



**SRILANKA INSTITUTE OF INFORMATION AND  
TECHNOLOGY**

BSc (Hons) In Information Technology Specializing in Data Science

**IT3021 - DATA WAREHOUSING AND BUSINESS  
INTELLIGENCE**

**Assignment 2**

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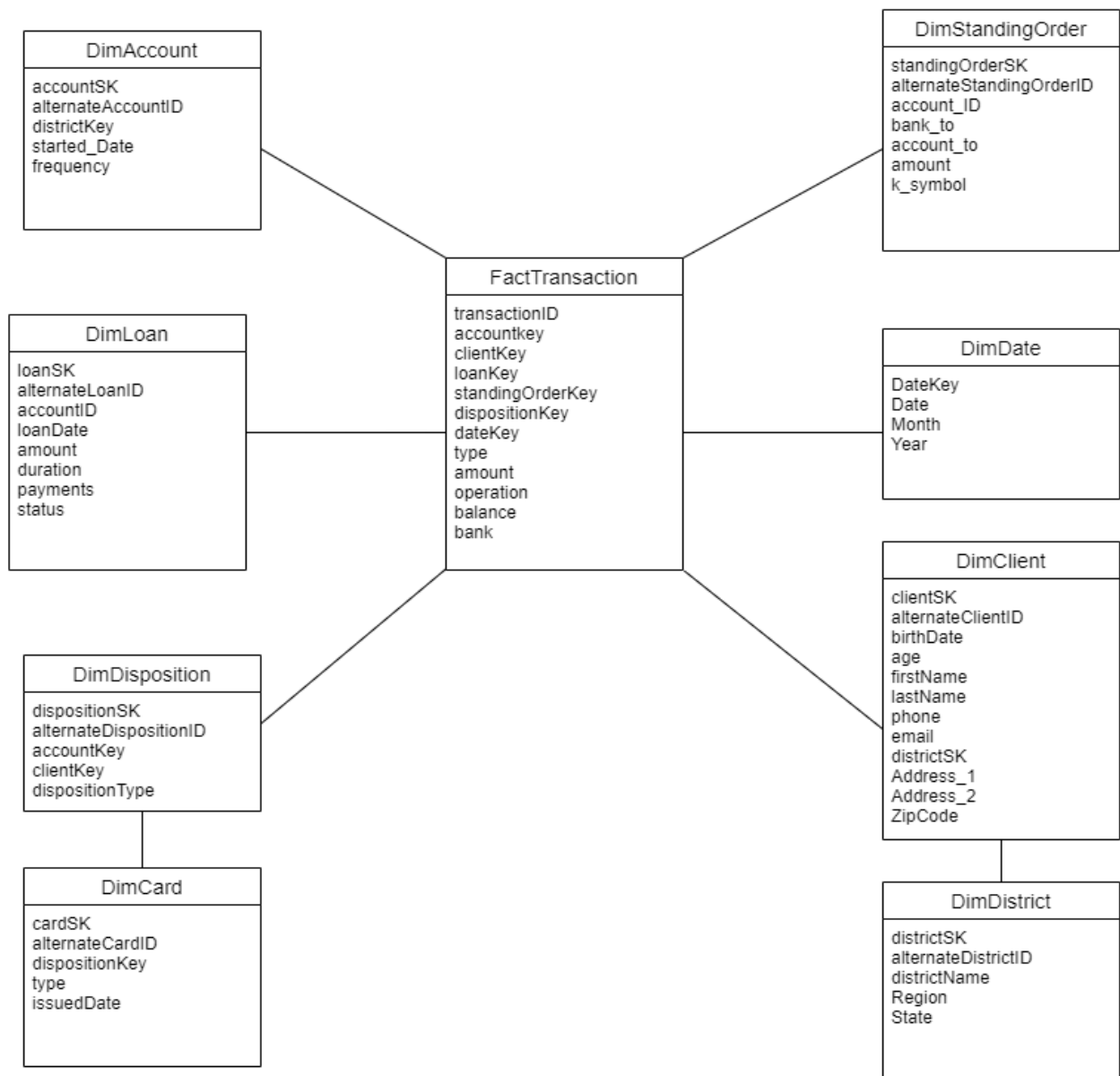
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## 1. Data Source

The data source used for the analysis purpose is 'Predict\_loan\_defaulter\_DW,' which was developed in the assignment 1. This data warehouse was created based on a data set from a bank in Czech Republic to predict loan defaulters in the years 1993 and 1994. The data set has been modified to develop a scenario that meets the requirement of the assignment. Its features allow viewing a transaction from multiple dimensions, from accounts, date, standing order, client, loan, district and disposition.

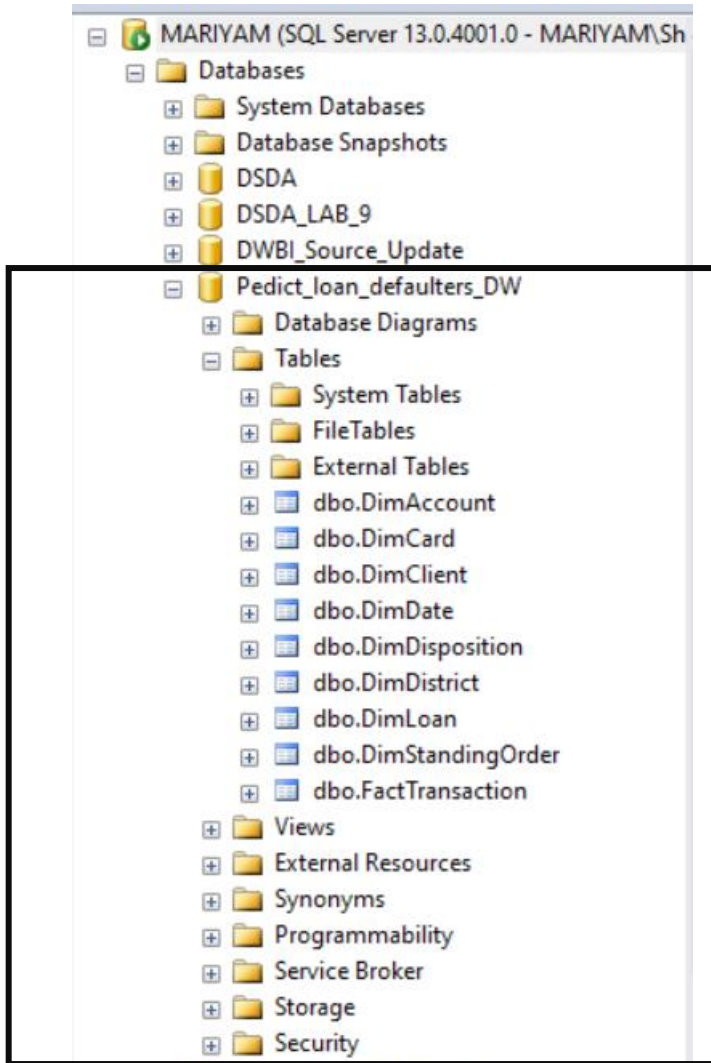
*The Data warehouse schema*



*Figure 1: Data Warehouse Snowflake Schema*

The data warehouse design was implemented using the snowflake schema. It is an extension of star schema and consists of some dimensions that are normalized. According to the schema above, there are 8 dimensions and 1 fact table.

Assumption: Client dimension is considered as a slowly changing dimension.



#### Dimension Tables:

- Dim Account
- Dim Card
- Dim Date
- Dim Client
- Dim Disposition
- Dim District
- Dim StandingOrder
- Dim Loan
- Dim District

#### Fact Tables:

- Fact Transactions

## 2. SSAS Cube Implementation

OLAP Cube is a method for *storing data in multidimensional forms*. It will allow to analyze a multidimensional data from multiple perspectives. The advantage of using a cube is that it pre-calculates most of the queries, that is time consuming to execute over relational tables that contains joins and aggregates. The main components of the cube are:

1. **Dimensions:** *Define the structure of the cube that is used for OLAP operations.*
2. **Measures:** *Provide aggregated numeric values of interest to the end user.*

### 2.1 Cube Creation

- As the initial step an analysis service project in the name ‘PredictLoan\_SSAS’ was created was the data source was configured in order to extract data to the cube.
- A data source view ‘PredictLoanDefaulters\_DSV’ was created and all necessary table links were created.
- A cube named ‘Predict\_Loan\_Defaulters\_Cube’ was created, by selecting the necessary measures. Then necessary attributes and hierarchies were added before the deployment of the cube.

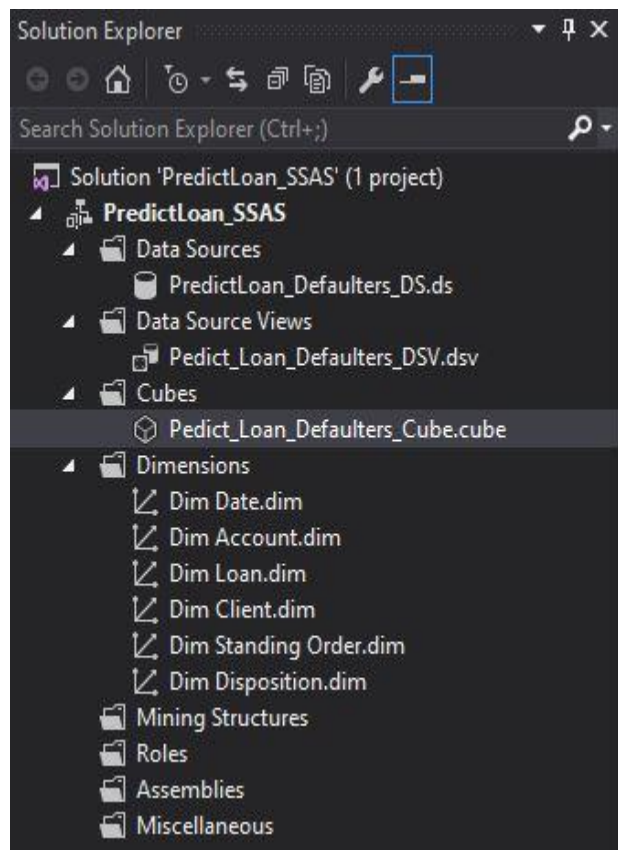


Figure 2: Cube creation solution explorer

## 2.2 Data Source View

It represents the cube structure, measures and dimensions.

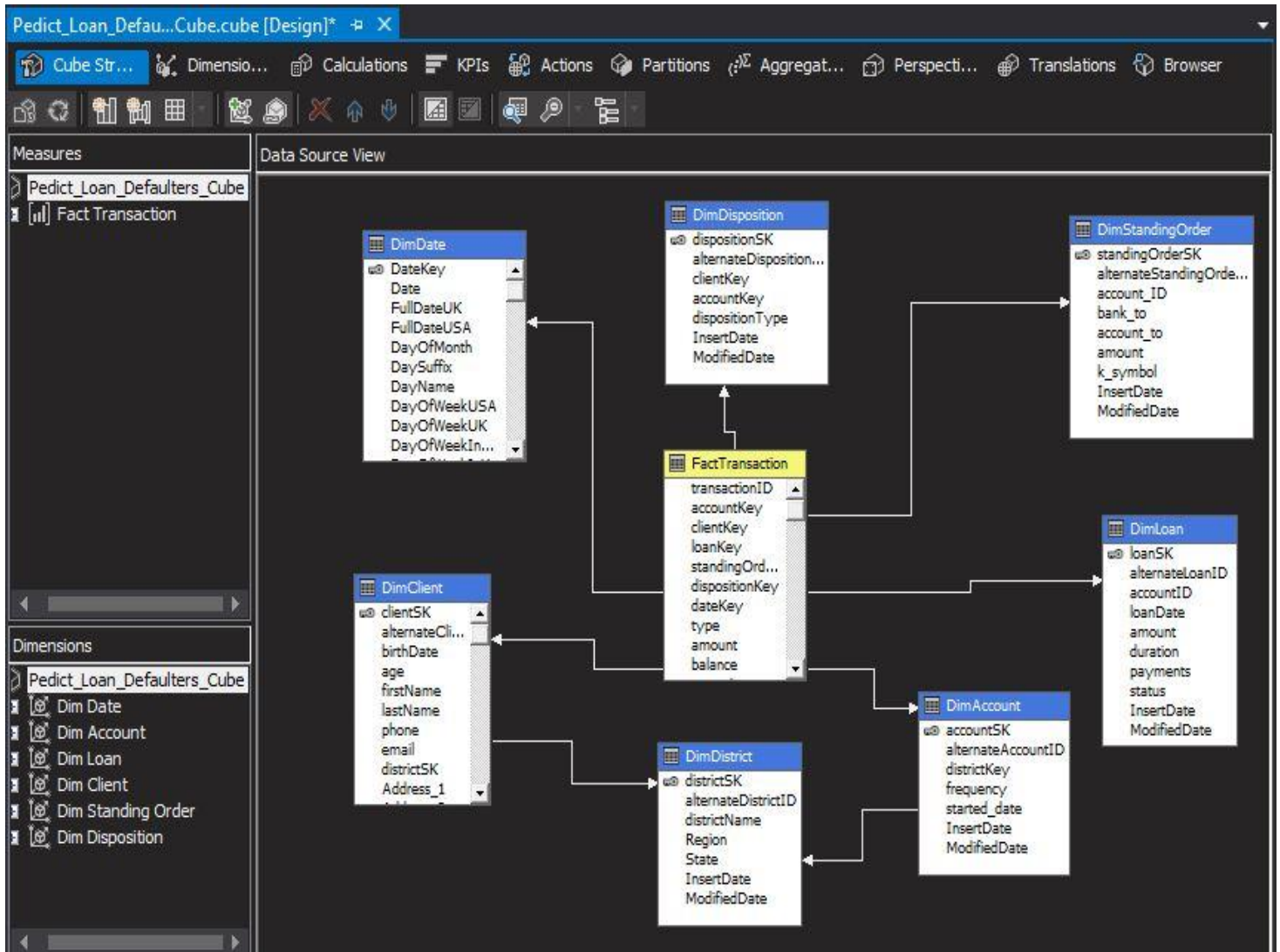
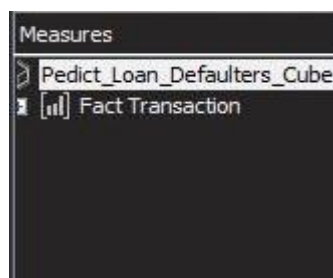
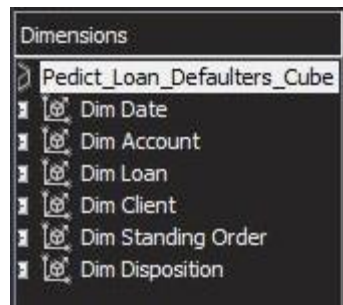


Figure 3:Cube Structure



Measures



Dimensions

## 2.3 Hierarchies

Hierarchies are a useful tool in SSAS to reduce complexity between attributes and guide users into a certain drill-down behavior.

a. **Location Hierarchy** – The higher level is the state, which contains multiple regions, and the regions contain multiple districts.



Figure 4: Location Hierarchy

b. **Date Hierarchy** – The higher level is the year, which then is followed by the lower levels quarter, month and date.



Figure 5: Date Hierarchy

## 2.4 KPI Values

In SQL Server Analysis Services, add *key performance indicators* (KPIs) can be added to our database cube in order to evaluate business performance, as reflected in the cube data. A KPI is associated with a measure group and is made up of a set of calculations. Typically, the calculations are a combination of calculated members and Multidimensional Expressions (MDX) statements.

*Relevant KPI's used:*

1. MeasureAmount\_KPI: Total loan amounts
2. MeasureBalance\_KPI: Total balances

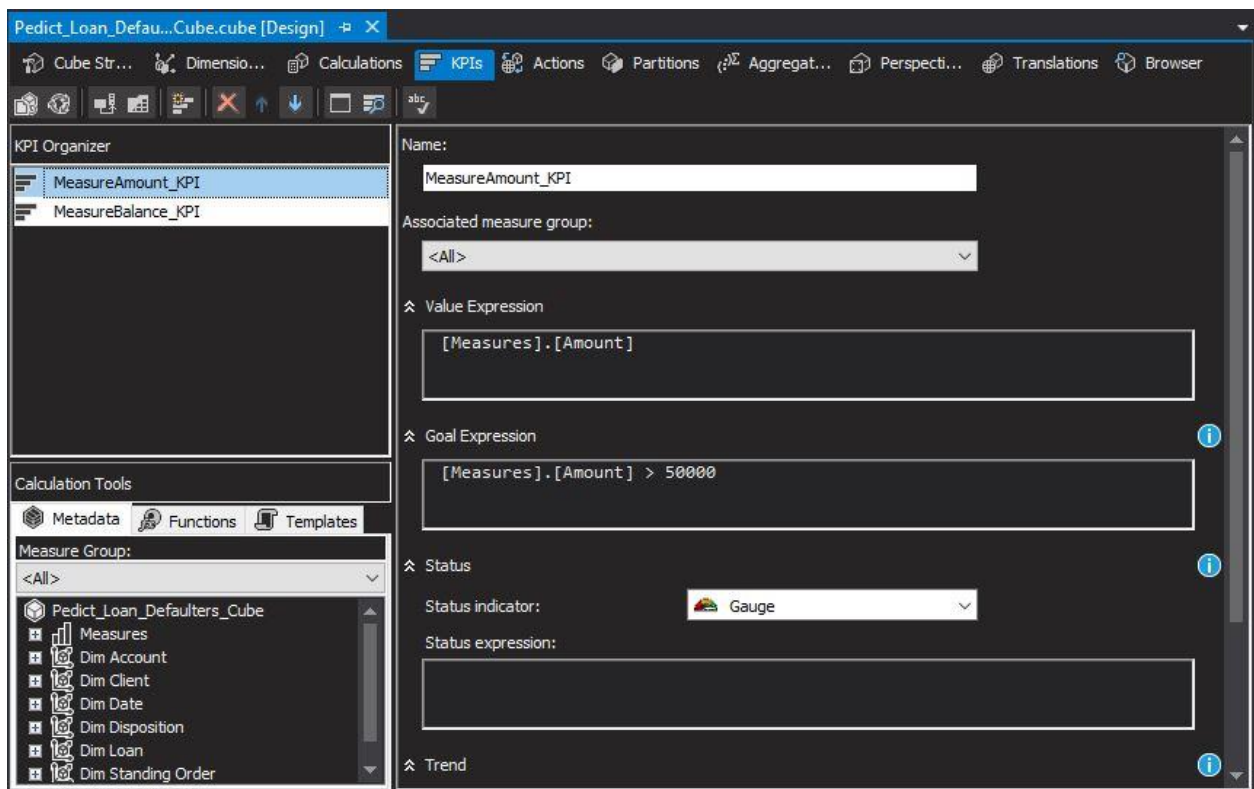


Figure 6: Adding KPI's



## 2.5 Cube Deployment

After setting all attributes, hierarchies and KPI's, finally the cube was deployed.

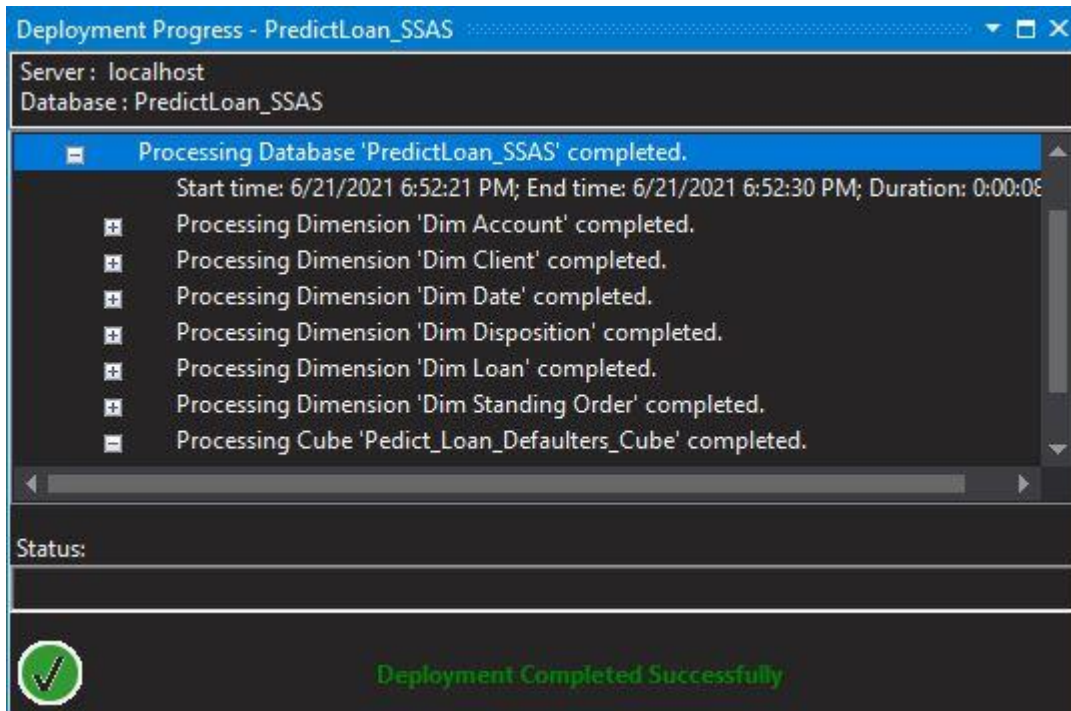


Figure 7: Deployment Success

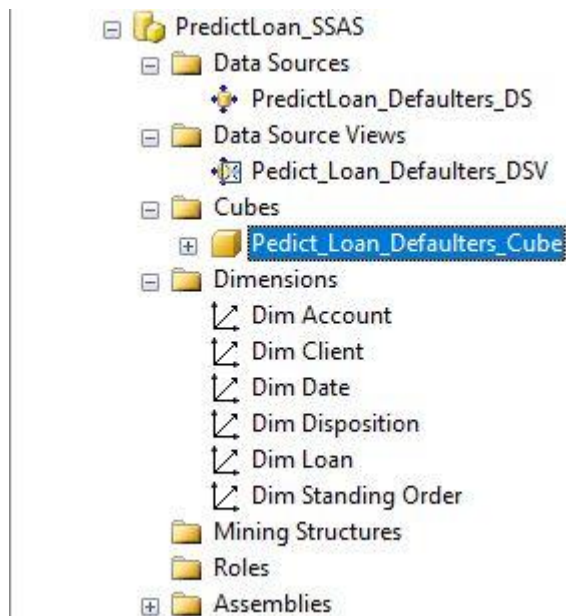


Figure 8: Cube Deployed to SSMS

### 3. Demonstration of OLAP Operations

OLAP operation is an important part of Business Intelligence, that provides powerful capabilities for data mining and trend analysis. They are capable of solving problems in both business and IT departments. OLAP helps to analyze big data amounts from different perspectives rapidly.

MDX query can be used to connect to the excel workbooks to get data to the semantic layer for respective demonstrations. This method needs to build up MDX query through SSAS project by browsing data. The same can be done using 'data' tab in excel. This will enable the connection with the whole set of facts and dimension tables. For the assignment purpose, the second approach of connecting to the entire data set was used.

Five analytical operations can be performed using OLAP:

1. *Roll-up*
2. *Drill-down*
3. *Slice and Dice*
4. *Pivot*

#### 3.1 Roll-up and Drill-down

**Roll-up** is also known as 'consolidation' and 'aggregation,' which can be performed in two ways:

1. Reducing dimensions
2. Climbing up a dimension hierarchy

**Drill-down** is the opposite of roll-up. It means to step down a hierarchy, which will enable navigation through details of a dimension. This operation fragments data into smaller parts. It can be done via:

1. Moving down a hierarchy
2. Increasing the dimension.

**Report 1** – *Total loan amounts and Total balances based on roll-ups and drill-down of State and Region.* The report displays the total loan amount, total balances and the achievement of the KPI goal for each year, based on the roll-ups and drill downs of State, Regions and districts.

#### *Roll-up (Regions rolled up to State)*

Figure 9: Pivot Table of roll up

Column Label									
	1993			1994			Total Amount	Total Balance	Total MeasureAmount_KPI Goal
Row Label	Amount	Balance	MeasureAmount_KPI Goal	Amount	Balance	MeasureAmount_KPI Goal			
Bohemia	102,621,624.00	508,817,476.00	TRUE	19,594,064.00	110,360,366.00	TRUE	122,215,688.00	619,177,842.00	TRUE
Czech	25,596,845.00	128,115,237.00	TRUE	4,927,217.00	27,081,364.00	TRUE	30,524,062.00	155,196,601.00	TRUE
Morava	76,085,622.00	385,943,645.00	TRUE	15,584,679.00	85,014,442.00	TRUE	91,670,301.00	470,958,087.00	TRUE
Grand Total	204,304,091.00	1,022,876,358.00	TRUE	40,105,960.00	222,456,172.00	TRUE	244,410,051.00	1,245,332,530.00	TRUE

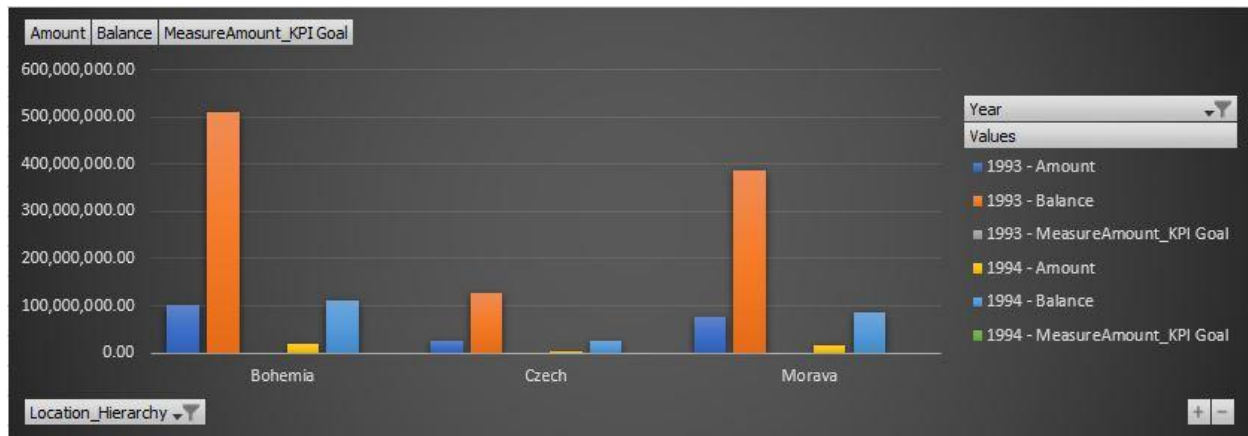


Figure 10: Pivot chart of roll up

The pivot table and the pivot chart shows the total loan amounts and the balances for all the rolled up States, according to each year.

### *Drill-down (States have been drilled down to regions)*

Row Labels	1993			1994			Total Amount	Total Balance	Total MeasureAmount_KPI Goal
	Amount	Balance	MeasureAmount_KPI Goal	Amount	Balance	MeasureAmount_KPI Goal			
Bohemia									
central Bohemia	27,192,812.00	131,384,523.00	TRUE	5,080,317.00	28,179,445.00	TRUE	32,273,129.00	159,563,968.00	TRUE
east Bohemia	23,166,397.00	116,736,634.00	TRUE	4,429,254.00	25,831,992.00	TRUE	27,595,651.00	142,568,626.00	TRUE
north Bohemia	18,607,614.00	91,459,656.00	TRUE	3,617,393.00	20,912,425.00	TRUE	22,225,007.00	112,372,081.00	TRUE
south Bohemia	16,589,195.00	83,469,045.00	TRUE	2,744,827.00	15,346,506.00	TRUE	19,334,022.00	98,815,551.00	TRUE
west Bohemia	17,065,606.00	85,767,618.00	TRUE	3,722,273.00	20,089,998.00	TRUE	20,787,879.00	105,857,616.00	TRUE
Czech	25,596,845.00	128,115,237.00	TRUE	4,927,217.00	27,081,364.00	TRUE	30,524,062.00	155,196,601.00	TRUE
Morava	76,085,622.00	385,943,645.00	TRUE	15,584,679.00	85,014,442.00	TRUE	91,670,301.00	470,958,087.00	TRUE
Grand Total	204,304,091.00	1,022,876,358.00	TRUE	40,105,960.00	222,456,172.00	TRUE	244,410,051.00	1,245,332,530.00	TRUE

Figure 11: Drill Down Pivot Table

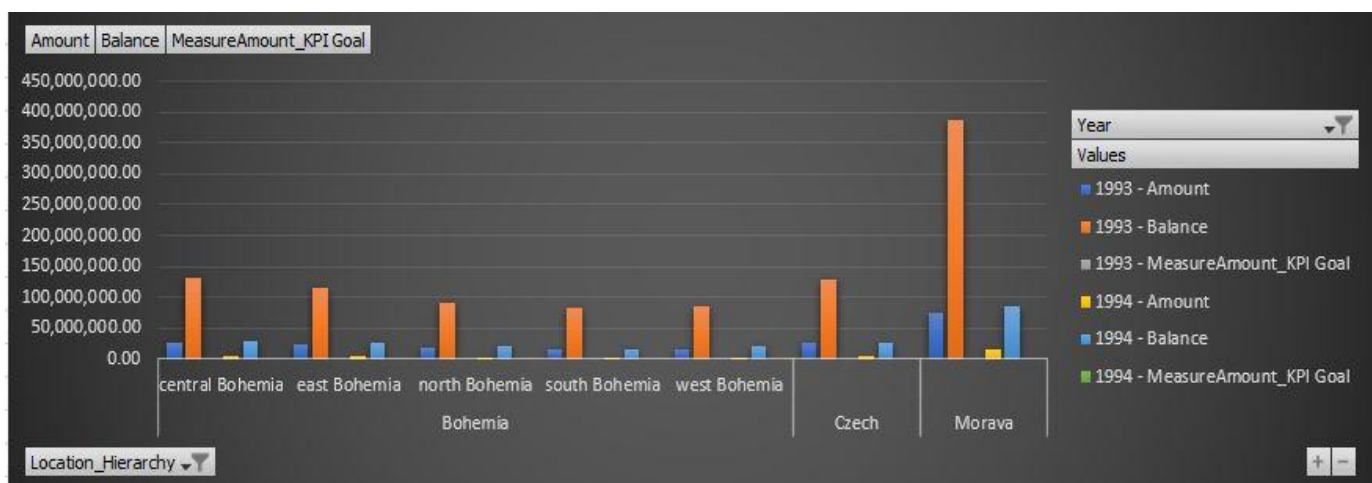


Figure 12: Drill Down Pivot Chart

The pivot table and chart represent the total loan amounts and balances for the drilled downed regions of the state '*Bohemia*,' for each year.

**Report 2 – Total loan amounts, balances and the number of transactions based on roll-ups and drill-down of Year, Quarter and months.** The report displays the total loan amounts, the balances and the number of transactions for each type of standing order based on the roll-up and drill down of the date hierarchy.

***Roll-Up (Quarters rolled up to Year)***

	Column Label ▼											
	Household			Leasing			Loan			Unknown		
Row Label ▼	Amount	Balance	Fact Transaction Count	Amount	Balance	Fact Transaction Count	Amount	Balance	Fact Transaction Count	Amount	Balance	Fact Transaction Count
1993	96,157,868.00	553,548,137.00	17718	30,956,219.00	121,789,649.00	2341	42,687,578.00	183,133,840.00	3804	34,502,426.00	164,404,732.00	17718
1994	20,749,017.00	138,907,518.00	4596	4,641,486.00	17,883,332.00	426	7,247,691.00	29,577,087.00	754	7,467,766.00	36,088,235.00	4596
Grand Total	116,906,885.00	692,455,655.00	22314	35,597,705.00	139,672,981.00	2767	49,935,269.00	212,710,927.00	4558	41,970,192.00	200,492,967.00	22314

Figure 13: Roll Up Pivot Table of Date hierarchy

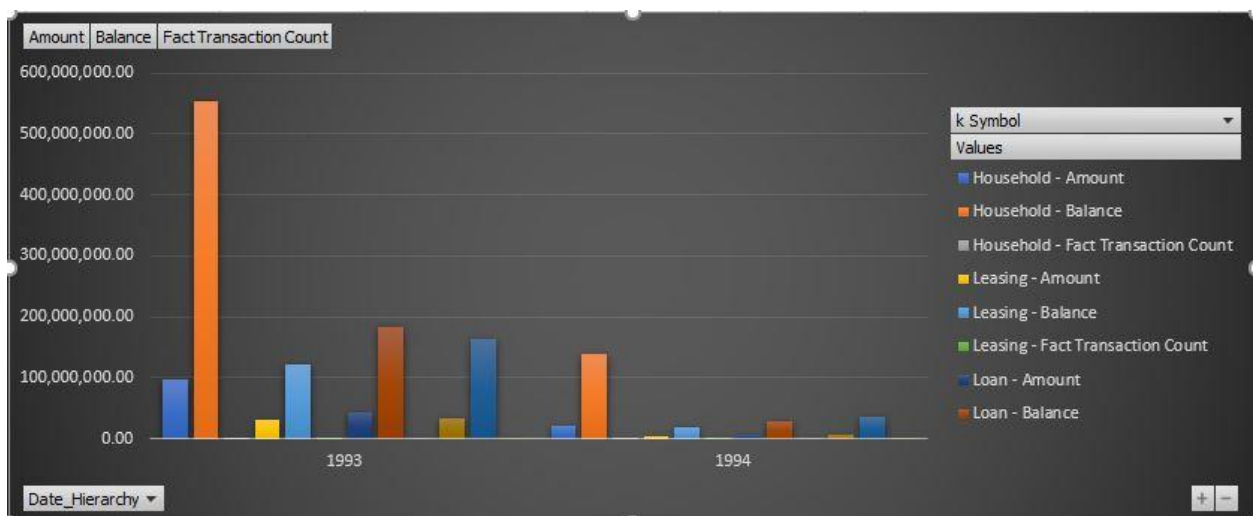


Figure 14: Roll Up Pivot Chart

The pivot table and the pivot chart represent the total loan amounts, balances, and the number of transactions for roll up on years, based on the standing order types such as household, leasing or loans.



	Column Labels										
	Household			Leasing			Loan			Unknown	
Row Labels	Amount	Balance	Fact Transaction Count	Amount	Balance	Fact Transaction Count	Amount	Balance	Fact Transaction Count	Amount	Balance
1993											
1	4,199,044.00	13,801,573.00	799	1,059,541.00	3,274,207.00	100	1,500,439.00	4,365,536.00	144	1,400,237.00	4,512,589.00
2	17,246,124.00	72,082,207.00	2363	5,748,818.00	18,218,412.00	362	8,179,265.00	30,848,119.00	613	6,176,264.00	25,140,805.00
3	28,431,487.00	169,688,344.00	5487	10,302,577.00	41,592,081.00	768	13,500,718.00	58,562,162.00	1204	10,252,630.00	50,971,243.00
4	46,281,213.00	297,976,013.00	9069	13,845,283.00	58,704,949.00	1111	19,507,156.00	89,358,023.00	1843	16,673,295.00	83,780,095.00
1994	20,749,017.00	138,907,518.00	4596	4,641,486.00	17,883,332.00	426	7,247,691.00	29,577,087.00	754	7,467,766.00	36,088,235.00
Grand Total	116,906,885.00	692,455,655.00	22314	35,597,705.00	139,672,981.00	2767	49,935,269.00	212,710,927.00	4558	41,970,192.00	200,492,967.00

Figure 15: Drilled down pivot table

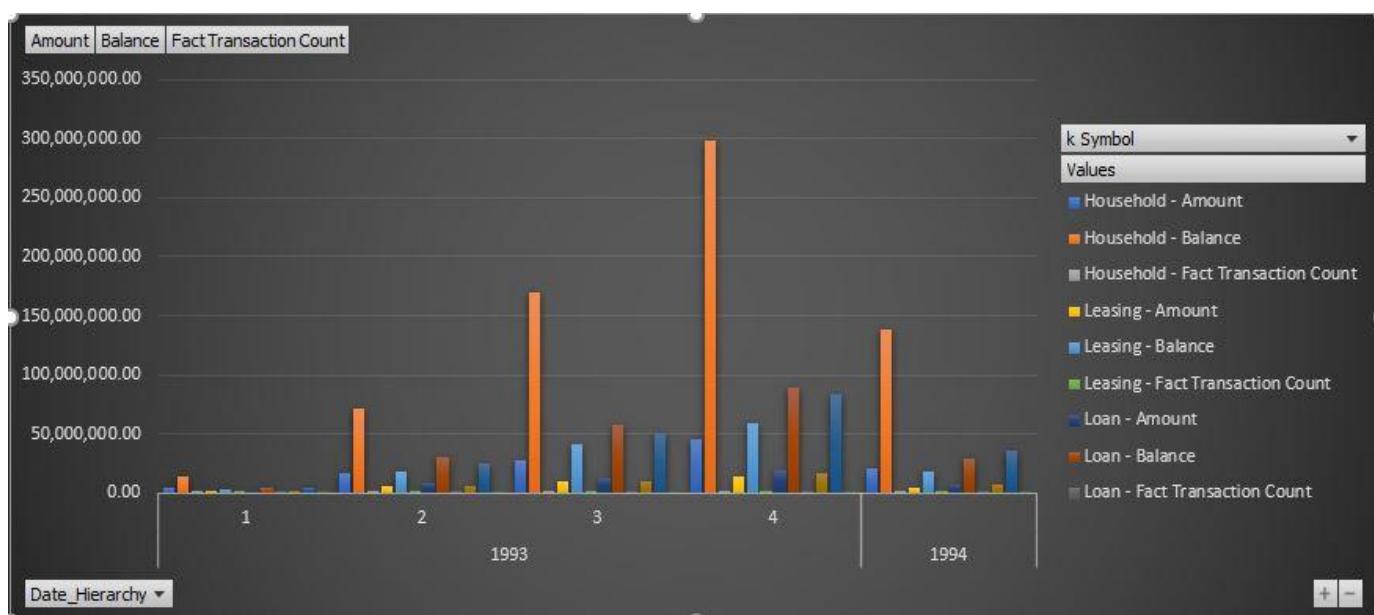


Figure 16: Drilled down pivot chart

Both the pivot chart and the table show the *total loan amounts*, *total balances* and the *number of transactions* based on the standing order type, for the drilled down year '1993' to its quarters.

### 3.2 Slice

**Slice** create a rectangular subset of the cube, by selecting a single value for one of its dimensions. A slice function is much like a report or a query that it returns data based on a request for what to see.

**Report** – *Total loan amounts, balances, number of transactions and the KPI goals based on States and the banks.* The report represents the total loan amounts, the balances, the number of transactions and the achievement of the KPI goals based on a selected state and the banks belonging to the state.


A	B	C	D	E	F	G	H	I
Row Label	Amount	Balance	Fact Transaction Count	MeasureAmount_KPI Goal				
⊕ Bohemia								
AB	7,569,708.00	46,409,596.00	1455	TRUE				
CD	8,214,763.00	39,846,140.00	1051	TRUE				
EF	12,065,455.00	58,307,739.00	1480	TRUE				
GH	3,916,845.00	22,045,854.00	741	TRUE				
IJ	8,936,790.00	45,793,679.00	1310	TRUE				
KL	10,610,456.00	52,756,837.00	1536	TRUE				
MN	5,975,026.00	29,693,480.00	910	TRUE				
OP	9,260,713.00	48,771,888.00	1413	TRUE				
QR	5,391,153.00	27,966,759.00	878	TRUE				
ST	8,581,749.00	41,897,892.00	1256	TRUE				
UV	7,658,038.00	42,856,932.00	1333	TRUE				
WX	7,101,826.00	34,473,001.00	953	TRUE				
YZ	8,816,812.00	43,178,063.00	1134	TRUE				
Grand Total	104,099,334.00	533,997,860.00	15450	TRUE				

Figure 17: Pivot table and slicer

The pivot table displays *bank wise total loan amounts, balances and the number of transactions*, based on the slicing of state '**Bohemia.**'

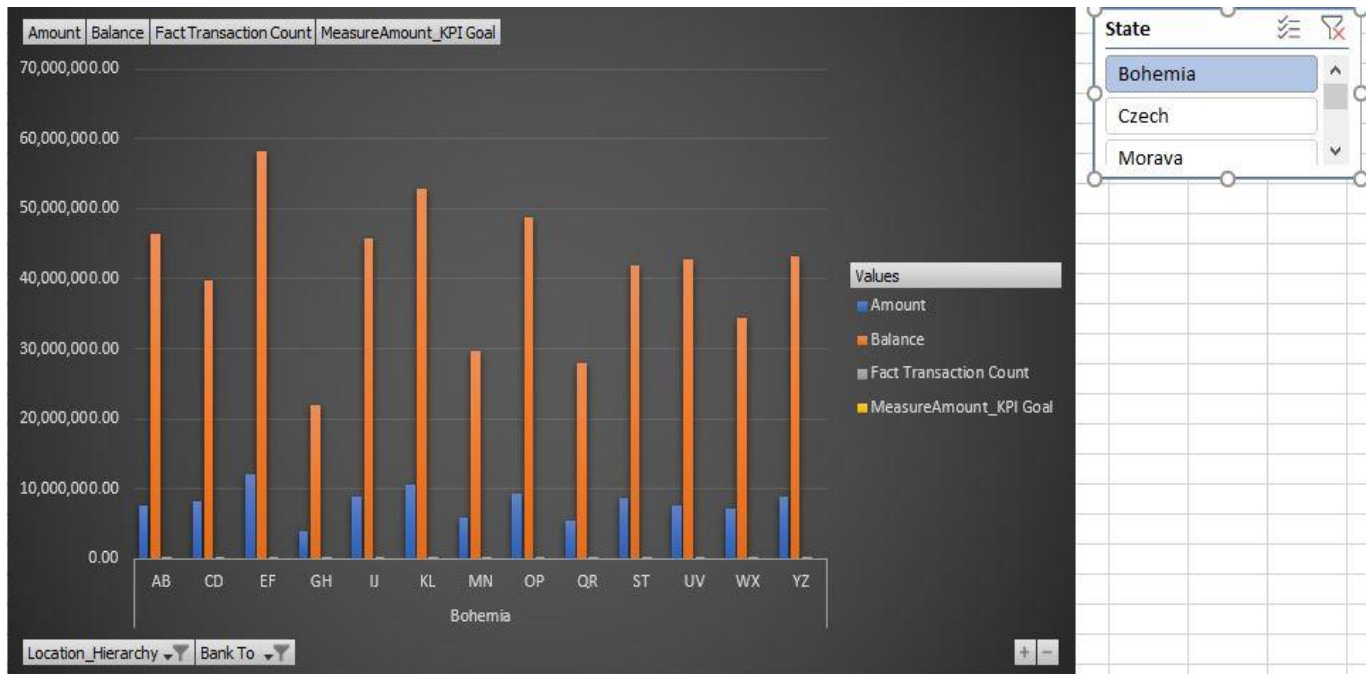


Figure 18: Pivot chart for Slice Operation

The pivot chart displays the *bank wise total loan amounts, balances and the number of transactions*, based on the slicing of state '**Bohemia.**'

### 3.3 Dice

Dice operation selects two or more dimensions from a cube, and results in a sub cube by selecting specific values on those selected dimensions. Dicing on the other hand, is more of a zoom feature that selects a subset over all the dimensions, but for specific values of the dimension.

**Report** – *Total loan amount, balances and number of transactions based on standing order type, the year and the frequency of the loan.* The report represents the total loan amounts, the balances and the count of transactions, that could be gathered for a selected year, selected type of the standing order and a selected frequency of loans.

Row Labels	Amount	Balance	Fact Transaction Count
1993			
Household			
Issuance After Transaction	1,268,936.00	5,417,810.00	114
Grand Total	1,268,936.00	5,417,810.00	114



Figure 19: Pivot table and slicer for Dice Operation

The pivot table represents the *total loan amounts, balances, the number of transactions* for the selected year '**1993**', selected standing order type '**household**' and the frequency '**Issuance after transaction.**'



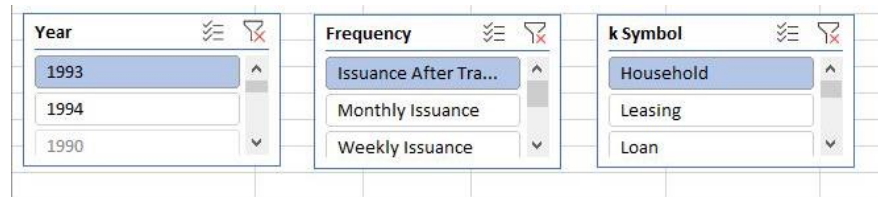
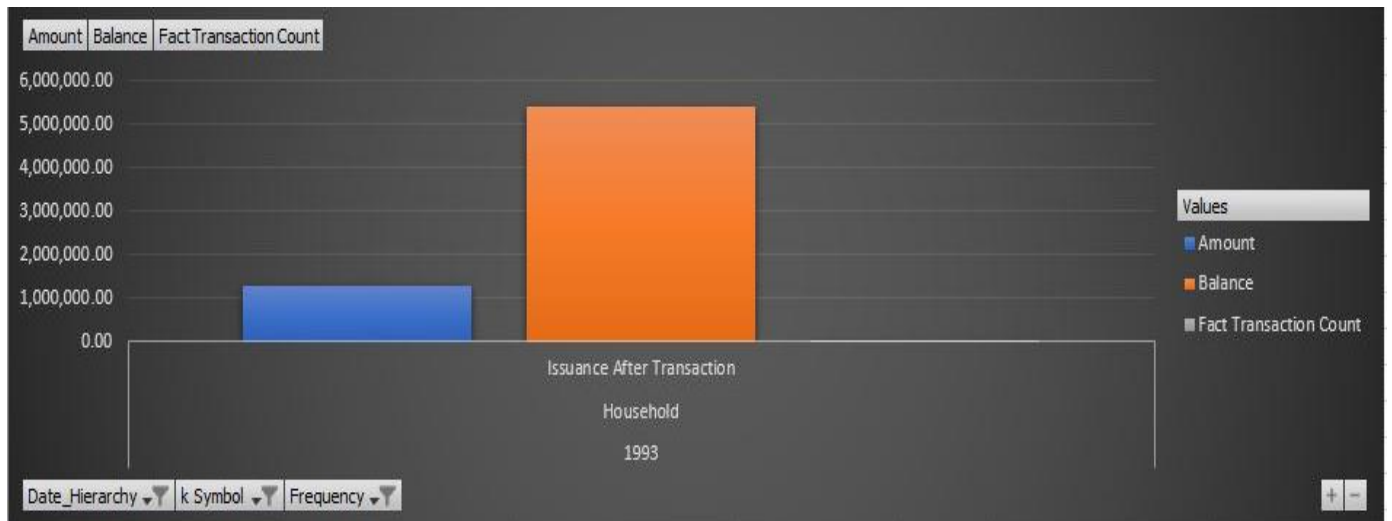


Figure 20: Pivot chart for dice operation

The pivot chart represents the *total loan amounts, balances, the number of transactions* for the selected year '**1993**', selected standing order type '**household**' and the frequency '**Issuance after transaction.**'

### 3.4 Pivot

Pivot operation provides a new perspective to the cube by rotating the data axes of the cube. It may contain swapping the rows and columns or moving one of the Row dimensions into the column dimensions.

**Report** – *Loan amounts, balances and the number of transactions based on Banks.*

Row Label	Amount	Balance	Fact Transaction Count
AB	14,679,574.00	79,601,904.00	2338
CD	15,083,959.00	78,597,297.00	2122
EF	19,521,867.00	99,272,341.00	2622
GH	10,613,704.00	55,824,868.00	1682
IJ	17,713,148.00	91,414,343.00	2530
KL	18,111,243.00	90,747,487.00	2624
MN	12,609,155.00	59,857,560.00	1736
OP	16,388,564.00	85,637,152.00	2408
QR	11,521,794.00	66,309,499.00	2067
ST	17,623,885.00	86,073,762.00	2451
UV	16,220,879.00	87,667,001.00	2568
WX	15,083,309.00	76,844,133.00	2155
YZ	17,268,778.00	86,992,216.00	2336
<b>Grand Total</b>	<b>202,439,859.00</b>	<b>1,044,839,563.00</b>	<b>29639</b>

*The report with bank as the rows and the total loan amounts, balances and the counts of transaction as columns.*

Column Label	AB	CD	EF	GH	IJ	KL
Values	AB	CD	EF	GH	IJ	KL
Amount	14,679,574.00	15,083,959.00	19,521,867.00	10,613,704.00	17,713,148.00	18,111,243.00
Balance	79,601,904.00	78,597,297.00	99,272,341.00	55,824,868.00	91,414,343.00	90,747,487.00
Fact Transaction Count	2338	2122	2622	1682	2530	2624

MN	OP	QR	ST	UV	WX	YZ	Grand Total
12,609,155.00	16,388,564.00	11,521,794.00	17,623,885.00	16,220,879.00	15,083,309.00	17,268,778.00	202,439,859.00
59,857,560.00	85,637,152.00	66,309,499.00	86,073,762.00	87,667,001.00	76,844,133.00	86,992,216.00	1,044,839,563.00
1736	2408	2067	2451	2568	2155	2336	29639

*The report has now changed the perspective, as the total loan amounts, balances and the number of transactions is transposed to rows and the banks to columns.*

## 4. SSRS Reports

**SQL Server Reporting Services (SSRS)** is a reporting software that allows you to produce formatted reports with tables in the form of data, graph, images, and charts. These reports are hosted on a server that can be executed any time using parameters defined by the users. SSRS reports can be developed using tools like report builder and deployed in SSRS Web portal for viewing.

*Report Builder:* It is a standalone application for creating paginated reports. Once designed the report can be deployed to the report server and displayed on the SSRS web portal.

*SSRS Web Portal:* The SQL Server Report Service Web Portal is a web-based experience. In this portal users can view reports, KPIs and navigate through the elements in the report server instance. User can also use the web portal to administer a single report server instance.

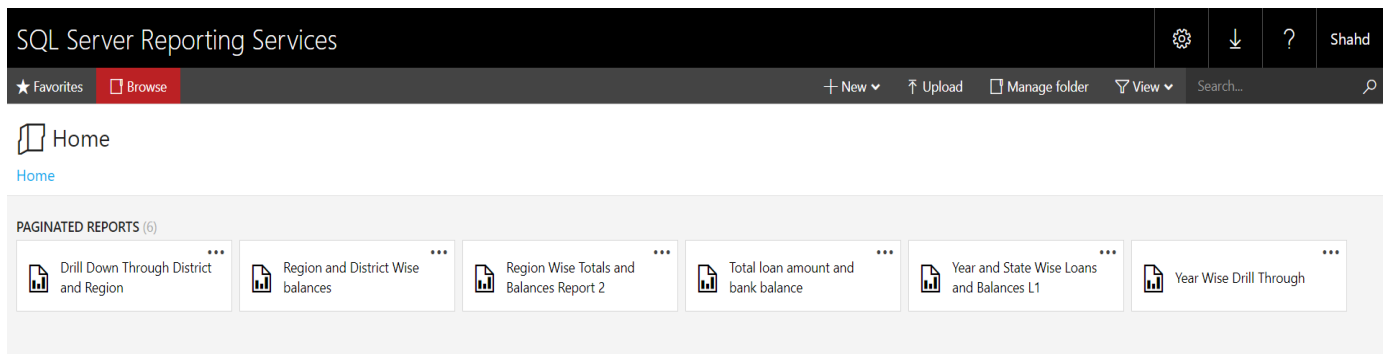


Figure 23: SSRS Web Portal

## 4.1 Report with matrix

In SSRS, *Matrix* is very similar to a table, but it is configured to show data grouped by columns and rows, with aggregate data at the intersection.

**Report:** Total Loan Amount and bank balances.

The report contains the data of *total loan amounts* and *total balances* for each *bank* for each *year*.

SQL Server Reporting Services				
★ Favorites    📁 Browse				
Home > Total loan amount and bank balance				
⏪	<	1 of 1	>	⏩
↺		100%	⏴	⏵
Total loan amount and Account balance based on Bank and Year				
Bank	1993		1994	
	Total Loan Amount	Total Balances	Total Loan Amount	Total Balances
AB	11,940,475.00	64,312,836.00	2,739,099.00	15,289,068.00
CD	12,837,066.00	65,357,977.00	2,246,893.00	13,239,320.00
EF	16,354,892.00	81,676,476.00	3,166,975.00	17,595,865.00
GH	8,955,130.00	45,649,686.00	1,658,574.00	10,175,182.00
IJ	14,791,089.00	74,671,317.00	2,922,059.00	16,743,026.00
KL	14,789,307.00	72,772,754.00	3,321,936.00	17,974,733.00
MN	10,464,092.00	49,549,229.00	2,145,063.00	10,308,331.00
OP	13,848,052.00	70,188,598.00	2,540,512.00	15,448,554.00
QR	9,610,008.00	54,173,413.00	1,911,786.00	12,136,086.00
ST	14,770,064.00	70,346,948.00	2,853,821.00	15,726,814.00
UV	13,676,773.00	71,918,284.00	2,544,106.00	15,748,717.00
WX	12,865,686.00	64,167,652.00	2,217,623.00	12,676,481.00
YZ	14,899,031.00	73,686,456.00	2,369,747.00	13,305,760.00

Figure 24: SSRS Matrix Report

### Query

```
SELECT d.Year, o.bank_to, SUM(t.amount) AS total_loan_amount, SUM(t.balance) AS
total_acc_balance
FROM FactTransaction t INNER JOIN DimDate d
ON t.dateKey = d.DateKey INNER JOIN DimStandingOrder o
ON t.standingOrderKey = o.standingOrderSK
GROUP BY d.Year, o.bank_to
```

## 4.2 Report with multiple parameters

In SSRS, *Multiparameter-values* allows us to pass either one or more input parameter values to the report. Also, it offers a “Select All” option that helps to select all parameter values.

**Report:** Region and district wise balances.

The report allows to select the region and district through a drop down. When the regions are selected, the districts belonging to the particular region will be filtered and allowed for selection. On selection of view report, the report displays the **total loan amounts** and the **total balances** for each **year**, grouped according to **type of standing order**, and the selected **region** and **district** accepted as parameters.

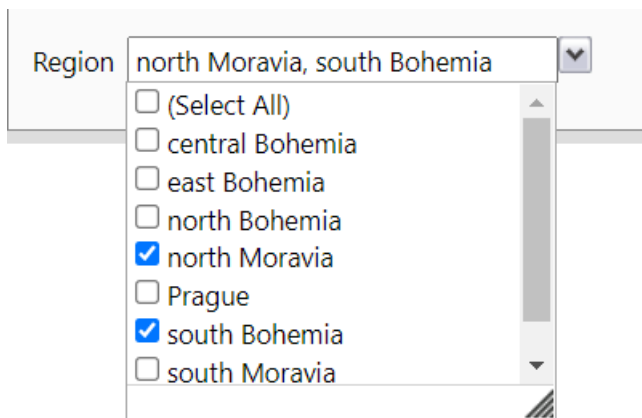


Figure 25: Selection of Region

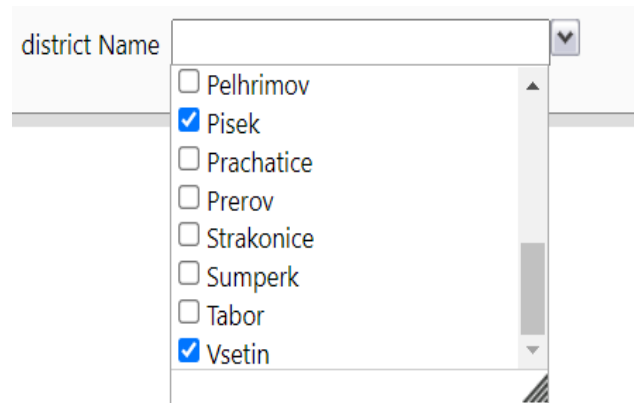


Figure 26: Selection of district

### SQL Server Reporting Services

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Region: north Moravia, south Bohemia    district Name: Opava, Pisek, Vsetin

Navigation controls: Previous, Next, 1 of 1, Refresh, Back, 100%, Save, Print, Find | Next

#### Region And District Wise Annual Total Loans and Total Balances

Region	District Name	Standing Order Symbol	1993		1994	
			Total Loan Amount	Total Account Balance	Total Loan Amount	Total Account Balance
north Moravia	Opava	Insurance	555,888.00	3,311,009.00	39,304.00	221,295.00
	Vsetin	Leasing	197,857.00	1,425,660.00	47,299.00	564,967.00
south Bohemia	Pisek	Household	253,493.00	1,239,596.00	49,954.00	386,422.00

Figure 27: SSRS Multiple Parameter Report

# SQL Server Reporting Services

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Region  district Name

1 of 1 100% Find | Next

Region And District Wise Annual Total Loans and Total Balances

Region	District Name	Standing Order Symbol	1993		1994	
			Total Loan Amount	Total Account Balance	Total Loan Amount	Total Account Balance
central Bohemia	Beroun	Household	739,684.00	2,937,119.00	12,236.00	68,763.00
north Bohemia	Louny	Leasing	252,553.00	1,147,197.00	42,792.00	306,362.00
north Moravia	Frydek - Mistek		302,211.00	1,145,993.00	44,600.00	297,052.00
	Opava	Insurance	555,888.00	3,311,009.00	39,304.00	221,295.00
	Vsetin	Leasing	197,857.00	1,425,660.00	47,299.00	564,967.00
south Bohemia	Jindrichuv Hradec	Household	207,213.00	1,036,131.00	47,189.00	349,596.00
	Pisek	Household	253,493.00	1,239,596.00	49,954.00	386,422.00
south Moravia	Zdar nad Savazou	Household	314,344.00	1,494,723.00	62,294.00	298,046.00
west Bohemia	Tachov	Household	325,874.00	1,420,729.00	58,327.00	232,614.00

Figure 28: SSRS Multiple parameter Report for select all

## Query:

```
SELECT d.Year, dt.Region, dt.districtName, sd.k_symbol, SUM(t.amount) AS
tot_loan_amount, SUM(t.balance) AS tot_acc_balance
FROM FactTransaction t INNER JOIN DimDate d
ON t.dateKey = d.DateKey INNER JOIN DimAccount a
ON t.accountKey = a.accountSK INNER JOIN DimDistrict dt
ON a.accountSK = dt.districtSK INNER JOIN DimStandingOrder sd
ON t.accountKey = sd.standingOrderSK
WHERE dt.districtName IN (@districtName)
GROUP BY d.Year, dt.Region, dt.districtName, sd.k_symbol
```

-- Getting the district---

```
SELECT
DimDistrict.Region
,DimDistrict.districtName
,DimAccount.districtKey
,DimAccount.accountSK
,FactTransaction.accountKey
FROM
DimDistrict
INNER JOIN DimAccount
ON DimDistrict.districtSK = DimAccount.districtKey
INNER JOIN FactTransaction
ON DimAccount.accountSK = FactTransaction.accountKey
WHERE DimDistrict.Region IN (@Region)
```

## 4.3 Drill-down report

In SSRS reports, *drill-down* allows expand or collapse a section of a report to show or hide detail data. We can expand the data using the plus button and collapse data using the minus button.

**Report:** Drill down through district and region.

The feature allows a user to view the ***total loan amounts***, the ***total balances*** and the ***number of transactions*** for each ***year*** based on ***region*** and ***district***. Initially the totals for a region will be displayed, which must then be expanded to view the same for a district.

### SQL Server Reporting Services

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Home > Drill Down Through District and Region

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## REGION AND DISTRICT WISE TOTAL BALANCES, LOAN AMOUNT & TRANSACTIONS

Region	District	1993			1994		
		Total Loan Amount	Total Balance	Total Transactions	Total Loan Amount	Total Balance	Total Transactions
⊞	central Bohemia	739,684.00	2,937,119.00	52	12,236.00	68,763.00	3
⊞	north Bohemia	252,553.00	1,147,197.00	30	42,792.00	306,362.00	9
⊞	north Moravia	1,055,956.00	5,882,662.00	110	131,203.00	1,083,314.00	27
⊞	south Bohemia	460,706.00	2,275,727.00	59	97,143.00	736,018.00	22
⊞	south Moravia	314,344.00	1,494,723.00	34	62,294.00	298,046.00	10
⊞	west Bohemia	325,874.00	1,420,729.00	29	58,327.00	232,614.00	4

Figure 29: SSRS Report before Drill down

# SQL Server Reporting Services

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Home > Drill Down Through District and Region

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## REGION AND DISTRICT WISE TOTAL BALANCES, LOAN AMOUNT & TRANSACTIONS

Region	District	1993			1994		
		Total Loan Amount	Total Balance	Total Transactions	Total Loan Amount	Total Balance	Total Transactions
central Bohemia		739,684.00	2,937,119.00	52	12,236.00	68,763.00	3
north Bohemia		252,553.00	1,147,197.00	30	42,792.00	306,362.00	9
north Moravia	Frydek - Mistek	302,211.00	1,145,993.00	25	44,600.00	297,052.00	8
	Opava	555,888.00	3,311,009.00	50	39,304.00	221,295.00	6
	Vsetin	197,857.00	1,425,660.00	35	47,299.00	564,967.00	13
south Bohemia	Jindrichuv Hradec	207,213.00	1,036,131.00	29	47,189.00	349,596.00	12
	Pisek	253,493.00	1,239,596.00	30	49,954.00	386,422.00	10
south Moravia	Zdar nad Sazavou	314,344.00	1,494,723.00	34	62,294.00	298,046.00	10
west Bohemia		325,874.00	1,420,729.00	29	58,327.00	232,614.00	4

Figure 30: SSRS Drilled Down Report

### Query:

```

SELECT d.Year, dt.Region, dt.districtName, SUM(t.amount) AS tot_loan_amount,
SUM(t.balance)AS tot_balance, COUNT(t.transactionID) AS num_of_transactions
FROM FactTransaction t INNER JOIN DimDate d
ON t.dateKey = d.DateKey INNER JOIN DimAccount a
ON t.accountKey = a.accountSK INNER JOIN DimDistrict dt
ON a.accountSK = dt.districtSK
GROUP BY d.Year, dt.Region, dt.districtName
  
```



## 4.4 Drill Through Report

In SSRS, a *drill through* allows a user click on a link or an area in a chart with summarized data, which then opens a separate, related report to show detailed data. Drill through reports commonly contain details about an item that is contained in an original summary report. The data in the drill through report is not retrieved until the user clicks the link in the main report.

### **Report:**

Level 1 – Year and State wise loan amounts and balances L1

Level 2 – Region wise totals and balances report 2 & Year wise drill through

This report displays two column charts. First chart represents the data of *total loan amounts and balances for each state*. Second chart represents the *total loan amounts and balances for each year*.

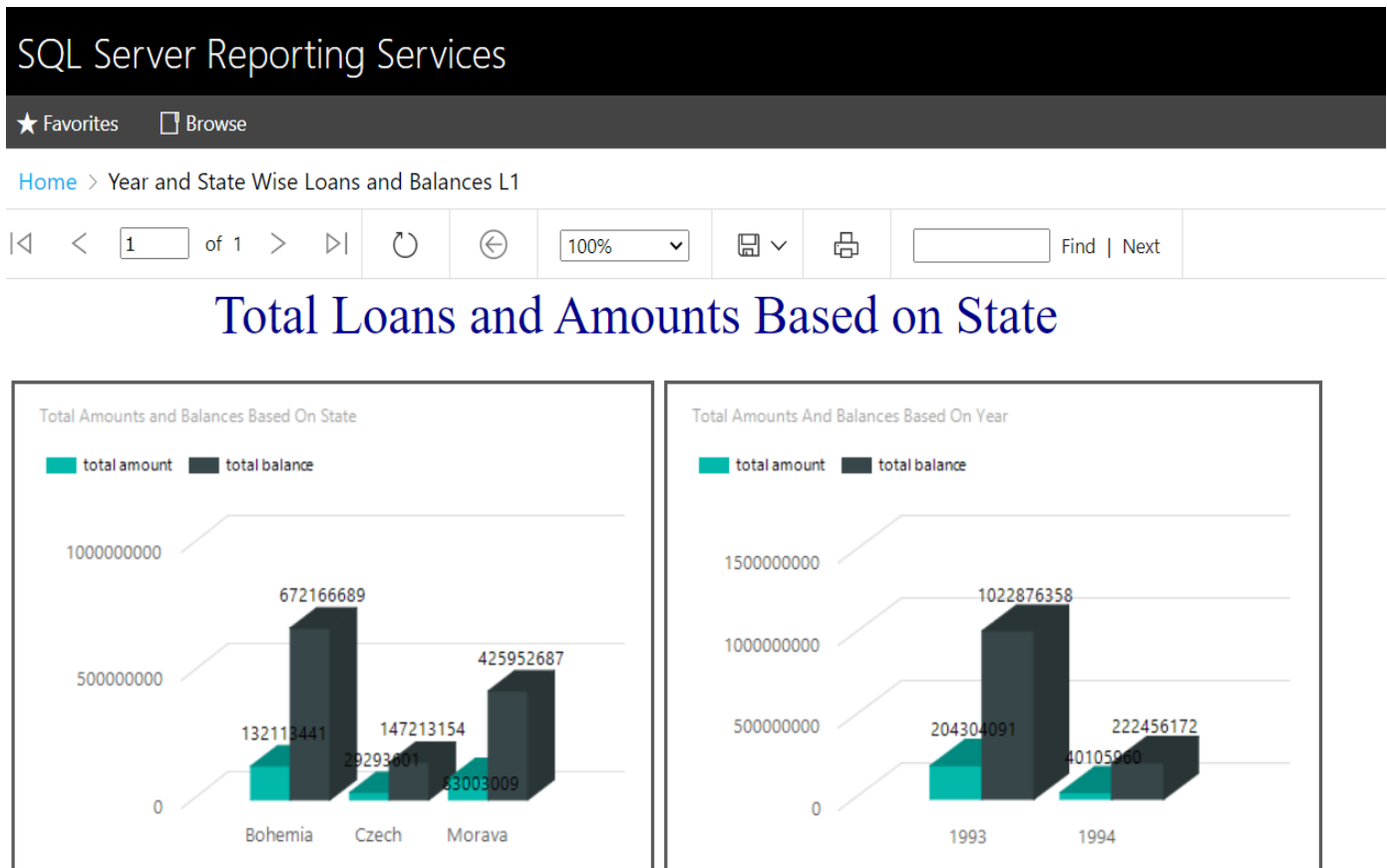
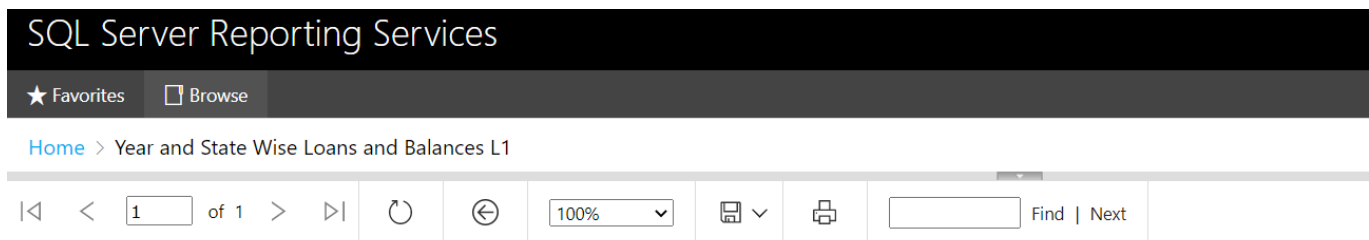


Figure 31: The Level 1 report of Drill through

When the user clicks on a bar in the report contain states, it will display a detailed report that provides the same information based on each region belonging to the state. The below diagram shows details when the state **'bohemia'** is clicked.



## Total Loans and Amounts Based on Regions

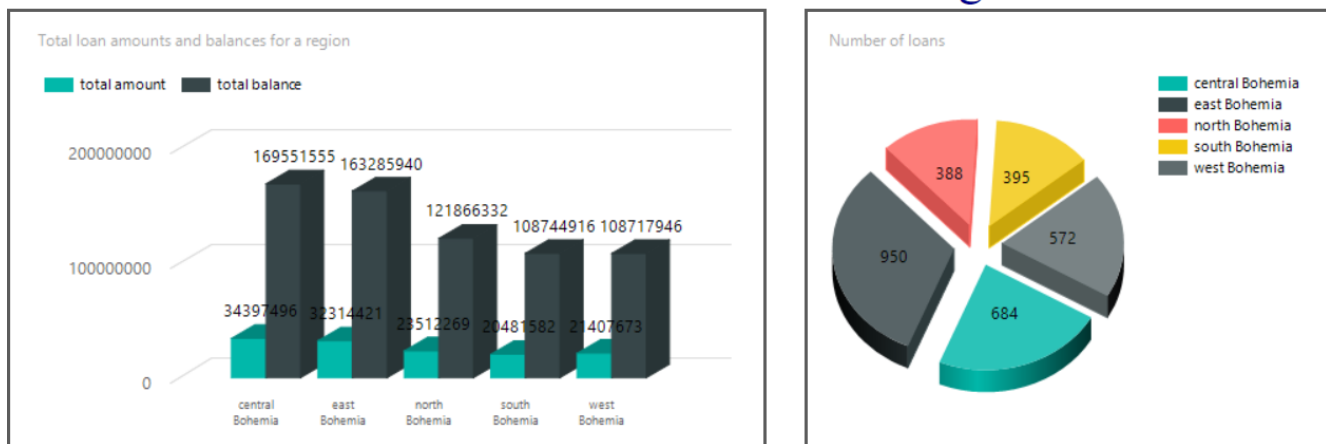
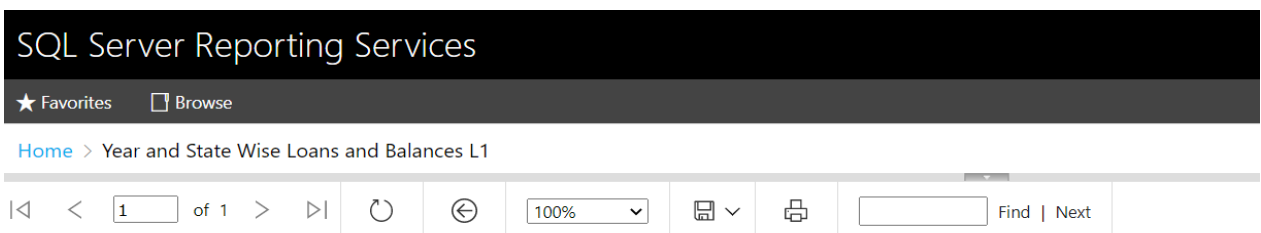
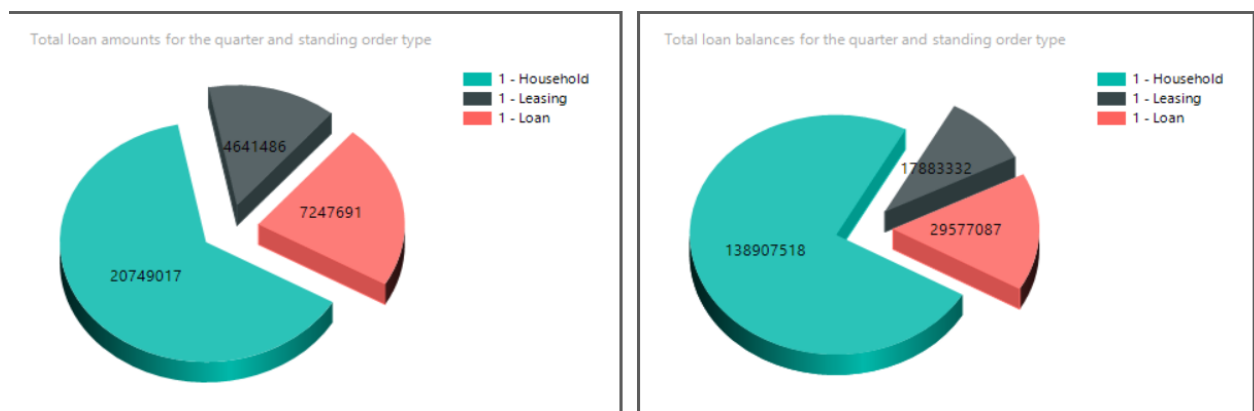


Figure 32: Drilled Through State Bohemia

When the user clicks on a bar in the report containing years, it will display a detailed report that provides the same information for each quarter and the type of standing loan in that particular year. The below diagram shows details when the year **1994** is clicked.



## Total Loan Amounts and Balances Based on Quarter and Standing order type



### *Query:*

```
-- Main Report --
SELECT d.State, dt.Year, SUM(t.amount) AS total_amount, SUM(t.balance) AS
total_balance
FROM FactTransaction t INNER JOIN DimDate dt
ON t.dateKey = dt.DateKey INNER JOIN DimClient c
ON t.clientKey = c.clientSK INNER JOIN DimDistrict d
ON c.districtSK = d.districtSK
GROUP BY d.State, dt.Year

-- sub report region wise --
SELECT d.Region, COUNT(t.loanKey) AS number_of_loans, SUM(t.amount) AS
total_amount, SUM(t.balance) AS total_balance
FROM FactTransaction t INNER JOIN DimClient c
ON t.clientKey = c.clientSK INNER JOIN DimDistrict d
ON c.districtSK = d.districtSK
WHERE d.State IN (@State)
GROUP BY d.Region

-- sub report year wise --
SELECT dt.Quarter, s.k_symbol, SUM(t.amount) AS Total_loan, SUM(t.balance)
AS total_balance
FROM FactTransaction t INNER JOIN DimDate dt
ON t.dateKey = dt.DateKey INNER JOIN DimStandingOrder s
ON t.standingOrderKey = s.standingOrderSK
WHERE dt.Year IN (@Year)
GROUP BY dt.Quarter, s.k_symbol
```

## 5. References

- [1] <https://www.sqlshack.com/analysis-services-ssas-multidimensional-design-tips-relations-hierarchies/#:~:text=sample%20OLAP%20cube.,Hierarchies,a%20certain%20drill%2Ddown%20behavior>
  
- [2] <https://www.red-gate.com/simple-talk/databases/sql-server/bi-sql-server/adding-a-kpi-to-an-sql-server-analysis-services-cube/#:~:text=In%20SQL%20Server%20Analysis%20Services,of%20a%20set%20of%20calculations.>
  
- [3] <https://www.guru99.com/online-analytical-processing.html>
  
- [4] <https://www.google.com/search?q=SSRS&oq=SSRS&aqs=chrome..69i57j0i271l3j69i61j69i65j69i60l2.697j0j7&sourceid=chrome&ie=UTF-8>
  
- [5] "SSRS - How to build Drill-Through Report in SSRS," <https://www.youtube.com/watch?v=sPl-Zp0X5Pk&feature=youtu.be>
  
- [6] Working with Multi-Valued Parameters in SSRS, <https://www.interfacett.com/blogs/using-parameters-with-multiple-values-in-sql-server-reporting-services/>