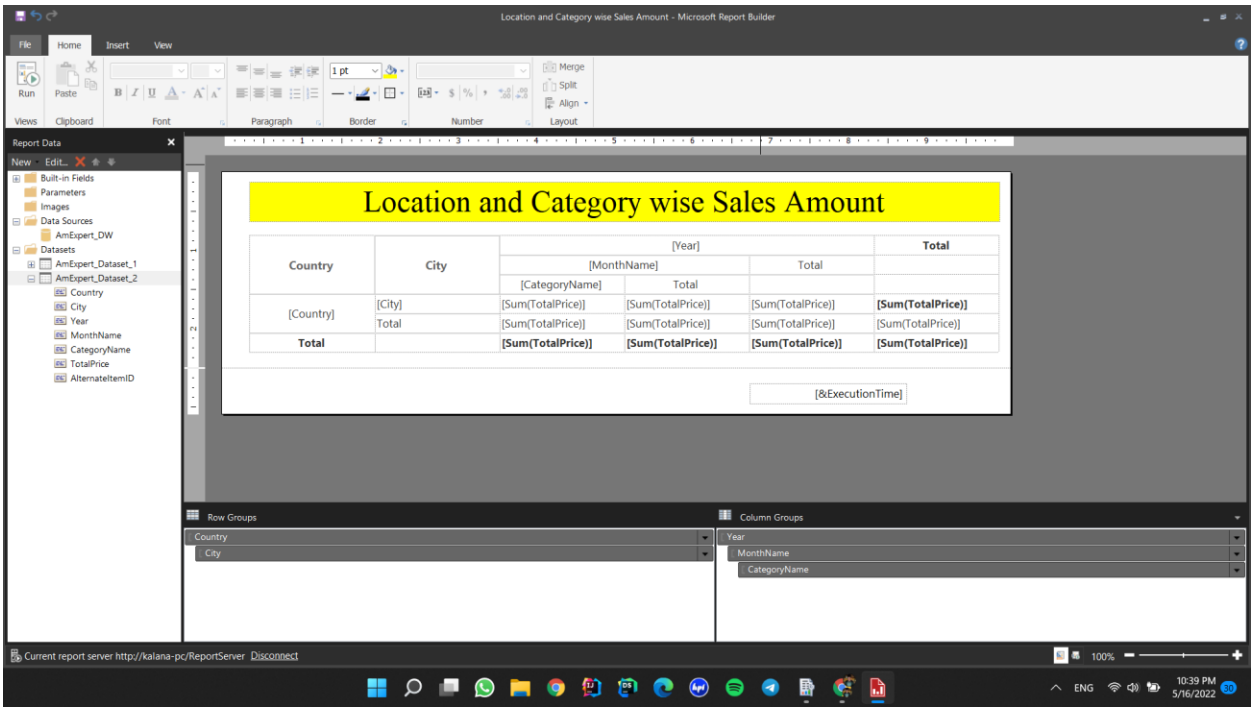
Right click on the Dataset and follow the guiding

4.2. Report with a matrix

In SSRS, a matrix is similar to a table, except it is set up to display data organized by rows and columns, with statistical data at the intersection. This is the same as using a pivot table in a spreadsheet.

Query

```
SELECT
 DimItem.AlternateItemID, DimItemCategory.CategoryName,
 DimCustomer.AlternateCustomerID, DimCustomer.FirstName,
 DimCustomer.LastName, DimCustomer.Country, DimCustomer.City,
 DimDate.MonthName, DimDate.[Year], FactTransaction.Quantity,
 FactTransaction.SellingPrice, FactTransaction.TotalDiscount,
 FactTransaction.TotalPrice, FactTransaction.TransactionID
FROM
 DimItem
 INNER JOIN DimItemCategory
  ON DimItem.CategoryKey = DimItemCategory.CategorySK
 INNER JOIN FactTransaction
  ON DimItem.ItemSK = FactTransaction.ItemKey
 INNER JOIN DimDate
  ON FactTransaction.TransactionDateKey = DimDate.DateKey
 INNER JOIN DimCustomer
  ON FactTransaction.CustomerKey = DimCustomer.CustomerSK
```



1 of 2 ? 100% Find | Next

Location and Category wise Sales Amount

Country	City	2012 Total	2013 Total	Total
Afghanistan	Total	679834481.0700	668148659.8400	1347983140.9100
Albania	Total	269235674.2800	162989835.2100	432225509.4900
Angola	Total	16406341.0700	7107020.1000	23513361.1700
Argentina	Total	1865653102.7000	1834403287.5100	3700056390.2100
Armenia	Total	341816.9900	221822660.0600	222164477.0500
Australia	Total	28270907.0800	18768958.9100	47039865.9900
Bangladesh	Total	107201694.0100	234587875.0600	341789569.0700
Belarus	Total	285657999.8600	195666110.3600	481324110.2200

4.3. Report with more than one parameter

We can transfer one or more than the input data to the report by using Multiparameter-values in SSRS. This one contains a "Select All" option, which allows you to choose all parameter values at any time.

Query

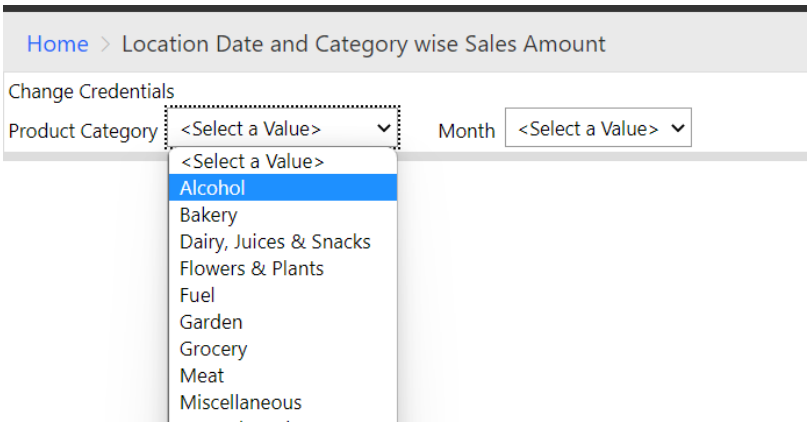
```
SELECT
  DimCustomer.Country, DimCustomer.City, DimDate.[Year], DimDate.MonthName,
  DimItemCategory.CategoryName, FactTransaction.TotalPrice,
  DimItem.AlternateItemID
FROM
  FactTransaction
  INNER JOIN DimDate
    ON FactTransaction.TransactionDateKey = DimDate.DateKey
  INNER JOIN DimCustomer
    ON FactTransaction.CustomerKey = DimCustomer.CustomerSK
  INNER JOIN DimItem
    ON FactTransaction.ItemKey = DimItem.ItemSK
  INNER JOIN DimItemCategory
    ON DimItem.CategoryKey = DimItemCategory.CategorySK
WHERE DimItemCategory.CategoryName = @ProductCategory and
DimDate.MonthName = @MonthName
```

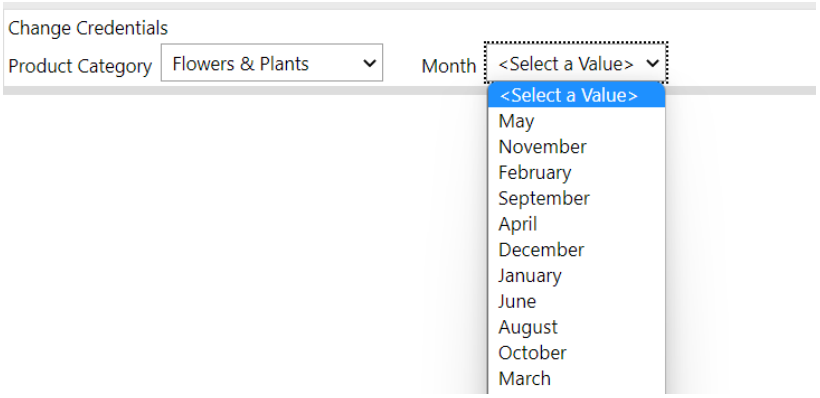
Query for ProductCategory

```
SELECT CategorySk, AlternateCategoryID, CategoryName FROM DimItemCategory
```

Query for MonthName

```
SELECT DISTINCT(MonthName) FROM DimDate
```





Location, Date and Category wise Sales Amount

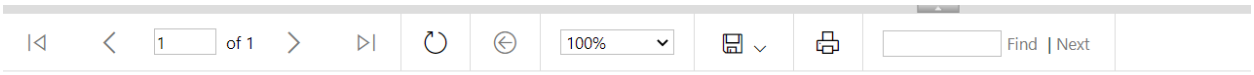
	2012	2013	Total
⊞ Afghanistan	178.1000		178.1000
⊞ Australia	106.5000		106.5000
⊞ Belarus	284.6000		284.6000
⊟ Bosnia and Herzegovina	248.9800		248.9800
Petkovci	248.9800		**248.9800**
⊞ Brazil	699.9300	88.6900	788.6200
⊟ Bulgaria		178.1000	178.1000
Strazhitsa		178.1000	**178.1000**
⊞ Cameroon	118.6100		118.6100
⊞ Canada		1406.6300	1406.6300

4.4. Drill Down Report

Drill Down in SSRS simply allows users to display or hide column records by displaying plus and minus signs on a text field (in other words, allowing the user to interact).

Query

```
SELECT
  DimCustomer.Country, DimCustomer.City, DimDate.[Year], DimDate.MonthName,
  DimItemCategory.CategoryName, FactTransaction.TotalPrice, DimItem.AlternateItemID
FROM
  FactTransaction
  INNER JOIN DimDate
    ON FactTransaction.TransactionDateKey = DimDate.DateKey
  INNER JOIN DimCustomer
    ON FactTransaction.CustomerKey = DimCustomer.CustomerSK
  INNER JOIN DimItem
    ON FactTransaction.ItemKey = DimItem.ItemSK
  INNER JOIN DimItemCategory
    ON DimItem.CategoryKey = DimItemCategory.CategorySK
```



Location and Category wise Sales Amount

Country	City	Alcohol	Bakery	Dairy, Juices & Snacks	Flowers & Plants	Fuel	Garden	Grocery	Meat
⊞Afghanistan		427.0800	39254.0800	26408.9800	6352.4400	1346332357.6300	568.5000	1020562.3900	49318.7200
⊞Albania		1342.5200	12921.4900	1651.7100	1940.5700	246971813.2300	579.8900	271097.0700	22853.3900
⊞Angola		594.1400	12349.0700	8175.0200	2418.5600	22606477.4200		504457.4600	37552.0400
⊞Argentina		1918.4800	32572.8300	25068.0500	5658.9200	3284747067.3500	5934.6400	1438899.8300	53300.5700
⊞Armenia			12996.6200	1082.5100		221639682.1300		243126.5200	9388.7000
⊞Australia			8867.9000	8233.5300	3417.0200	46485021.7300	355.8400	347290.3000	23228.1300
⊞Bangladesh			3588.3700	1404.8700		341638514.3800		95189.0200	1503.5300
⊞Belarus			6057.8500	9044.1600	462.3400	465743598.1500		271216.4100	27421.3100

Location and Category wise Sales Amou

Country	City	Alcohol	Bakery	Dairy, Juices & Snacks	Flowers & Plants	Fuel	Garden	Grocery
	Āsmār		498.3200	14279.3300		4277212.1400		91449.6600
	Būrkah		6138.7600	2888.7500	480.1500	275169856.7400		263996.6700
	Deh-e Now	213.3600	720.2800	8146.2800	533.5800	92853071.4800		97268.3800
⊟Afghanistan	Farah		10900.0000	307.0700		102979668.2400		132664.7100
	Injīl		15195.3600	606.9500	4626.6700	146845584.3300		226802.8600
	Qarāwul	213.7200	5801.3600	180.6000	712.0400	724206964.7000	568.5000	208380.1100
⊞Albania		1342.5200	12921.4900	1651.7100	1940.5700	246971813.2300	579.8900	271097.0700
⊞Angola		594.1400	12349.0700	8175.0200	2418.5600	22606477.4200		504457.4600
⊞Argentina		1918.4800	32572.8300	25068.0500	5658.9200	3284747067.3500	5934.6400	1438899.8300

4.5. Drill-through Report

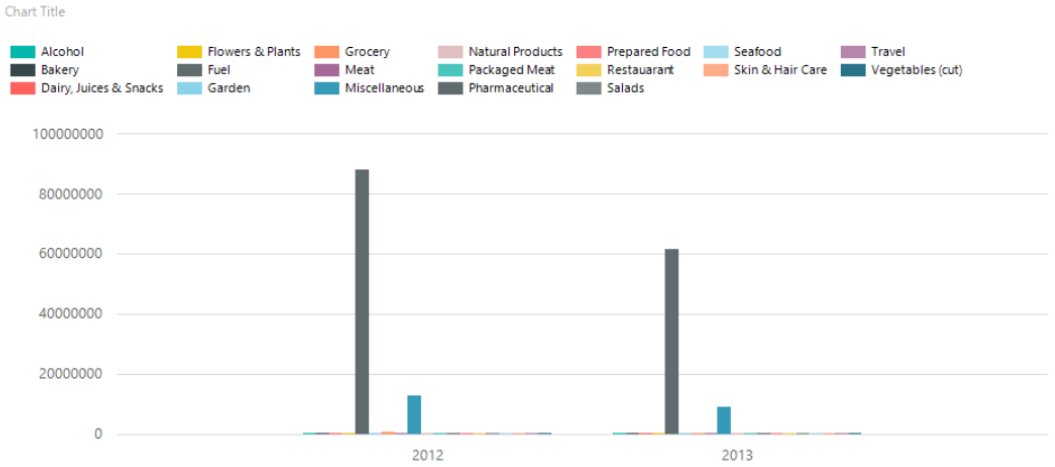
Main Query

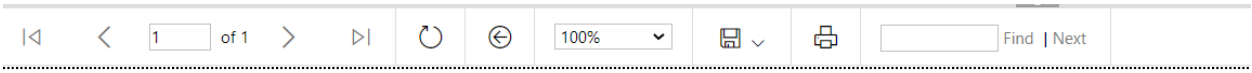
```
SELECT

DimDate.[Year], DimDate.MonthName, DimItem.AlternateItemID,
DimItemCategory.CategoryName, FactTransaction.Quantity

FROM

DimItem

INNER JOIN DimItemCategory

ON DimItem.CategoryKey = DimItemCategory.CategorySK

 INNER JOIN FactTransaction

 ON DimItem.ItemSK = FactTransaction.ItemKey

INNER JOIN DimDate

ON FactTransaction.TransactionDateKey = DimDate.DateKey
```

Sub Query

```
SELECT

DimDate.[Year], DimDate.MonthName, DimItem.AlternateItemID,
DimItemCategory.CategoryName, FactTransaction.Quantity

FROM

DimItem

INNER JOIN DimItemCategory

ON DimItem.CategoryKey = DimItemCategory.CategorySK

 INNER JOIN FactTransaction

 ON DimItem.ItemSK = FactTransaction.ItemKey

INNER JOIN DimDate

ON FactTransaction.TransactionDateKey = DimDate.DateKey

WHERE DimDate.[Year] = @Year
```

Year and Category wise Sales Quantity





Month and Category wise Sales Quantity