

Sri Lanka Institute of Information Technology

Year 03



**Assignment II**

**Data Warehouse & Business Intelligence**

**2021**

**Submitted by**

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## Table of Contents

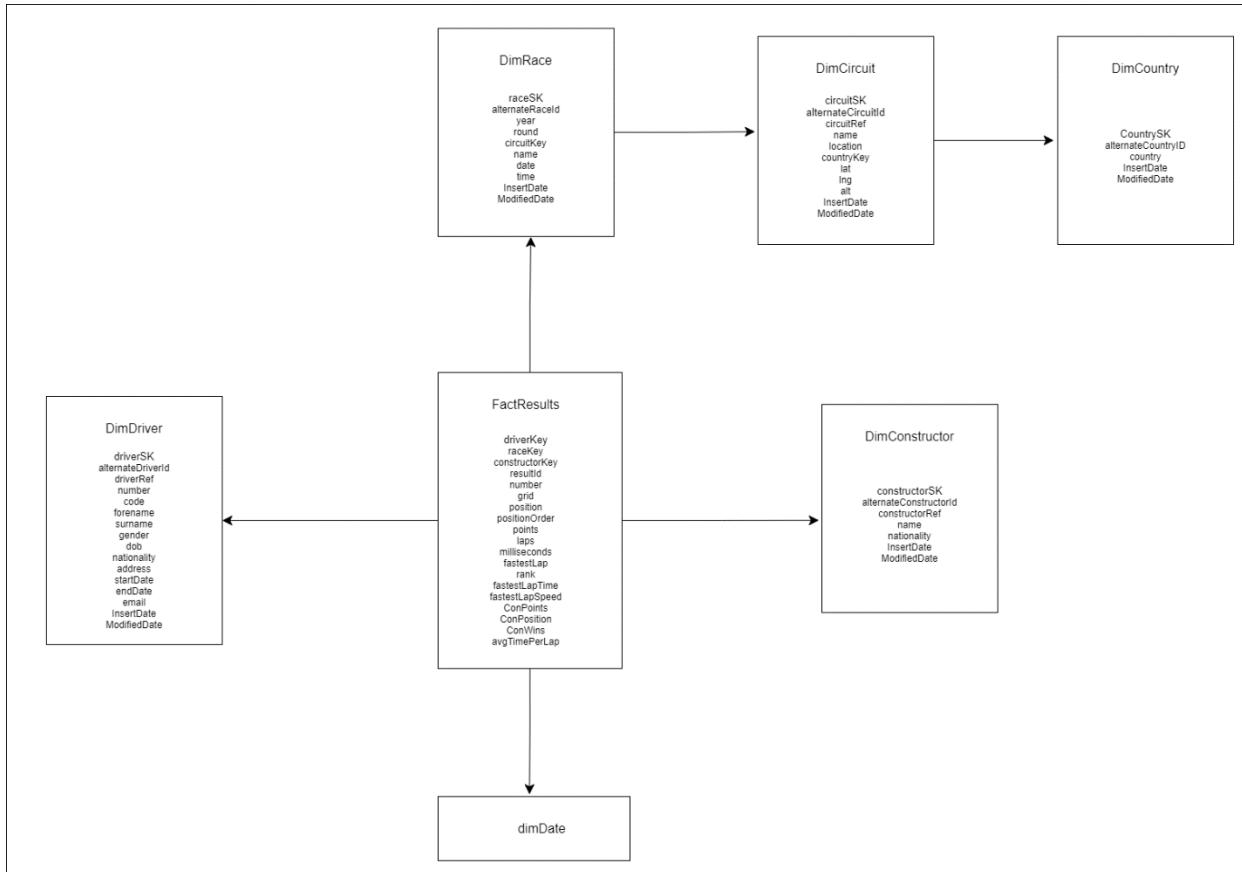
Data source .....	3
Cube creation implementation.....	5
Demonstration OLAP operation.....	12
Demonstrate drill down operation using power pivot option in excel.....	12
Roll up operation using excel pivot table.....	14
Demonstrate slice operation using slicer in excel .....	16
Dice operation using two slicers(nationality and year) .....	17
SSRS REPORT generation .....	19
Report with matrix.....	19
Report with more than one parameter .....	20
Visualize report more than one parameter using bar charts. ....	26
Drill down report using SSRS.....	28
Drill through report using ssrs .....	30

## Data source

I have used the data warehouse as the data source which I created using Formula 01 race details to analyze the performance of the drivers and constructors.

This Datawarehouse database has data of all the races, drivers, constructors, circuits and results of each driver in races.

The dimensional model of the warehouse schema given below

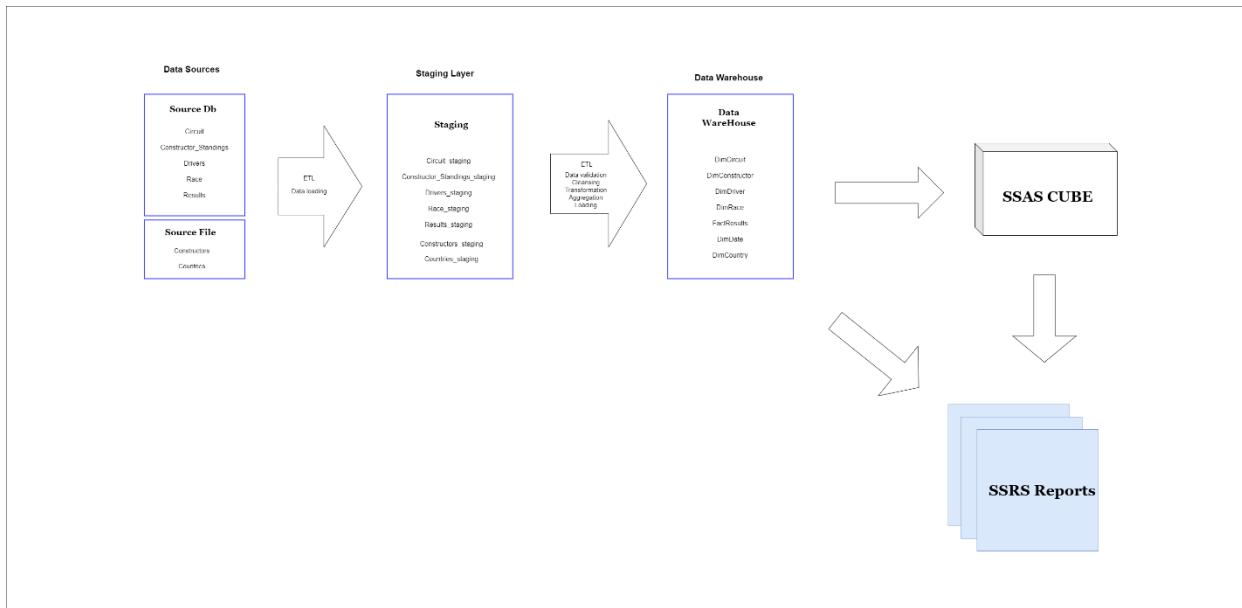


According to the diagram shown above the original data source of the dataset has undergone a series of data transformations to create the above diagram. The changes occurred are given below

- Ommited unwanted fields like Urls from the dimentions etc..
- Added aggregated calculation to field called AvgTimePerLap to calculate average time per lap(milliseconds) by any driver of a race

- Heirachy has been created to drill down the results according to country -> circuit -> race
- Driver dimestion has been use as the slowly changing dimention

Data consuming high level diagram is shown below



I have created an OLAP cube to consume data to create reports and visualize data using SSRS report generating tools. But it is also possible to connect it directly to the data warehouse ratherthan connecting to an OLAP cube to consume data

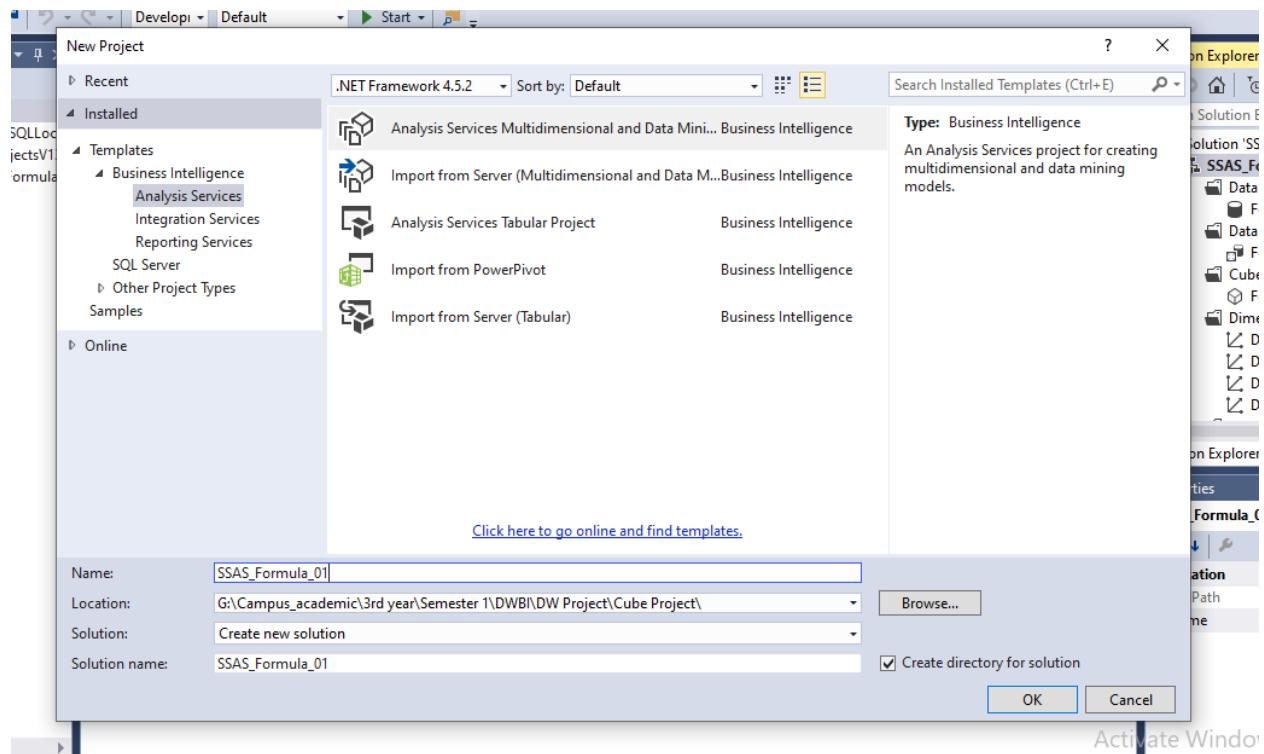
## Cube creation implementation

As of the requirement of the data consumers an olap cube is created in order to consume data from the data warehouse rather than consume data directly from the datawarehouse

Steps of the data warehouse creation is given below.

Step 01 :-

**Creating SSAS project** (Analysis service multidimensional and data mining project) using Microsoft visual studio server data tools (SSAS\_Formula\_01)

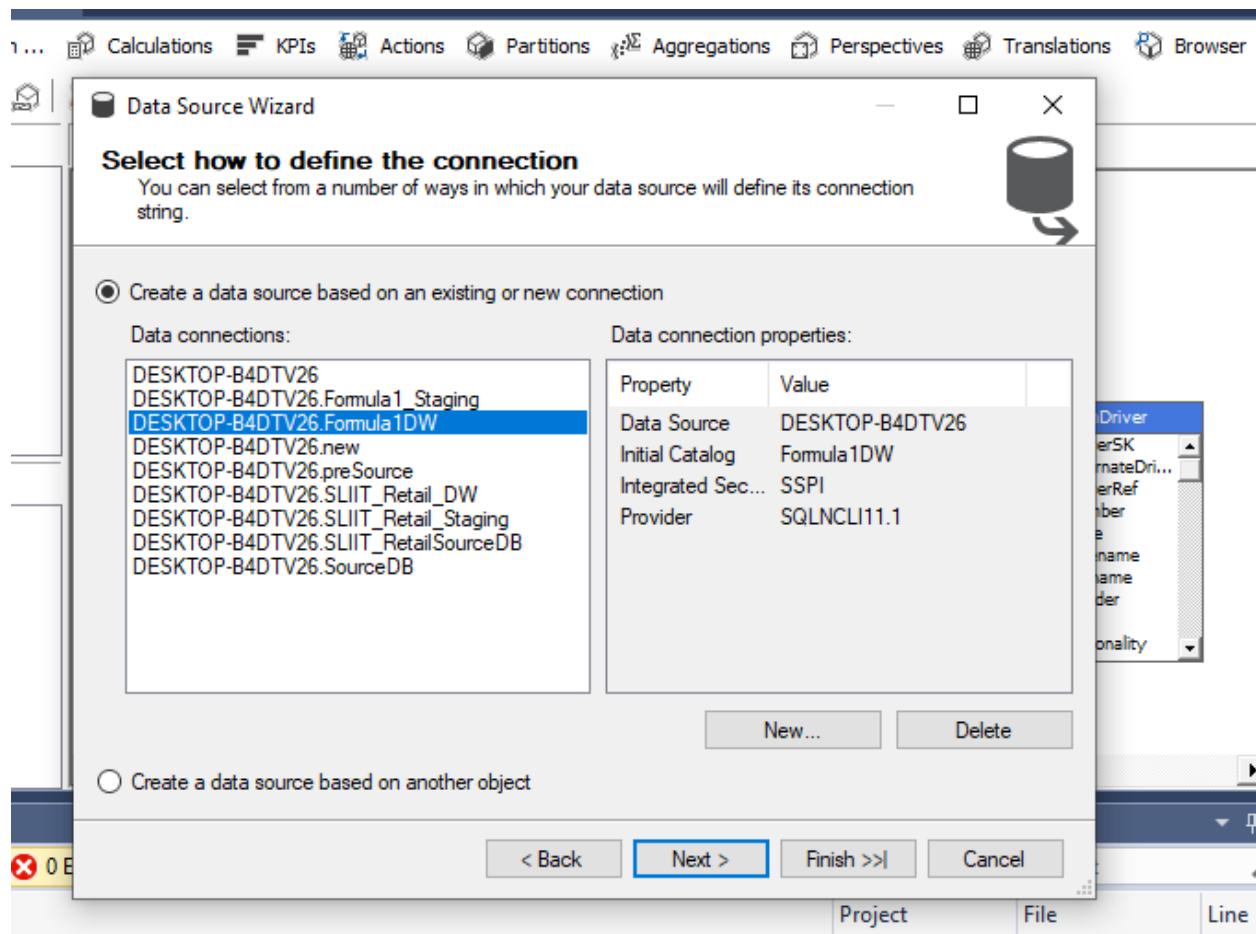


Step 02 :-

### Creating the data source

As I mentioned above I have used the data warehouse which was developed as Formula01DW as the data source for the cube development.

To access the data source, I have used windows authentication to the cube

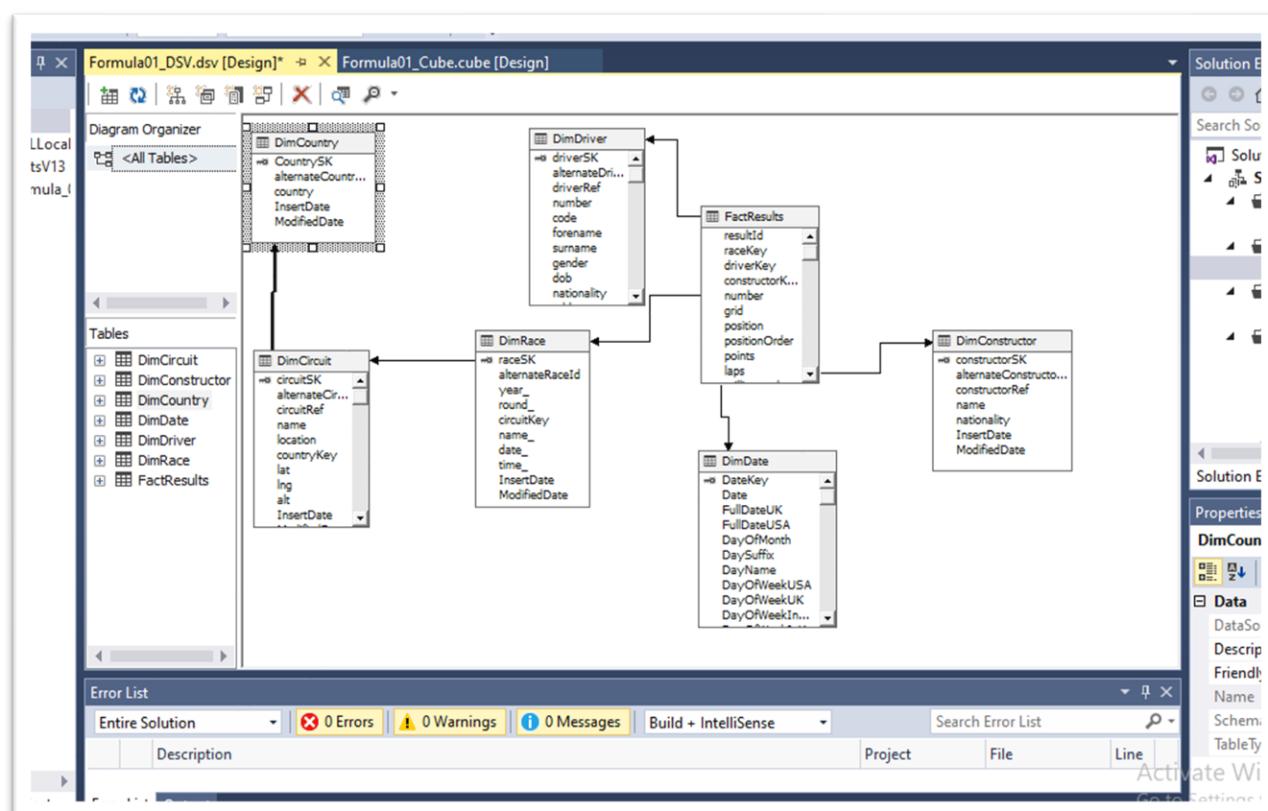
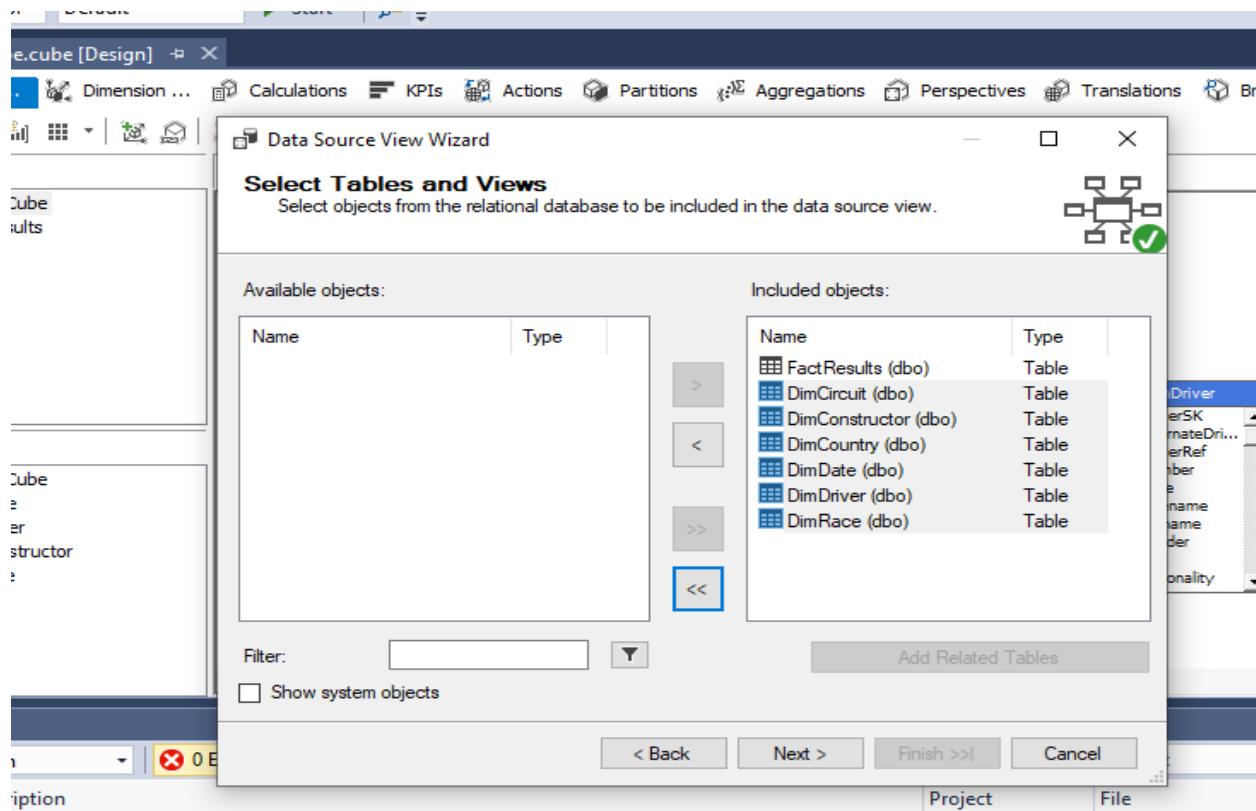


Step 03: -

### Defining the view for the data source

In order to create the cube it is essential to create a logical view of the actual database of the data warehouse. In this step the SSAS tools automatically capture the dimensions and the fact table.

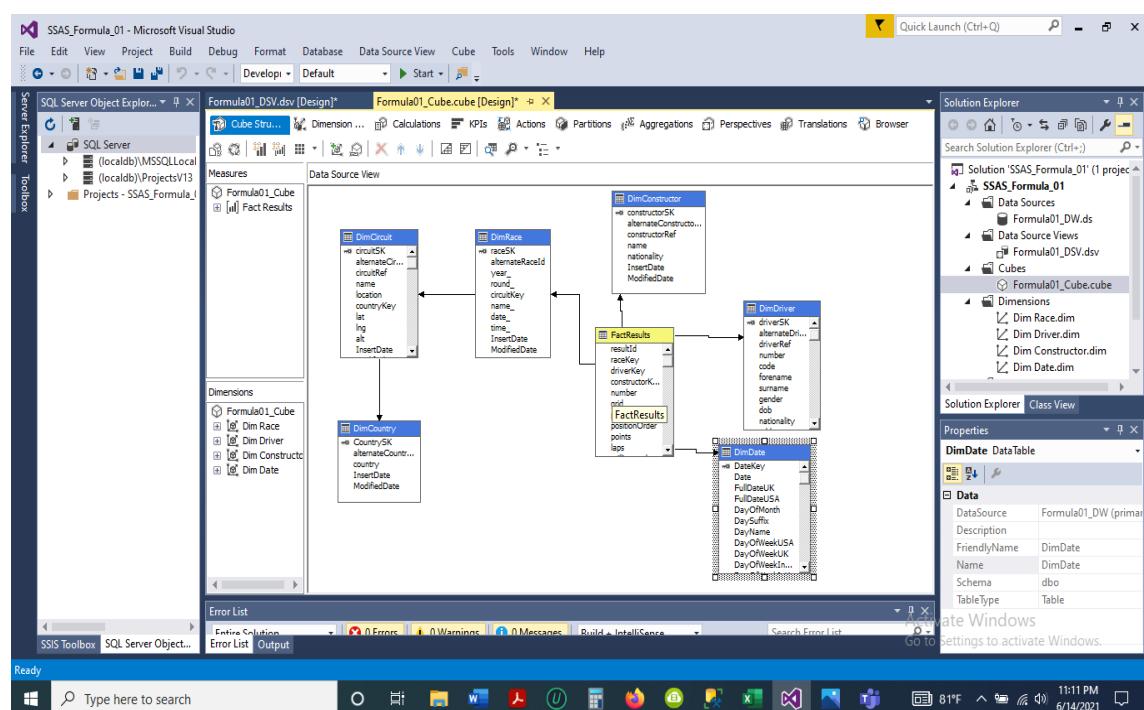
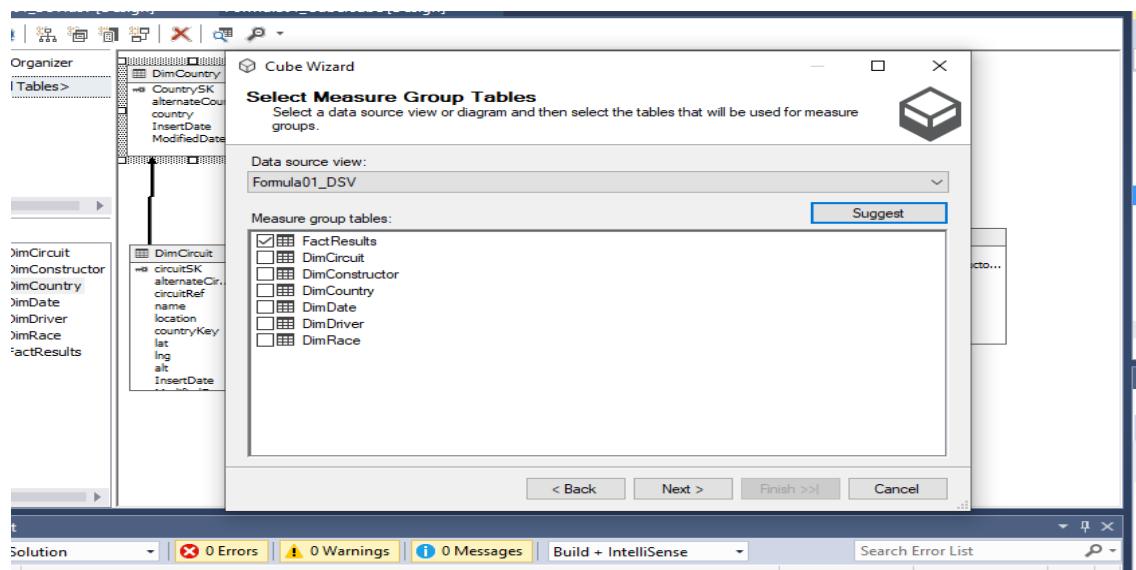
In order to complete the creation of the view I have defined the relationships of the dimension table and the fact.



## Step 04:-

### Creating the cube

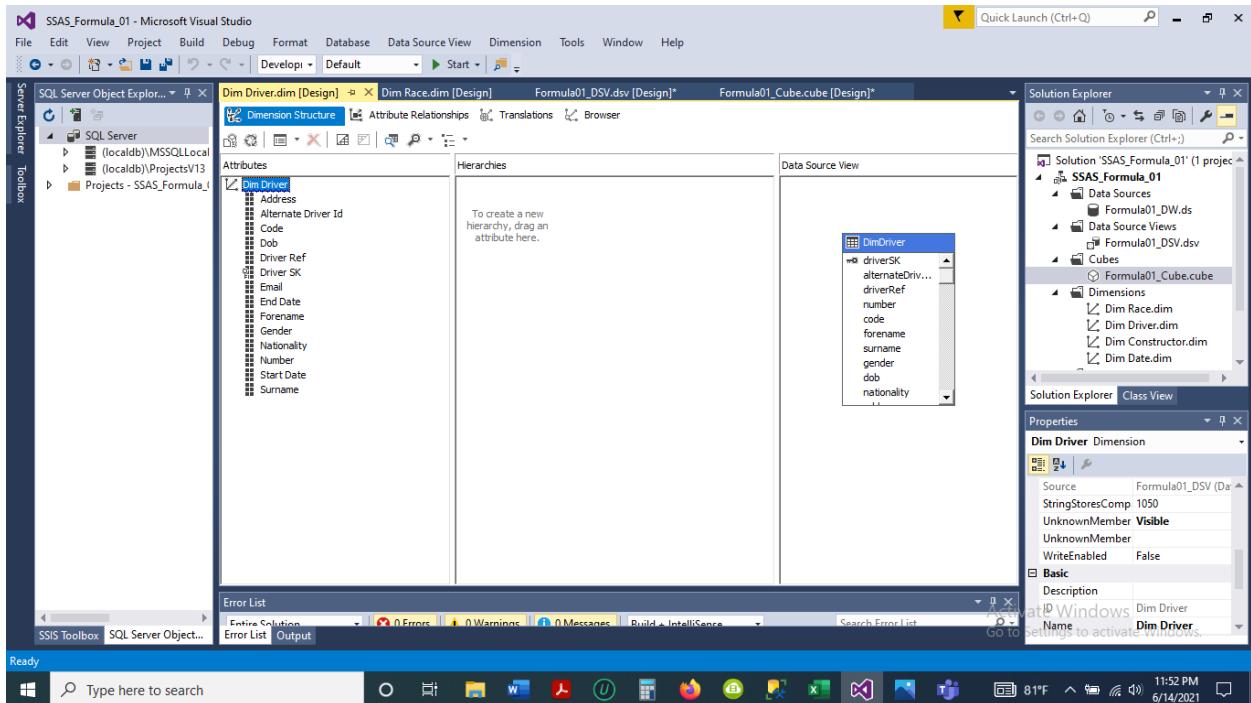
After creating the data source view next and the final step is creating the cube. To create the cube, I have used the existing tables as in the data source view then the SSAS data tools will automatically pick the facts and dimensions and create the cube around the fact.

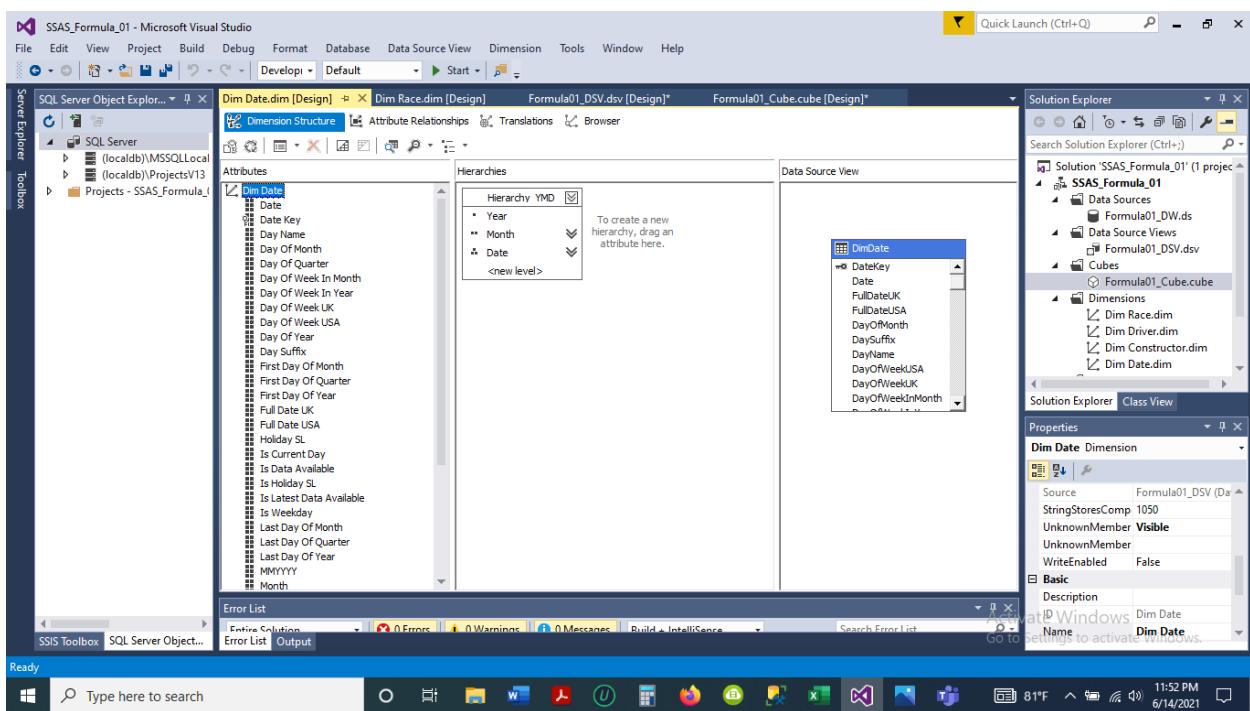
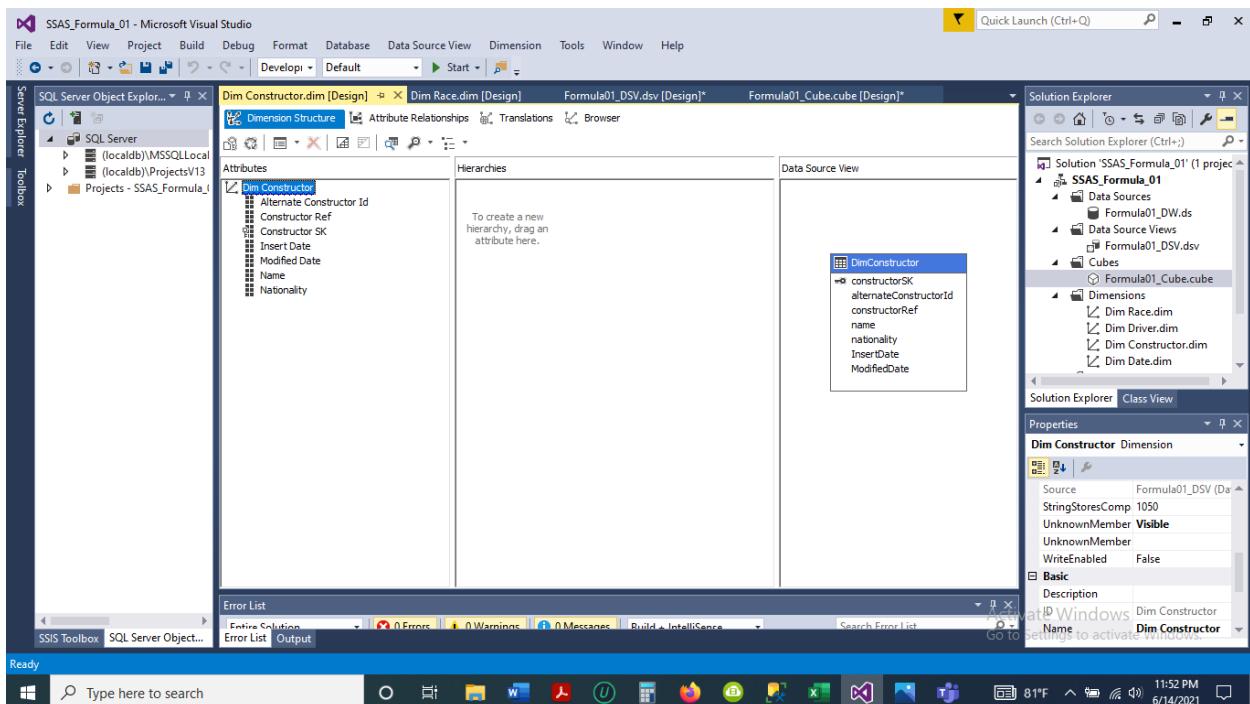


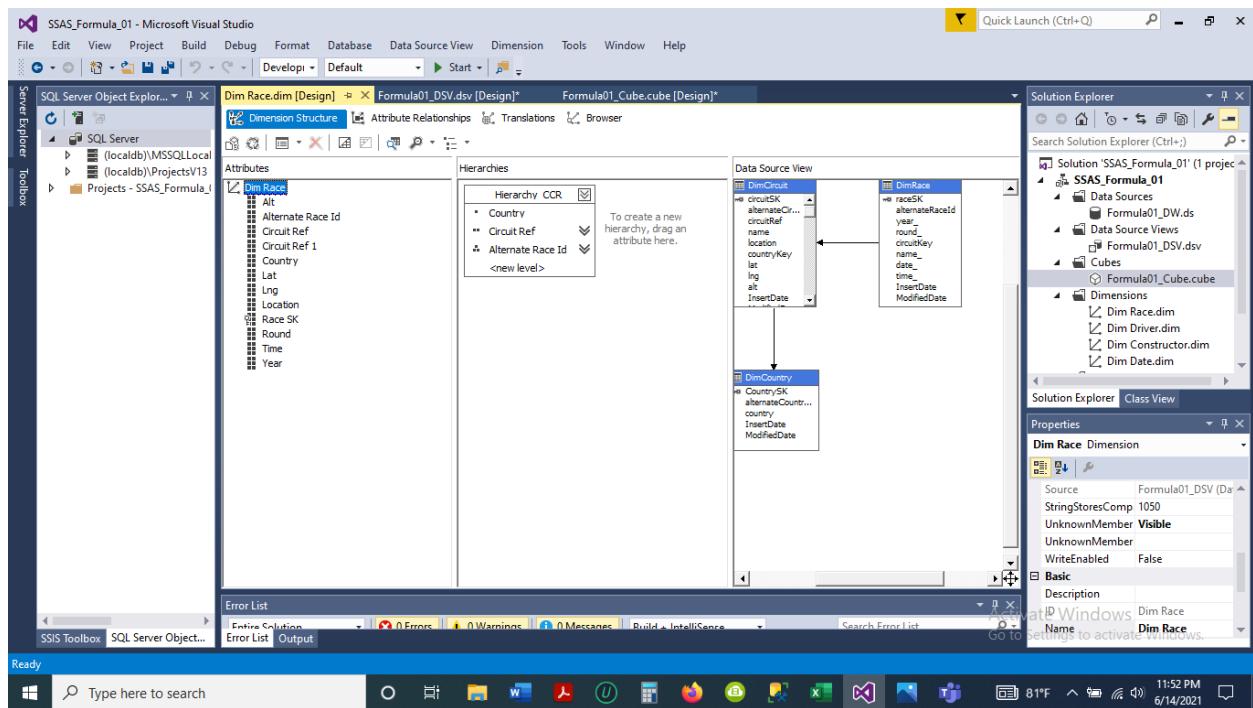
Once the cube is created, next I have defined necessary attributes to the dimensions as the business requirement and created necessary hierarchies.

Below are some hierarchies I have created,

- Date dimension: year -> month -> date
- Race dimension: country -> circuit -> race



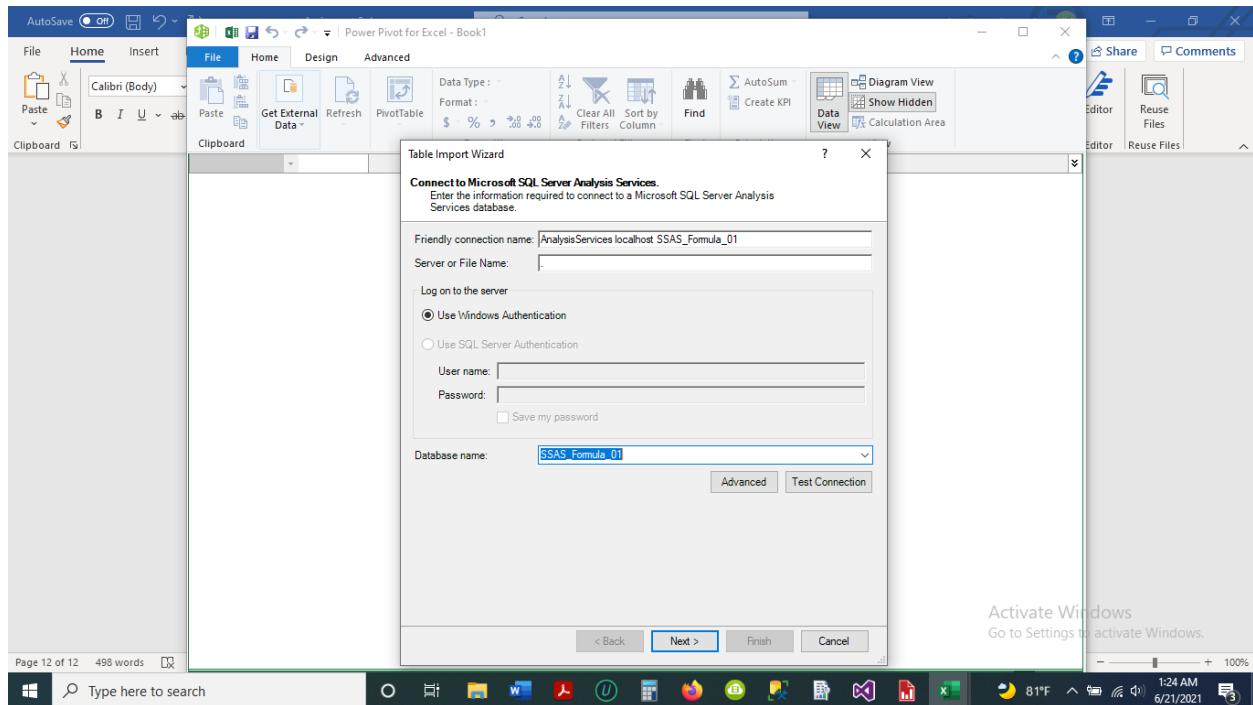




## Demonstration OLAP operation

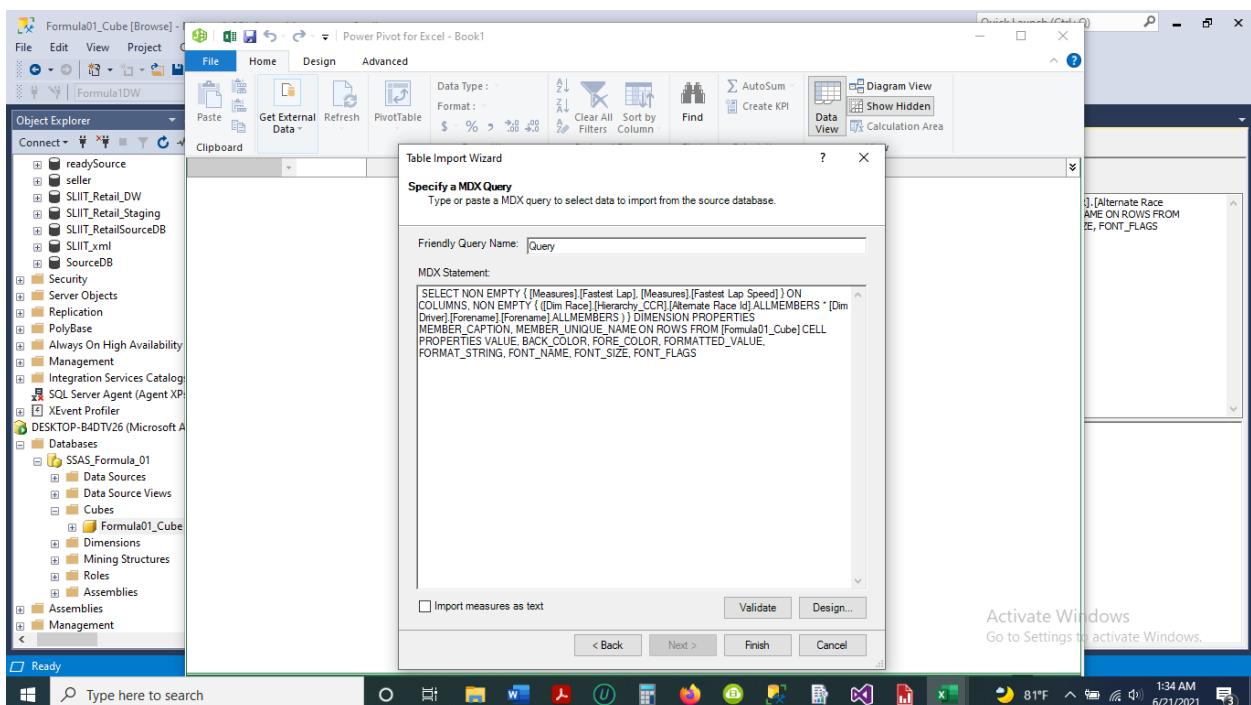
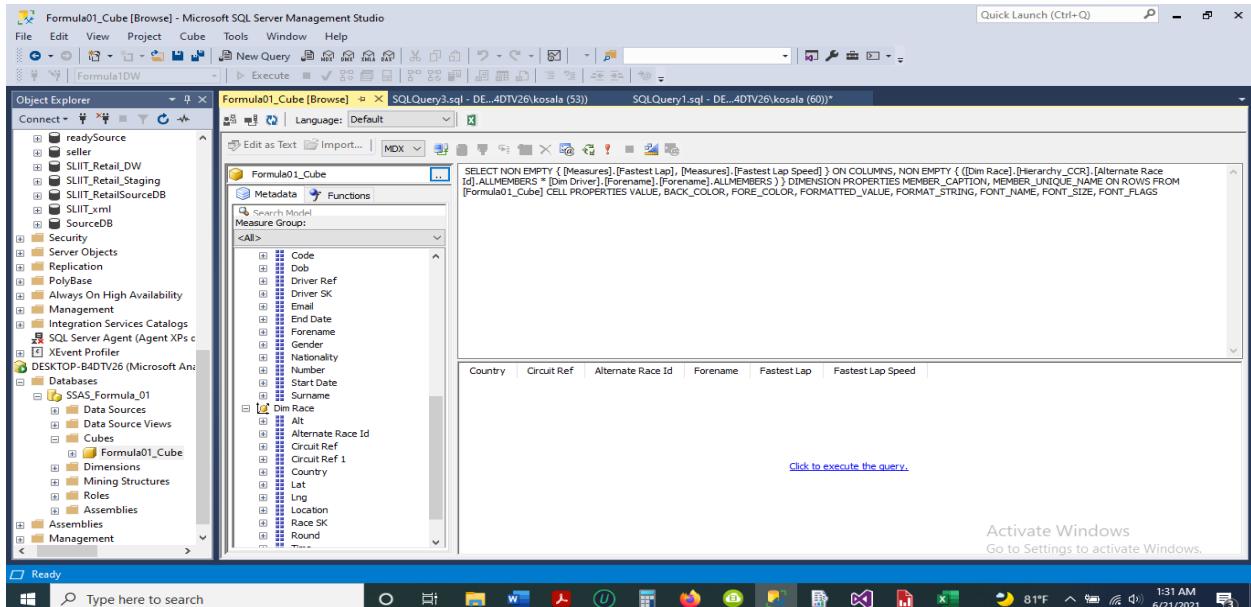
Demonstrate drill down operation using power pivot option in excel

As the first step, I created a new work book and imported necessary fields to create the cube in the power pivot in excel using the cube that we have created in the SSAS project previously using visual studio.



Then create the cube using necessary fields analysis service in SQL Server Management Studio by dragging and dropping the fields from the cube and the mdx query is taken in order to import data to power pivot by copying the mdx query.

To create the mdx query, I have used the hierarchy that I have created in the SSAS cube (Country -> Circuit -> race) , driver name , fastest lap and fastest lap speed



After importing the records, I created the pivot table using that dataset in power pivot in order to demonstrate the drill down operation

The screenshot shows a Microsoft Excel window titled "Book1 - Excel". The ribbon tabs include File, Home, Insert, Page Layout, Formulas, Data, Review, View, Help, Data Streamer, Inquire, Power Pivot, PivotTable Analyze, and Design. The "Power Pivot" tab is selected. The main area displays a PivotTable with data for "Fastest Lap Speed" across various countries like Argentina, Australia, Austria, Bahrain, Belgium, Brazil, Canada, China, France, Germany, Hungary, India, and Italy. The PivotTable Fields pane on the right lists fields such as Dim RaceHierarchy\_CCRAlternate Race Id, Dim DriverForenameForename, MeasuresFastest Lap, and MeasuresFastest Lap Speed. The status bar at the bottom shows "2:40 AM 81°F 6/21/2021".

## Roll up operation using excel pivot table

To demonstrate the roll up operation, I have used excel workbook to import the complete cube.

In order to do that first, I have imported the cube using data source as the cube from the analysis service and created the pivot table wizard using the cube.

The screenshot shows a Microsoft Excel window titled "drill down driver performance.xlsx - Saved". The ribbon tabs include File, Home, Insert, Page Layout, Formulas, Data, Review, View, Help, Data Streamer, Inquire, Power Pivot, and others. The "Data" tab is selected. A "Data Connection Wizard" dialog box is open, showing the "Select Database and Table" step. It lists the database "SSAS\_Formula\_01" and the cube "Formula01\_Cube". The status bar at the bottom shows "2:55 AM 81°F 6/21/2021".

I have used constructor points as quantity to measure using the roll up operation in hierarchy country -> circuit -> race , to demonstrate the rollup operation I have used the totals of the rows like individual race wise total , circuit wise total and country wise total.

The screenshot shows a Microsoft Excel spreadsheet titled "drill down driver performance.xlsx". The PivotTable Fields pane on the right has "Con Points" checked. The main table displays race-wise totals for various drivers across different circuits and teams. The columns include: Tecno, Theodore, Tolman, Toro Rosso, Toyota, Trevis, Trojan, Tyrrell, Vanwall, Veritas, Watson, Williams, Wolf, Zakspeed, and Grand Total. The rows show individual race results, grouped by circuit (Hierarchy\_CCR) and race (Con Points). The table highlights the first few rows of the first circuit.

	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV
1	Tecno	Theodore	Tolman	Toro Rosso	Toyota	Trevis	Trojan	Tyrrell	Vanwall	Veritas	Watson	Williams	Wolf	Zakspeed	Grand Total		
2	0	0	0	0	0	0	0	35	0	0	0	215	9	0	910		
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4																	
5	0	0	0	0	0	0	0	5	0	0	0	118	0	0	183		
6	0	0	0	0	0	0	0	0	0	0	0	118	0	0	436		
7	0	0	0	0	0	0	0	0	0	0	0	336	0	0	608		
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	250	0	0	674		
11	0	0	0	0	0	0	0	0	0	0	0	114	0	0	615		
12	0	0	0	0	0	0	0	0	0	0	0	154	0	0	265		
13	0	0	0	0	0	0	0	0	0	0	0	20	0	0	506		
14	0	0	0	0	0	0	0	11	0	0	0	137	0	2	298		
15	0	0	0	0	0	0	0	0	22	0	0	141	0	0	431		
16	0	0	0	0	0	0	0	7	0	0	0	71	0	0	220		
17	0	0	0	53	32	0	0	2	0	0	0	184	0	0	2876		
18	0	0	0	74	7	0	0	356	0	0	0	1638	0	2	17081		
19	0	0	0	63	0	0	0	0	0	0	0	221	0	0	4026		
20	0	0	0	58	130	0	0	0	0	0	0	318	0	0	11231		
21	1	1	2	463	206	0	0	303	32	0	0	3137	0	0	35150		
22	0	1	0	783	375	0	0	83	0	0	0	1728	0	0	39876		
23	0	1	1	160	106	0	0	730	0	0	0	507	26	0	24163		

The screenshot shows a Microsoft Excel spreadsheet titled "drill down driver performance.xlsx". The PivotTable Fields pane on the right has "Con Points" checked. The main table displays race-wise totals for various drivers across different circuits and teams. The columns include: EG, EH, EI, EJ, EK, EL, EM, EN, EO, EP, EQ, ER, ES, ET, EU, EV, and E. The rows show individual race results, grouped by circuit (Hierarchy\_CCR) and race (Con Points). The table highlights the first few rows of the first circuit.

	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	E	
1	Theodore	Tolman	Toro Rosso	Toyota	Trevis	Trojan	Tyrrell	Vanwall	Veritas	Watson	Williams	Wolf	Zakspeed	Grand Total				
2	0	0	0	0	0	0	35	0	0	0	215	9	0	910				
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	73	0	0	0	1459	0	2	4603			
5	0	0	0	53	32	0	0	2	0	0	0	184	0	0	2876			
6	0	0	0	74	7	0	0	356	0	0	0	1638	0	2	17081			
7	0	0	0	63	0	0	0	0	0	0	0	221	0	0	4026			
8	0	0	0	58	130	0	0	0	0	0	0	318	0	0	11231			
9	0	0	0	1	2	463	206	0	0	303	32	0	0	0	35150			
10	1	1	0	783	375	0	0	83	0	0	0	1728	0	0	39876			
11	1	0	0	188	171	0	0	0	0	0	0	512	0	0	11017			
12	0	0	0	9	194	0	0	581	22	0	0	2163	8	0	17924			
13	1	0	0	184	265	0	0	648	33	0	0	3510	66	0	38293			
14	0	0	0	373	382	0	0	81	0	0	0	3314	0	0	32202			
15	0	0	0	126	0	0	0	0	0	0	0	60	0	0	8581			
16	0	0	0	3	20	343	395	0	0	694	46	0	0	5304	14	6	52918	
17	0	0	0	0	0	611	312	0	0	189	0	0	0	3596	55	0	43896	
18	0	0	0	0	0	127	0	0	0	0	0	0	195	0	0	9998		
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9257	
20	0	0	0	0	0	0	0	0	0	0	0	0	636	0	0	0	0	9257
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9257
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9257
23	1	0	0	160	180	0	0	227	0	0	0	1391	26	0	19292			

## Demonstrate slice operation using slicer in excel

To demonstrate the slicing, I have used constructor details and date hierarchy (year -> month -> date) from the SSAS cube.

To do the actual slicing, I have created slicer to nationality field of the constructor.

The screenshot shows a Microsoft Excel spreadsheet titled "drill down driver performance.xlsx". The PivotTable has "Con Points" in the Row Labels and "Year" in the Column Labels. A single Slicer for "Nationality" is applied, with the "Italian" option selected. The data shows points for various teams across different years, with the Italian team having the highest points in most years.

Dice operation using two slicers(nationality and year)

To demonstrate the dice operation, I have added another slicer for year field to separate data in year wise while the data is separated nationality wise as well.

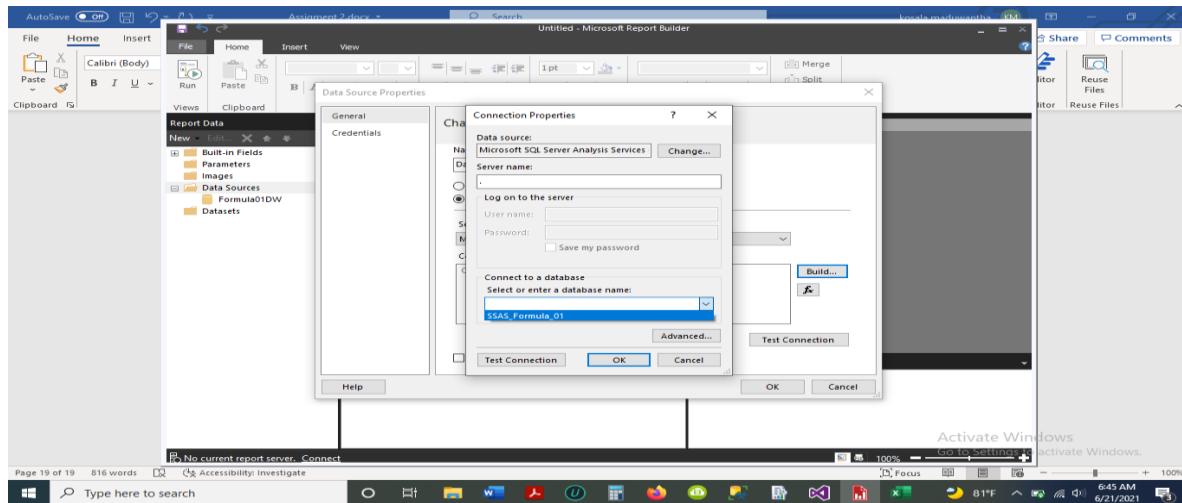
The screenshot shows the same Microsoft Excel spreadsheet with two Slicers: one for "Nationality" and one for "Year". Both "British" and "Year 1990" are selected. The data is now filtered to show only British drivers in the year 1990. The PivotTable Fields pane shows the selected fields: Nationality (British) and Year (1990).



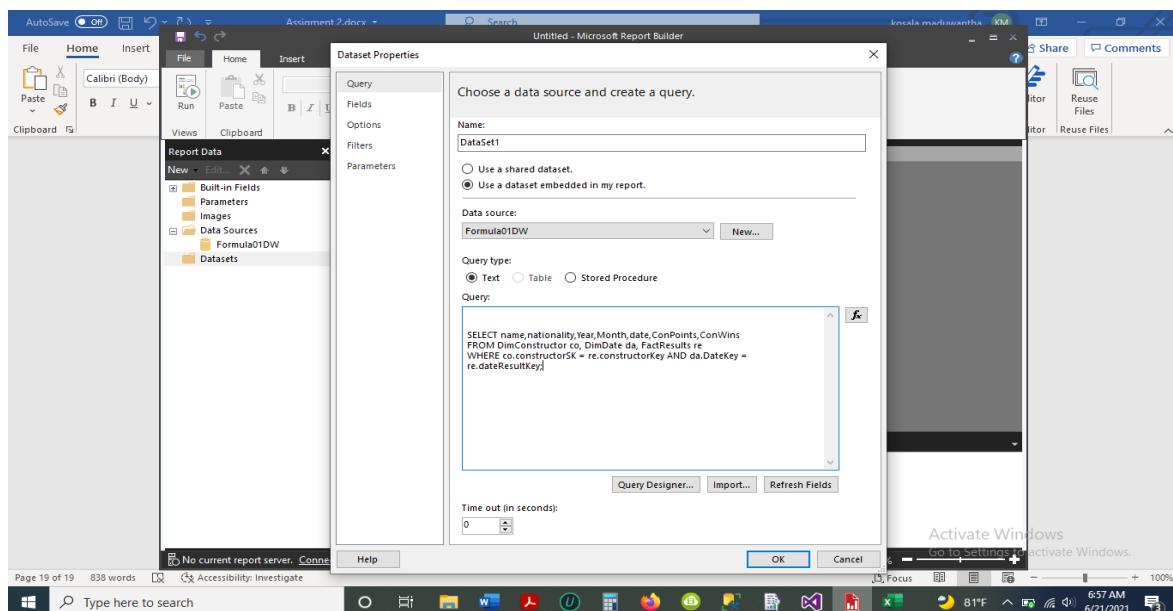
## SSRS REPORT generation

### Report with matrix

To create a report with a matrix, first I have connected the report builder to the data warehouse Formula1DW directly as embedded data source.



After that, I have created the data set (custom created query) to build the report to demonstrate the analysis as the matrix report.



After creating the data set, I then created the matrix using that dataset with the aid of matrix creating wizard in report builder.

After creating the matrix, it included all the records of years. To reduce the number of years and some other records, modifications were made to the table.

The screenshot shows two windows side-by-side. On the left is Microsoft SQL Server Management Studio (SSMS) with the query editor open containing the SQL code for the 'Constructor\_performance' report. On the right is Microsoft Report Builder with the report preview window showing a matrix report titled 'Constructor\_performance'. The matrix has columns for 'nationality', 'name', 'Con Points', 'Con Wins', and 'Total' for the years 2001, 2003, 2010, and a Grand Total row. The data includes various nationalities like Austrian, British, French, German, Indian, Irish, Italian, Japanese, Malaysian, and Swiss, along with their respective points and wins. The report is dated 6/21/2021 2:51:24 PM.

### Report with more than one parameter

To create report which use parameters to populate data first, I have created new report using report builder and created another data source using the data warehouse and then I have created a dataset to get drivers' fastest lap and max Lap speed and created parameters for Country , Circuit and year fields.

The screenshot shows the Microsoft Report Builder interface. A 'Dataset Properties' dialog box is open, showing the 'Query' tab. The 'Name:' field is set to 'DataSet1'. The 'Data source:' dropdown is set to 'DataSource1'. The 'Query type:' is set to 'Text'. The 'Query' text area contains the following SQL code:

```

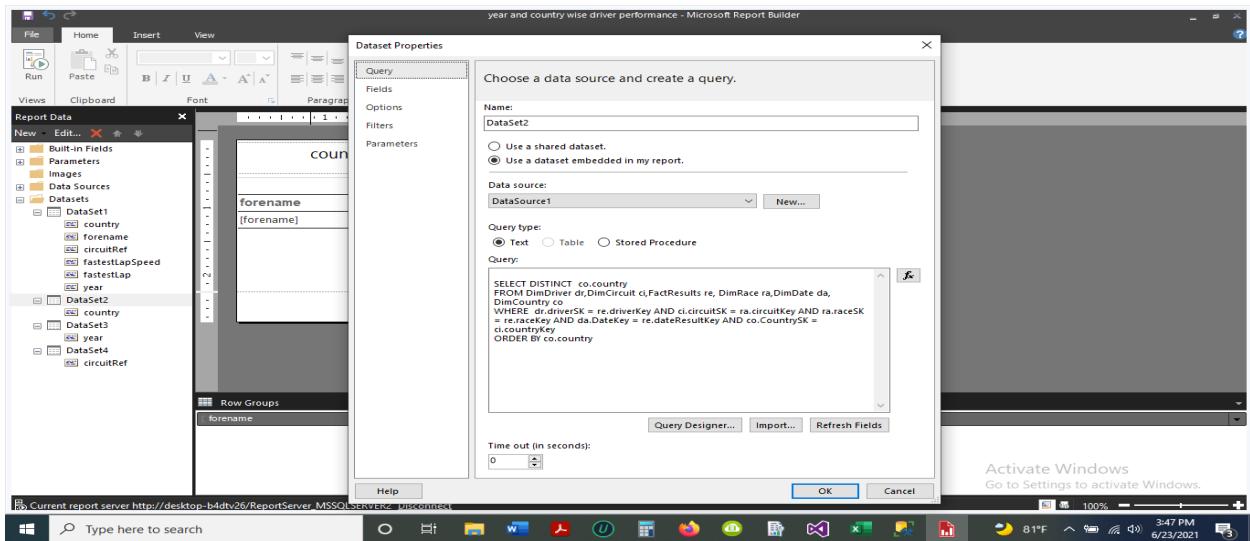
SELECT co.country, dr.forename,
       dc.circuitRef,re.fastestLapSpeed,re.fastestLap,da.year
  FROM DimDriver dr,DimCircuit ci,FactResults re, DimRace ra,DimDate da,
       DimCountry co
 WHERE dr.driverSK = re.driverKey AND ci.circuitSK = ra.circuitKey AND ra.raceSK
   = re.raceKey AND da.dateResultKey = re.dateResultKey AND co.CountrySK =
     circuitRef
   AND country =@Country AND year BETWEEN @PreYear AND @PostYear AND
   circuitRef = @Circuit
  
```

The report preview window on the right shows a simple table with columns for 'forename' and 'country'. The bottom status bar indicates the current report server is 'http://desktop-b4dhy26/ReportServer\_MSSQLSERVER'.

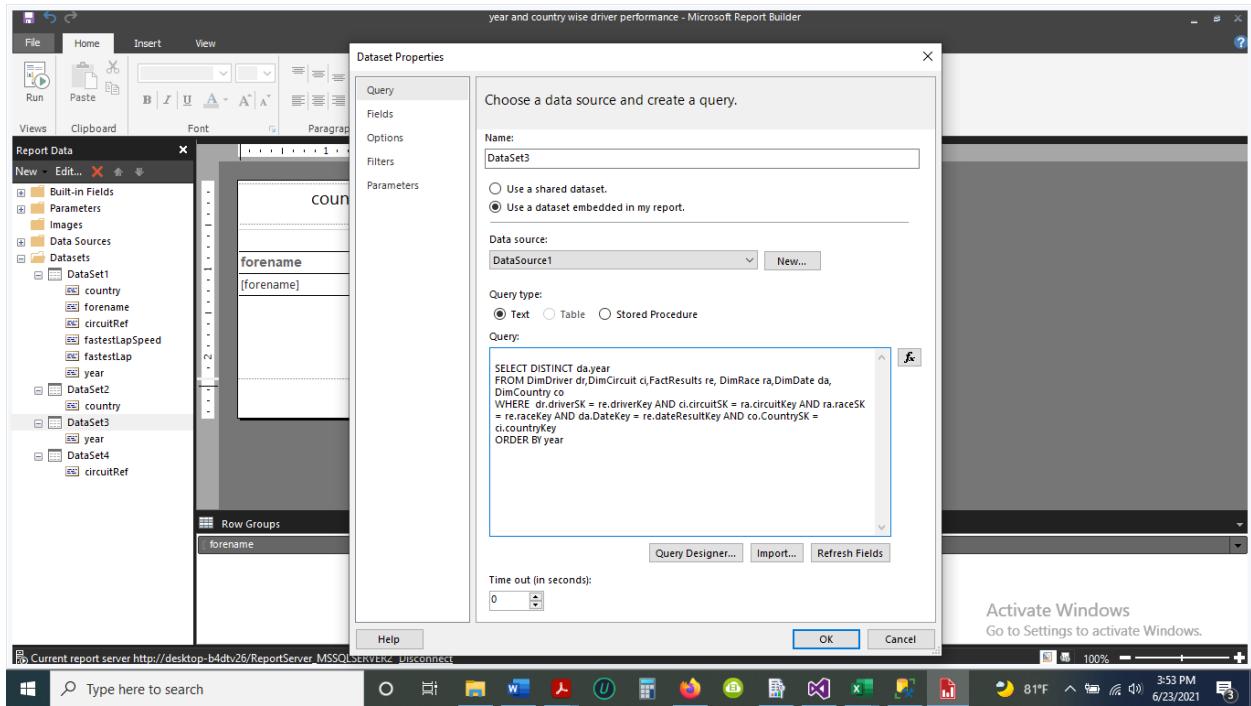
According to the above diagram, I have created the first dataset to get data from the source to populate data for the report. The query designed for the dataset is accepting parameters for Country , range of years values and Circuit

Instead of the main data set that is responsible for creating the report, I have created another three datasets to get data for the parameters so that the values are displayed to the front end.

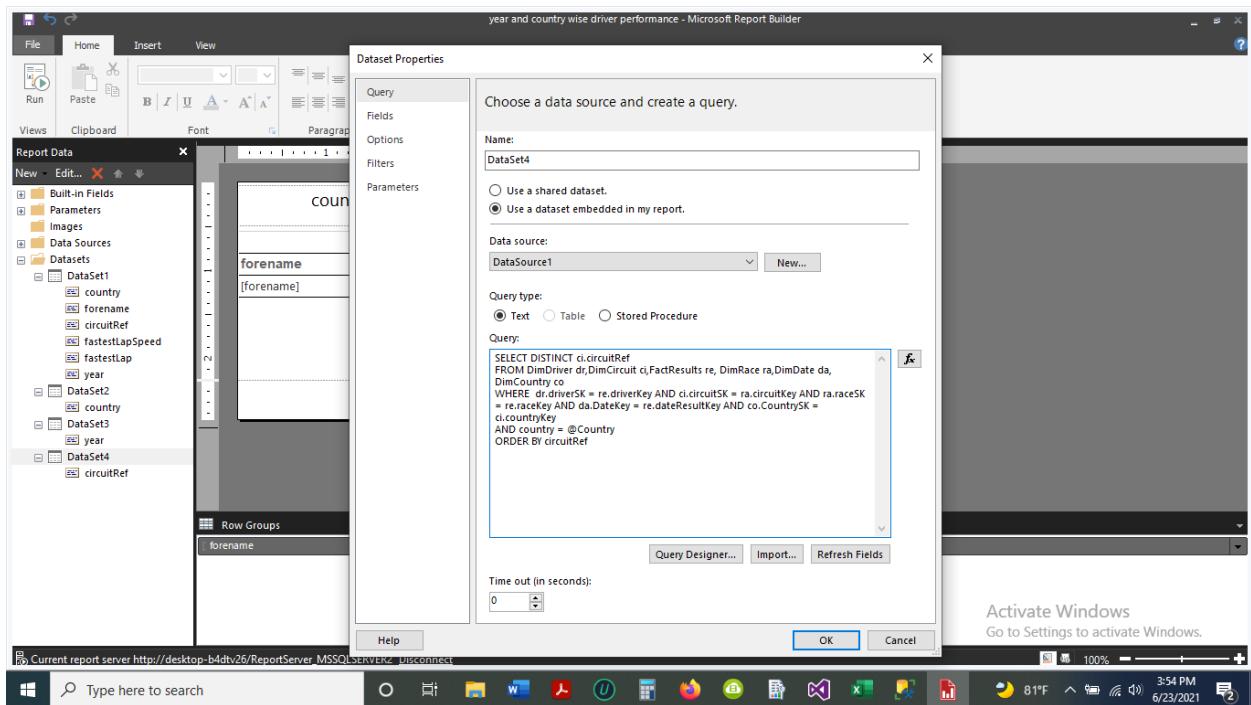
once



The data set shown in the above diagram is created to get data for the country parameter.

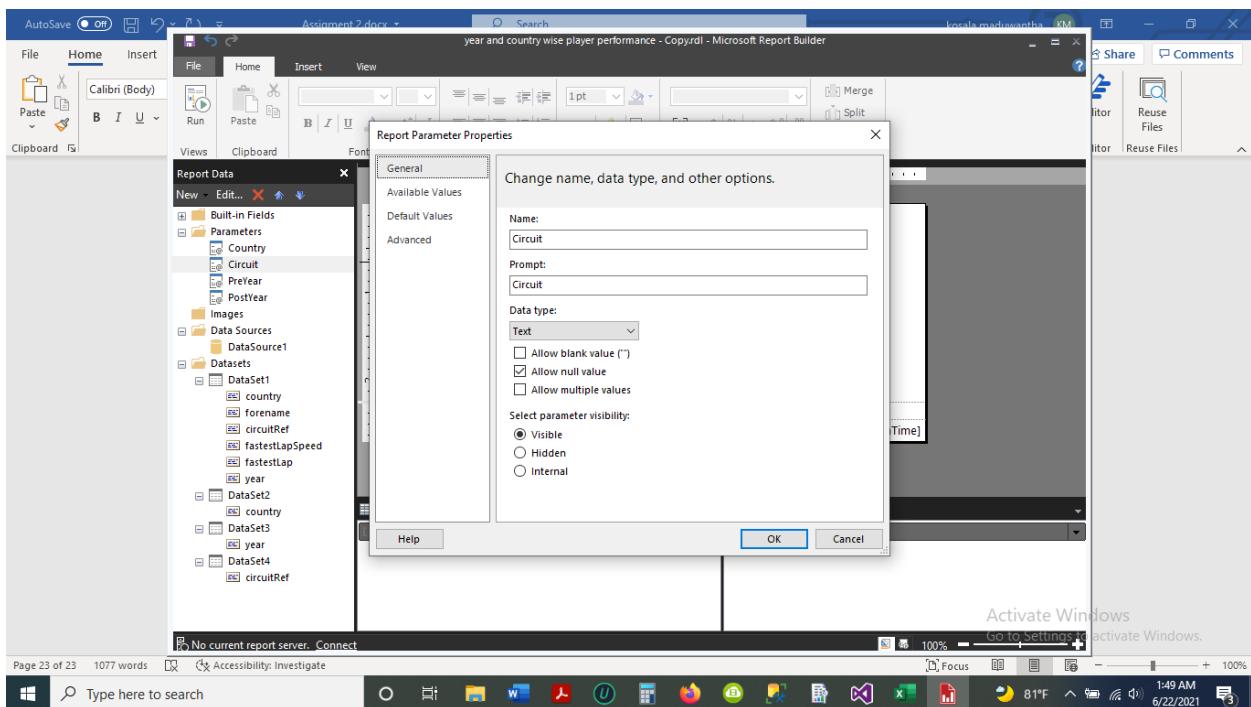
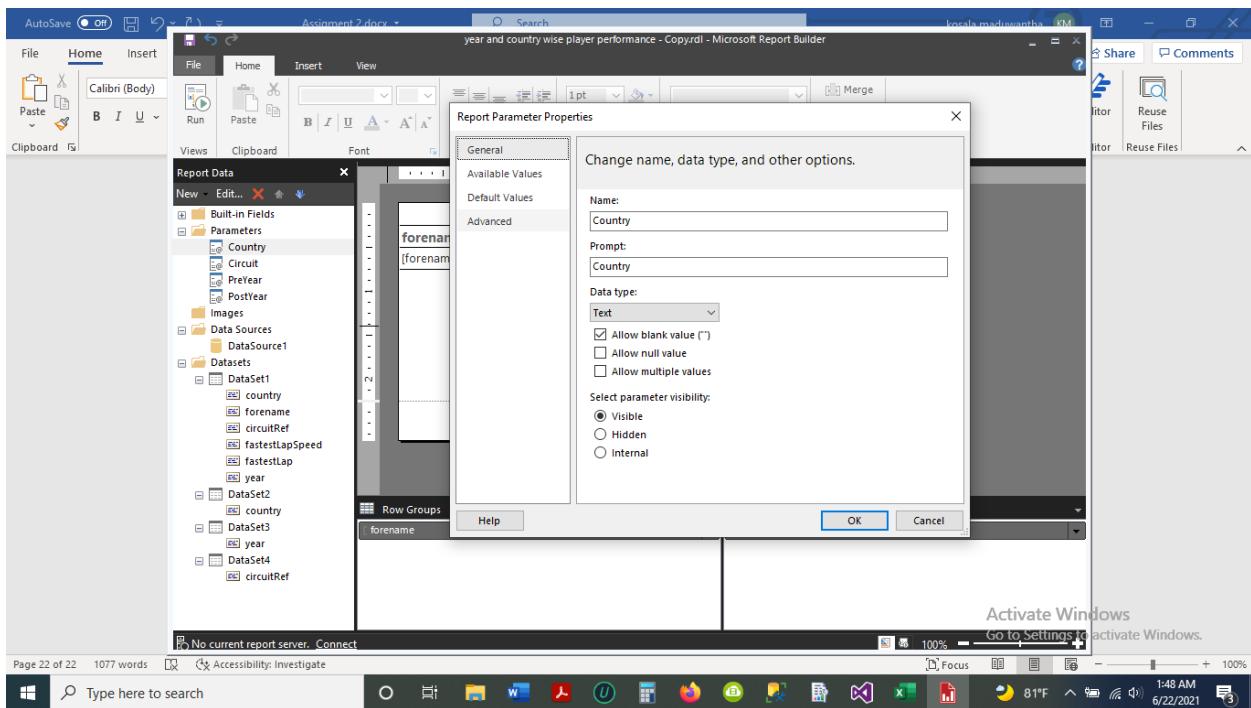


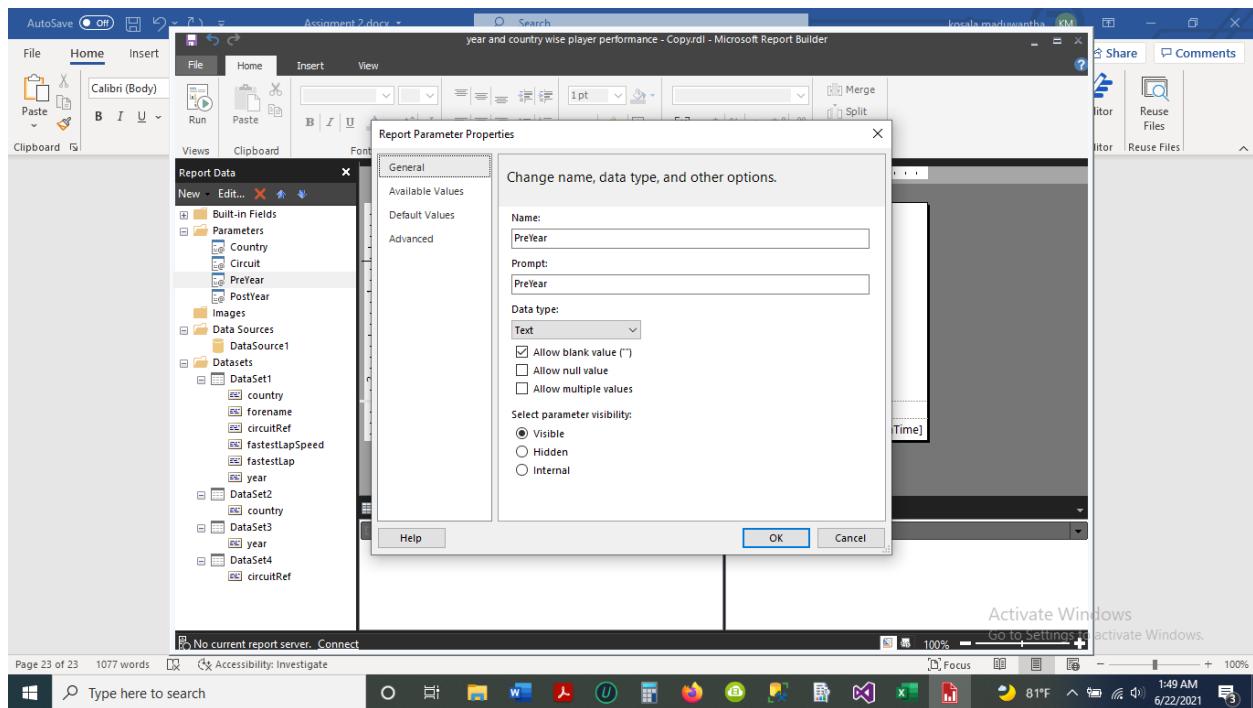
Above dataset is created to get data for the Year parameter.



Above dataset is created to get data for the circuit parameter.

For all the datasets, I have created separate parameters in parameters tab, they are @Country, @Circuit, @Year.





All the parameters accept data fetching by the datasets that I have created above.

After creating the report using the dataset, I have done some changes to the report like display nulls as zeros, and the final report is looks like below.

The screenshot shows the Microsoft Report Builder preview window. The report title is 'year and country wise player performance - Copy.rdl - Microsoft Report Builder'. The preview shows a table titled 'Country, Circuit and year wise performance'. The table has columns for 'forename', 'fastest Lap Speed', 'fastest Lap', and 'fastest Lap Speed' for the years 1992, 1993, and 1994. The table includes rows for Aguri, Alain, Andrea, Ayrton, Bertrand, Christian, Damon, Derek, Erik, Franck, Gerhard, Gianni, Heinz-Harald, and Jan. The preview window also shows dropdown menus for 'Country' (set to 'Australia'), 'Circuit' (showing 'adelaide' and 'albert\_park' in the dropdown), 'PreYear' (set to '1992'), and 'PostYear' (set to '2007'). The Windows taskbar at the bottom shows various application icons and the date/time.

Assignment 2.docx

year and country wise player performance - Copy.rdl - Microsoft Report Builder

File Run

Design Zoom

Views Zoom

First Previous 1 of 2 Next Last Stop Back

Print Page Setup Print Layout Export Options Find

Country Australia Circuit albert\_park PreYear 1992 PostYear 2007 View Report

Country, Circuit and year wise performance

	1996	1997	1998			
forename	fastest Lap Speed	fastest Lap	fastest Lap Speed	fastest Lap	fastest Lap Speed	fastest Lap
Alex	0	0	0	0	0	0
Alexander	0	0	0	0	0	246
Christian	0	0	0	0	0	0
Christijan	0	0	0	0	0	0
Cristiano	0	0	0	0	0	0
Damon	249	48	0	0	0	206
David	0	0	200	51	214	
Eddie	246	48	0	0	0	244
Felipe	0	0	0	0	0	0
Fernando	0	0	0	0	0	0
Gerhard	249	42	212	50	0	0
Giancarlo	0	0	0	0	0	0
Heikki	0	0	0	0	0	0
Heinz-Harald	239	47	190	22	197	

No current report server.

Page 24 of 24 1120 words Accessibility: Investigate

Focus 100% 1:58 AM 81°F 6/22/2021

Assignment 2.docx

year and country wise player performance - Copy.rdl - Microsoft Report Builder

File Run

Design Zoom

Views Zoom

First Previous 1 of 2 Next Last Stop Back

Print Page Setup Print Layout Export Options Find

Country Canada Circuit villeneuve PreYear 1992 PostYear 2007 View Report

Country, Circuit and year wise performance

	1992	1993	1994			
forename	fastest Lap Speed	fastest Lap	fastest Lap Speed	fastest Lap	fastest Lap Speed	fastest Lap
Aguri	0	0	209	46	0	0
Alain	0	0	196	52	0	0
Alessandro	0	0	226	66	0	0
Alexander	0	0	0	0	0	0
Andrea	233	22	0	0	0	0
Anthony	0	0	0	0	0	0
Antônio	0	0	0	0	0	0
Christian	205	33	225	43	0	0
Christijan	0	0	0	0	0	0
Cristiano	0	0	0	0	0	0
Damon	0	0	190	46	202	
David	0	0	0	0	0	218
Eddie	0	0	0	0	0	0
Éric	0	0	0	0	0	243

No current report server.

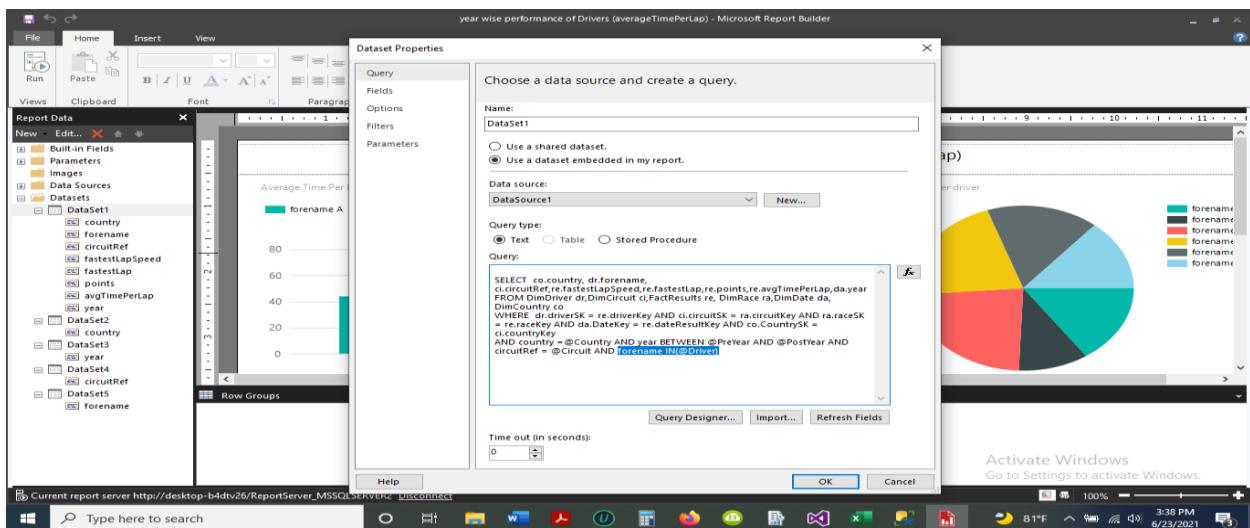
Page 24 of 24 1120 words Accessibility: Investigate

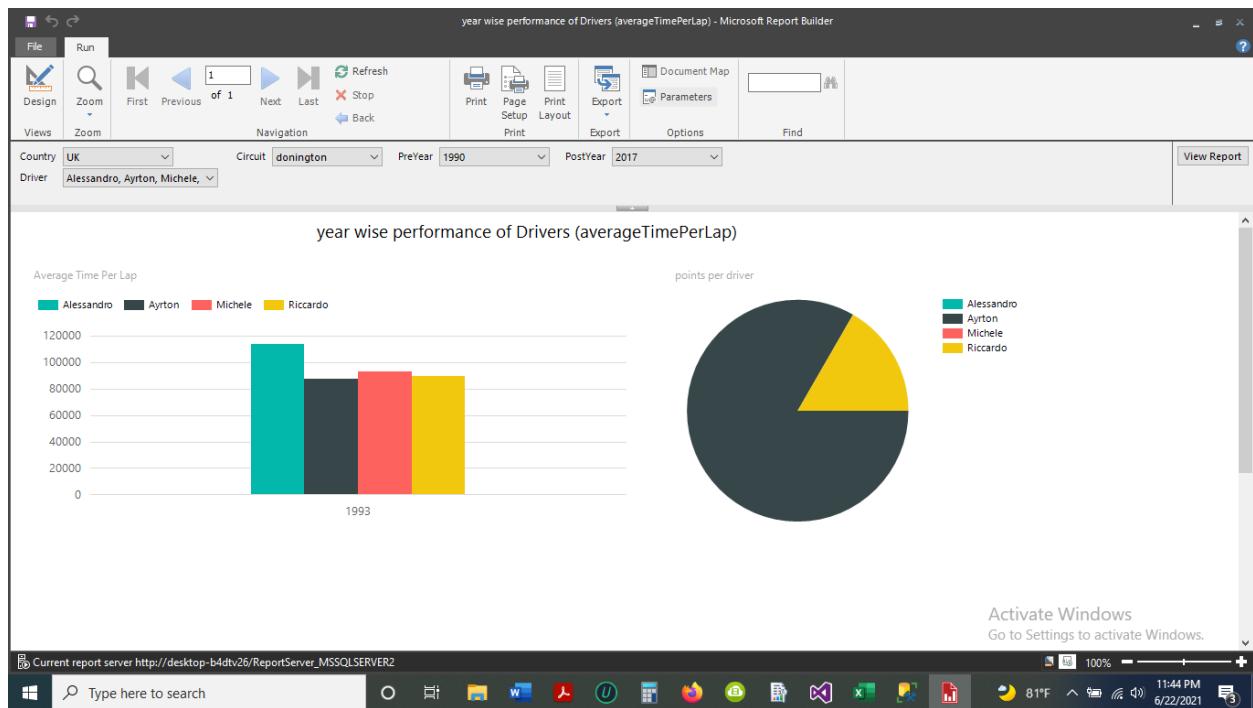
Focus 100% 1:59 AM 81°F 6/22/2021

Visualize report more than one parameter using bar charts.

By using same parameters and datasets, I have created a chart to visualize the country, circuit and year wise driver(player) performance.

To create the chart, I have used extra parameter called driver and changed the main dataset(query) which was responsible for the populate data of the report to accept driver name as parameter in where clause, and the parameter is accepting multiple values from the front end.

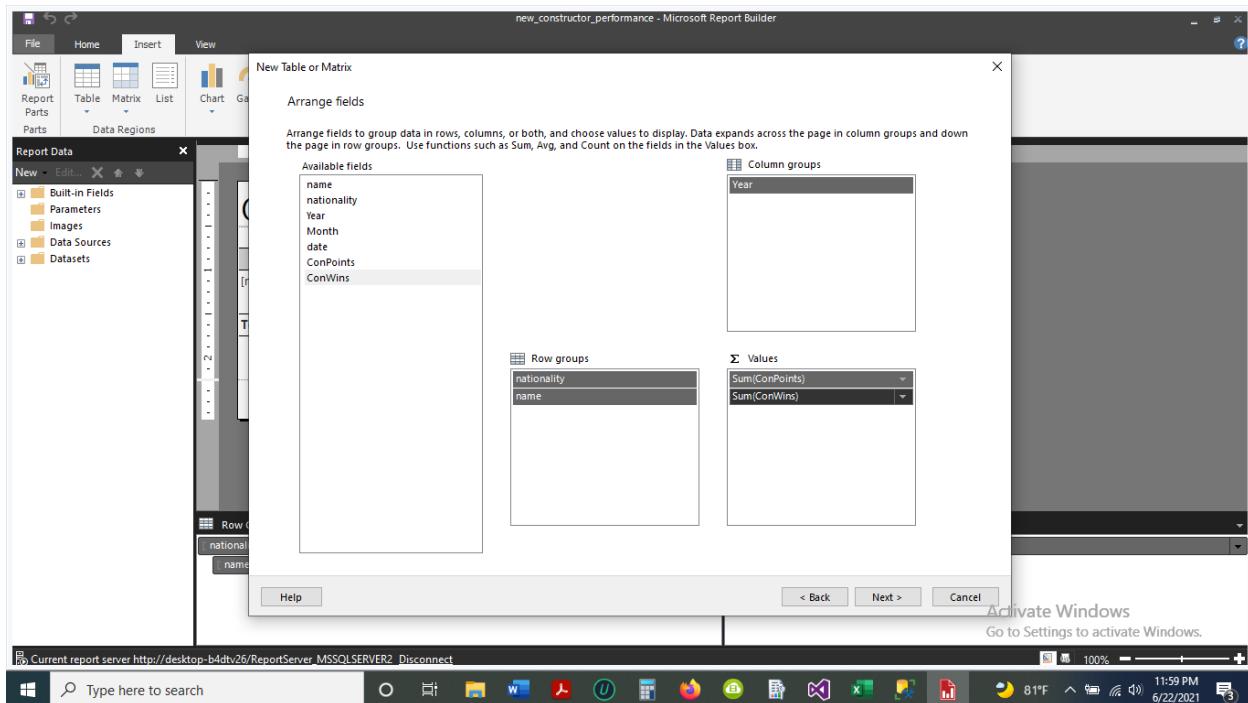


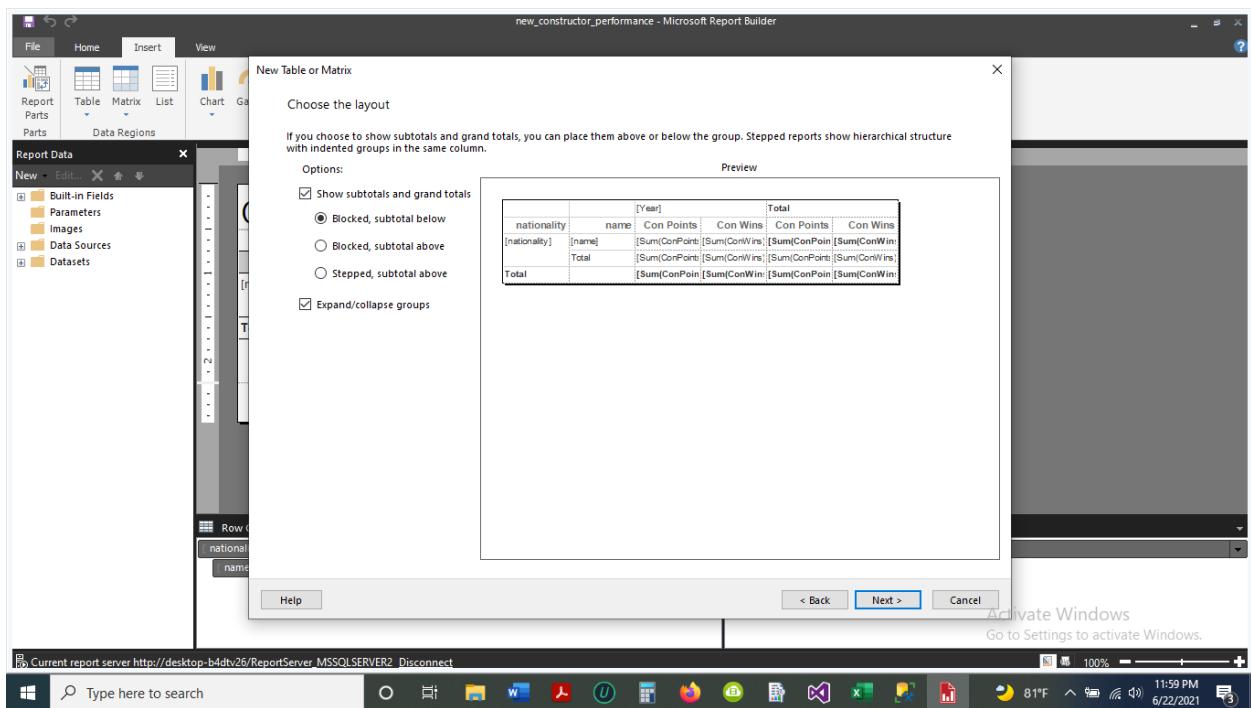


## Drill down report using SSRS

To visualize the drill down operation , I have created a table report by showing the performance of the constructor in the Formula01 contest.

To create the report as usual, I have created the data source using the data warehouse Formula1DW and after that I have created the data set to get constructors performance data and created a matrix by enabling drill down.





After creating the drill down report it looks as below

nationality	name	2001			2003			2010			Total		
		Con Points	Con Wins										
Austrian	Total	0	0	0	0	7879	137	7879	137				
British	Arrows	12	0	0	0	0	0	0	12	0			
	BAR	254	0	210	0	0	0	0	464	0			
	Jaguar	59	0	162	0	0	0	0	221	0			
	McLaren	1235	48	1811	44	7942	111	10988	203				
	Williams	762	40	1961	48	796	0	3519	88				
	Total	2322	88	4144	92	8738	111	15204	291				
French	Total	39	0	988	5	2378	0	3405	5				
German	Total	0	0	0	0	3657	0	3657	0				
Indian	Total	0	0	0	0	888	0	888	0				
Irish	Total	234	0	133	12	0	0	367	12				
Italian	Benetton	70	0	0	0	0	0	70	0				
	Ferrari	2763	143	2247	97	6633	71	11643	311				
	Minardi	0	0	0	0	0	0	0	0				
	Toro Rosso	0	0	0	0	195	0	195	0				
	Total	2833	143	2247	97	6828	71	11908	311				
Japanese	Total	0	0	132	0	0	0	132	0				
Malaysian	Total	0	0	0	0	0	0	0	0				
Swiss	Total	300	0	189	0	409	0	898	0				

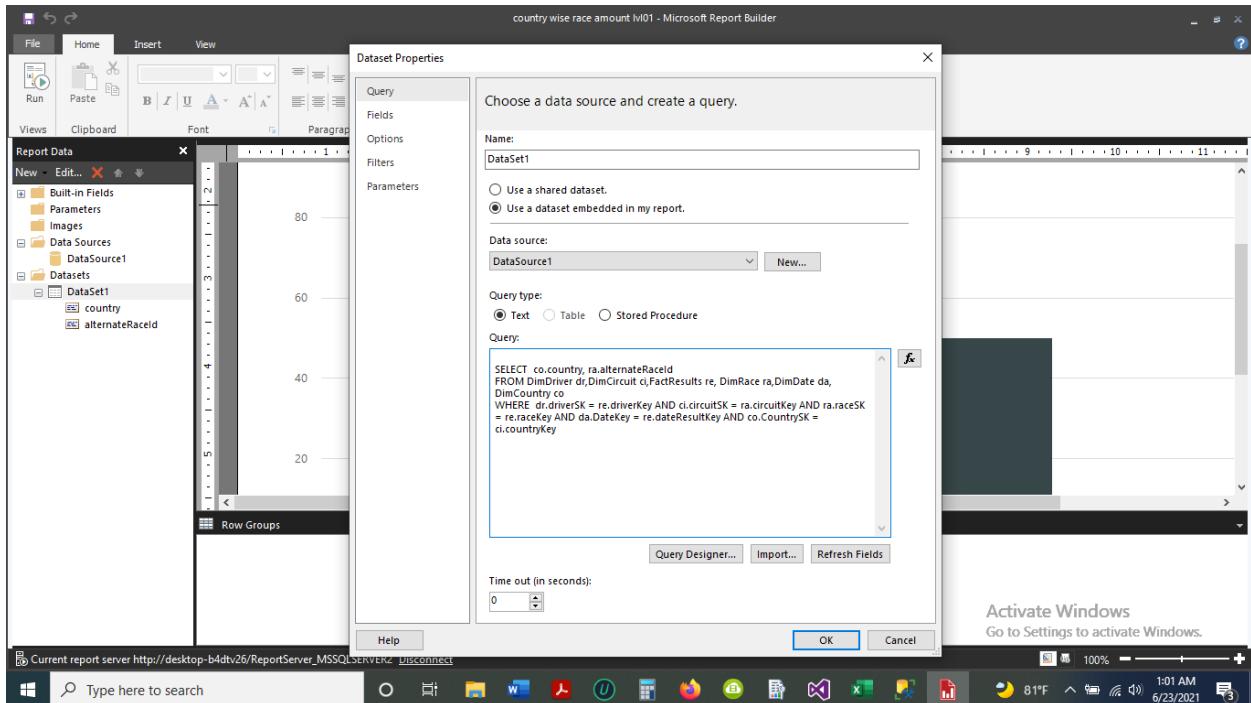
## Drill through report using ssrs

To visualize drill through operation, I have created two bar charts as level01 and level02.

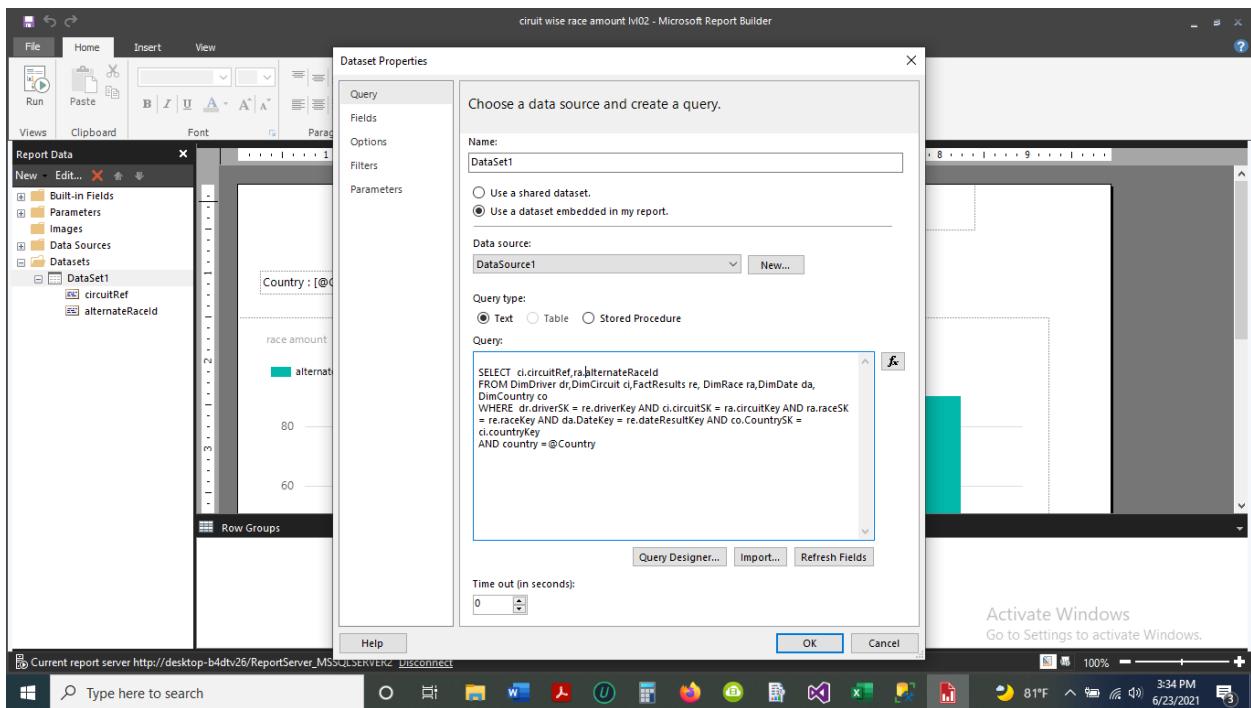
Level01 bar chart visualize number of races country wise and the level 02 visualize the number of races circuit wise , country and circuit is in hierarchy Country -> circuit

To create those charts, first I have created a data source by using data warehouse Formula1DW and created the data set to populate data for the charts

Dataset For the level one chart which is responsible for the visualization of country wise race amount is given below,



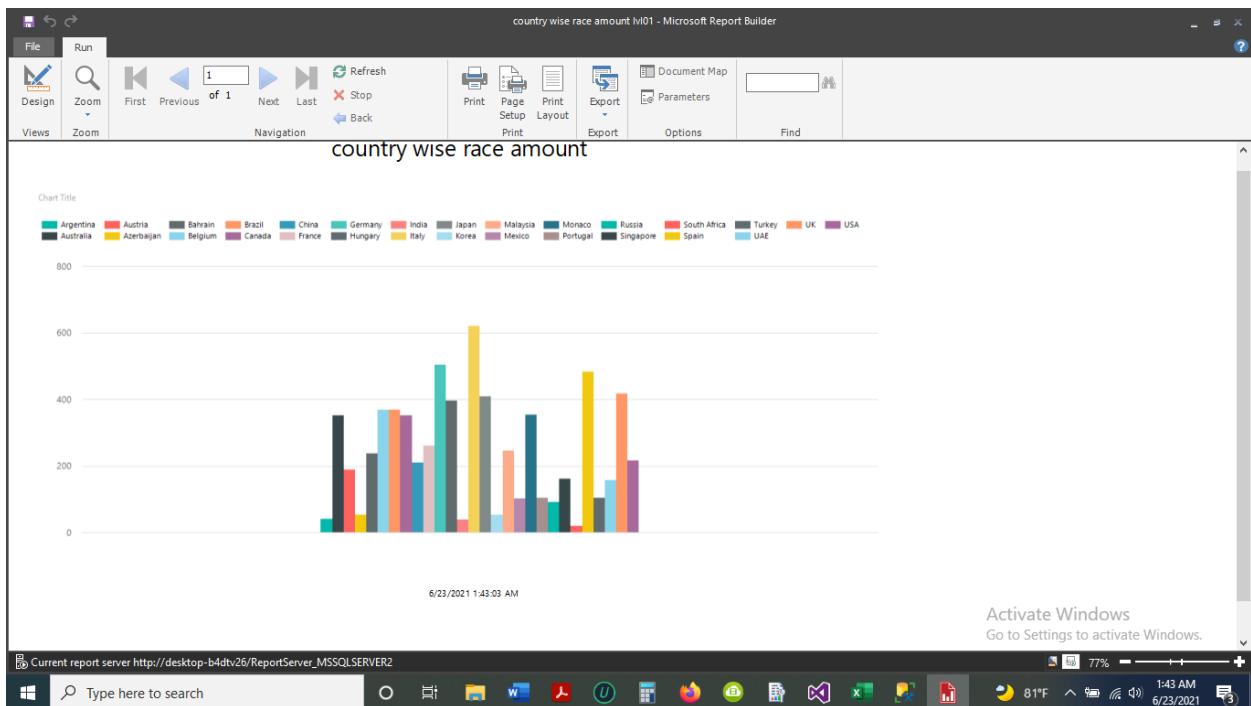
Dataset for the level two chart which is responsible for the visualization of Circuit wise race amount is given below



The level two report dataset is accepting one parameter which is passing from the level one report.

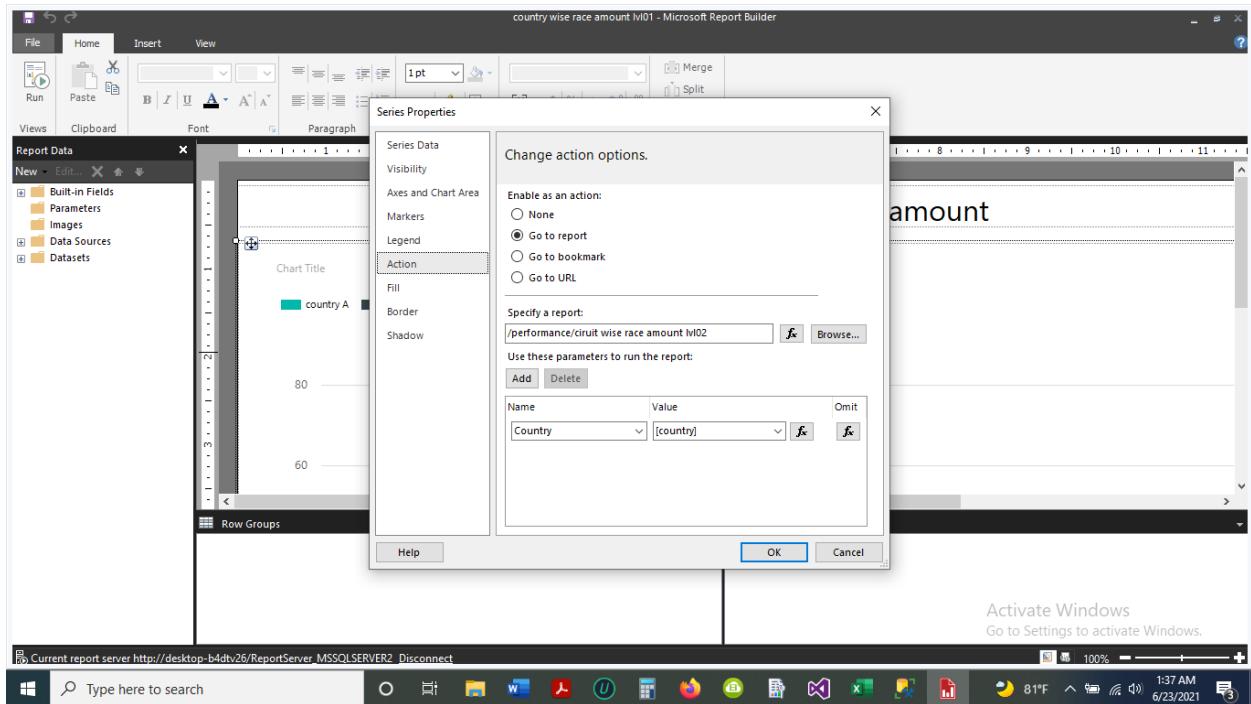
After creating dataset of the first report level01 (country wise race amount), I have created the bar chart using chart creating wizard.

After creating the bar chart of level01, it looks as below,



After creating the level01 report, I have created the second report level02 (Circuit wise amount of races) for the second report dataset is requires a parameter Country to get amount of circuits country wise and that parameter is passing through the level01 report (by clicking on a bar will trigger the second report by passing country name as parameter).

In order to pass the parameter, I have created the action trigger using chart properties as below.

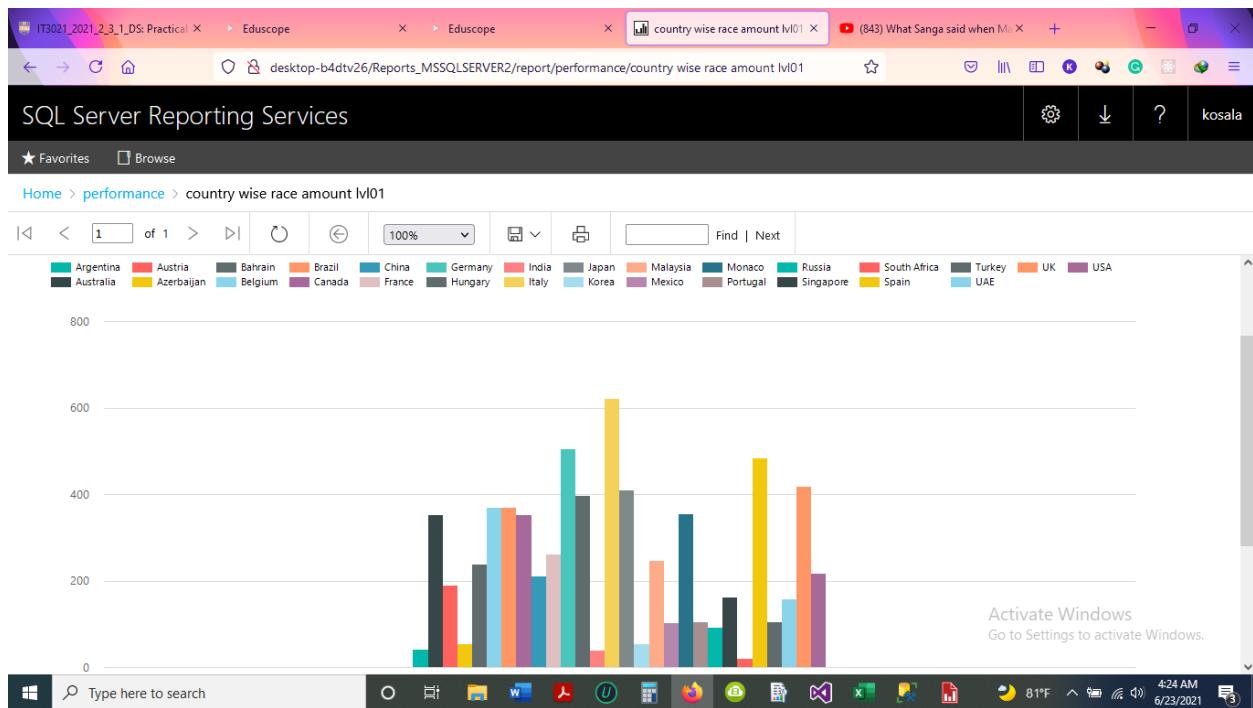


\*\* before creating this trigger, I have created the level 02 report.

After creating the level02 chart, I have created another chart (level03 chart) to display constructor performance given the country and the circuit as the final step of the drill through.

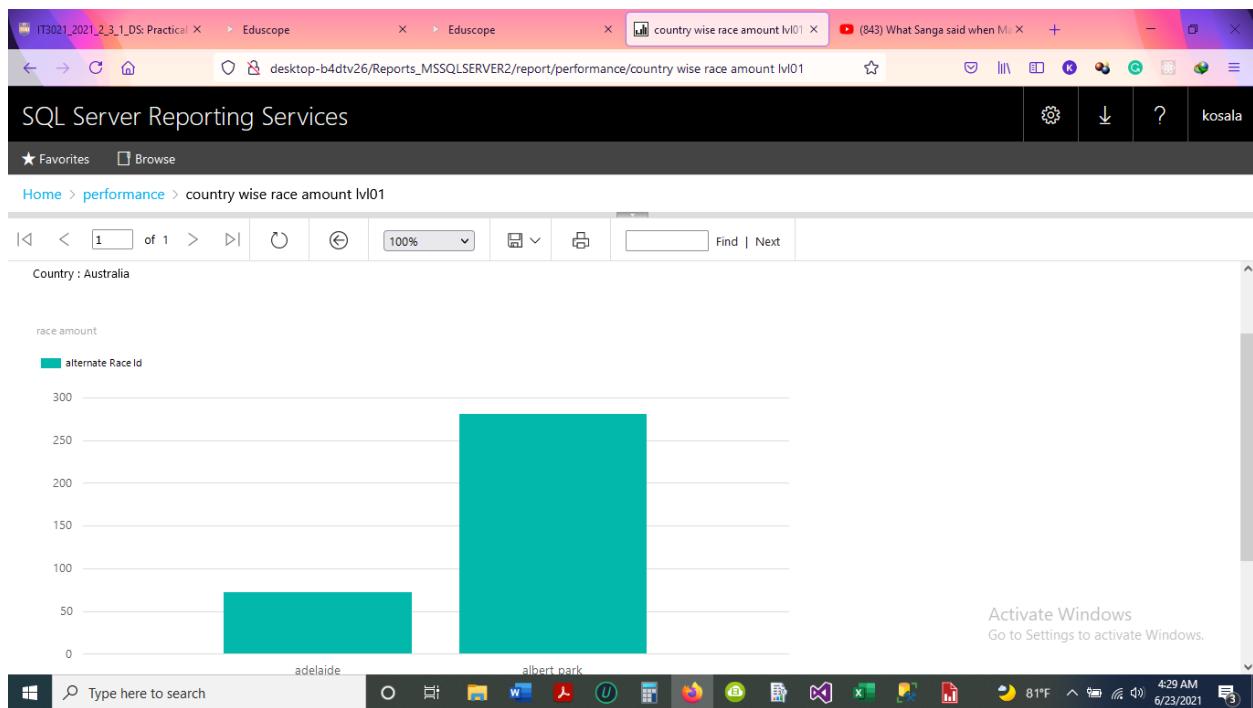
After creating each of the reports related to drill through, I have published them on report server.

Demonstration of the drill through is given below.



By clicking on any bar(country) will trigger to display another bar chart which is visualizing the amount of races held in circuits of a particular country (passed as parameter) .

Ex:- click on Australia bar



By clicking on circuit, it will trigger complete detailed report of a constructor performance according to country and circuit.

Ex :- click on Adelaide

SQL Server Reporting Services

Home > performance > country wise race amount lvl01

constructor performance according to race and circuit

Country : Australia  
Circuit : adelaide

nationality	constructor	alternate Race Id	Con Points	Con Wins
British	brabham	336	2	0
	footwork	256	5	0
		272	9	0
		288	8	0
		304	6	0
		320	0	0
	march	304	3	0
mclaren	256	30	0	
		272	84	0
		288	84	5
		304	99	5
		320	278	16
	336	121	6	

Activate Windows  
Go to Settings to activate Windows.