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**Sri Lanka Institute of Information Technology**

**Data Warehousing and Business Intelligence**

**IT3021**

**- Assignment 2 -**

**2022**

**Assignment 2 Report**

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**Table of Contents**

[**1** **Data source for the assignment 2** 1](#_Toc103716118)

[1.1 Data Source Introduction 1](#_Toc103716119)

[**2** **SSAS Cube implementation** 3](#_Toc103716120)

[**2.1** **Cube Implementation** 3](#_Toc103716121)

[2.1.1 Creating the Data Source 3](#_Toc103716122)

[2.1.2 Creating the Data Source View 4](#_Toc103716123)

[2.1.3 Creating the Cube 5](#_Toc103716124)

[2.1.4 Creating Hierarchies and Dimension Structures 5](#_Toc103716125)

[2.1.5 Creating KPIs 6](#_Toc103716126)

[2.1.6 Deploying the Cube 6](#_Toc103716127)

[**3** **Demonstration of OLAP Operations** 7](#_Toc103716128)

[3.1 Connecting to the SSAS Cube 7](#_Toc103716129)

[3.2 OLAP Operations Demonstration Excel Report 8](#_Toc103716130)

[**3.2.1** **Roll Up** 8](#_Toc103716131)

[**3.2.2** **Drill Down** 9](#_Toc103716132)

[**3.2.3** **Slice** 10](#_Toc103716133)

[**3.2.4** **Dice** 11](#_Toc103716134)

[**3.2.5** **Pivot** 12](#_Toc103716135)

[**4** **SQL Server Reporting Service (SSRS) Reports** 13](#_Toc103716136)

[4.1 Building the Reports 13](#_Toc103716137)

[4.1.1 Creating the Data Source 14](#_Toc103716138)

[4.1.2 Creating the Data Set 14](#_Toc103716139)

[4.1.3 Creating Tables Matrices and Charts 15](#_Toc103716140)

[**4.2** **Report Demonstrations** 15](#_Toc103716141)

[**4.2.1** **Report 1: Report with a matrix.** 16](#_Toc103716142)

[**4.2.2** **Report with more than one parameter.** 17](#_Toc103716143)

[**4.2.3** **Report 3: SSRS drill-down report.** 19](#_Toc103716144)

[**4.2.4** **Report 4: SSRS drill-through report.** 21](#_Toc103716145)

[**4.2.5** **Extra Report: Report with one parameter.** 25](#_Toc103716146)

[**5** **Insurance Claims Dashboard** 26](#_Toc103716147)

[**6** **References** 27](#_Toc103716148)

# **Data source for the assignment 2**

## Data Source Introduction

Graphical user interface, text, application, email

Description automatically generatedThe data warehouse, which was created and loaded using the transformed, staged data in the assignment has been used as the data source for this project (DS\_Insurance\_Claims\_Fraud\_DW).

Figure 1: Data Source

The data warehouse was created using the Insurance Claims Fraud dataset which contains a one-year worth data, from 2020/06/01 till 2021/06/30 about insurance claims frauds.

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

* Dimensions –

1. DimPolicyClaim – The policy claim dimension table contains the policy claim details. PolicyClaimsSK is the surrogate key.
2. DimCustomer – The customer dimension contains insurance policy holder / customer details. CustomerSK is the surrogate key.
3. DimAgent – Contains details of insurance agents who manages the customer insurances. AgentSK is the surrogate key.
4. DimVendor – Contains insurance provider details. VendorSK is the surrogate key.
5. DimDate – This is a common dimension. DateKey is the surrogate key. An SQL script was used to generate the date dimension.

* Fact table –

1. FactInsurance – Contains all the transactional data. References dimension tables via foreign keys.

Diagram

Description automatically generated

Figure 2: Data Warehouse ER

Diagram

Description automatically generated

Figure 3: Implemented DW

# **SSAS Cube implementation**

A data structure called an OLAP cube, also known as a hypercube or multidimensional cube, allows OLAP databases to do near-instantaneous 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.

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

* **Analysis Services -> Multidimensional -> Analysis Services Multidimensional and Data Mining Project**

## **Cube Implementation**

### Creating the Data Source

Graphical user interface, text, application, email

Description automatically generatedA data warehouse has been chosen as the data source by connecting the data warehouse, DS\_Insurance\_Claims\_Fraud\_DW through the SQL Server Management Studio. The service account mode was used in connecting to the SSMS.

Figure 4: DS in SSDT Solution Explorer

Graphical user interface, application

Description automatically generatedGraphical user interface, application, email

Description automatically generated

Figure 5: Data Source, Impersonation Information

Figure 6: Data Source, General

### 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.

Graphical user interface, text, application

Description automatically generatedDiagram, schematic

Description automatically generated

Figure 7: DSV in SSDT Solution Explorer

Figure 8: Data Source View

### Creating the Cube

Using the created data source view in the above step, the cube has been created. In the Cube Wizard the created data source view was selected. Then the Fact table was selected as the measures group table. Then the measures used are selected and finally the available dimensions are selected, and the cube is given a proper name.

Diagram

Description automatically generated

Figure 9: Implemented Cube

### 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 attributes 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.

Graphical user interface, text

Description automatically generatedThis process is repeated for all the dimensions.

Figure 10 : Agent Hierarchy

Text

Description automatically generatedText

Description automatically generatedText

Description automatically generated

Figure 11 : Vendor Hierarchy

Figure 12 : Customer Hierarchy

Figure 13: Date Hierarchy

### 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 [1].

In this scenario KPIs have been created for Claimed Amount, Tenure, attribute and Claimed Loss.

Graphical user interface, text, application, email

Description automatically generated

Figure 14: KPI Claimed Amount

### Deploying the Cube

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

Graphical user interface, text, application, email

Description automatically generated

Figure 15: Cube Deploying

# **Demonstration of OLAP Operations**

OLAP stands for Online Analytical Processing. This enables easy understanding of data and easy handling of data in making important business decisions. OLAP is an integral part of business intelligence (BI) where it helps greatly in trend analysis and other data analysis functions from various perspectives [1].

There are 5 main OLAP operations:

1. Drill Down – Drilling down converts less detailed information into more detailed information. It's possible to accomplish so by working your way down the concept hierarchy.
2. Roll Up – This is the opposite of drilling down. This performs aggregations on the data cube. This can be performed by climbing up the concept hierarchy.
3. Slice – It takes a single dimension from the OLAP cube and turns it into a new sub-cube.
4. Dice – Here a sub cube is selected from the OLAP cube by selecting two or more dimensions [1].
5. Pivot – This acts as a rotation operation, where the current view is rotated to get a new view.

## Connecting to the SSAS Cube

To apply the OLAP operations we must connect an Excel workbook to the data in the cube, MDX queries can be used for this process. MDX queries can be generated accordingly by browsing the cube.

In this instance MDX queries have not been used, instead the DATA tab feature of excel was used.

Graphical user interface, application

Description automatically generatedGraphical user interface, application

Description automatically generated

Figure 16: Connecting to SSAS Cube, 2

Graphical user interface, text, application, email

Description automatically generated

Figure 17: Connecting to SSAS Cube, 3

Figure 18: Connecting to SSAS Cube, 1

## OLAP Operations Demonstration Excel Report

### **Roll Up**

Here the roll up operation is done for claim amount, premium amount and number of policies have been rolled up according to the Vendor details and the time hierarchy. Hence the outright sums of the said measures can be utilized according to vendors or time by the consumer.

Table

Description automatically generated

Figure 19: Roll up according to Vendor

Table

Description automatically generated

Figure 20: Roll up according to Year

### **Drill Down**

Here the drill down has been done for the measures according to Vendor and Year.

Table

Description automatically generatedWhen drilling down according to the vendor, which working state, which postal code in that state, which city in that postal code, which branch in that city, which agent in that branch, which customer of that agent can be found for analysis. Same process can be done down the date hierarchy.

Figure 21: Drill down according to Vendor

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Description automatically generated

Figure 22: Drilling down according to Date Hierarchy

### **Slice**

Table

Description automatically generatedGraphical user interface, application, table

Description automatically generatedHere two slicing have been done in two ways to obtain the premium amount, claim amount and no of policies data. First the Vendor dimension have been sliced to give out the measures data for a specific vendor. Secondly the Date dimension have been sliced to obtain the measure mentioned for the year 2021 for each vendor.

Figure 23: Slice done for the Date dimension

Figure 24: Slice done for the Vendor dimension

### **Dice**

Here dicing is done to get a sub-cube which can be used to visualize the measures according to the selected vendors and a particular year. Another dicing was done to get the sub cube which represents the data according to the vendor’s name, insurance type and the year.

Graphical user interface, chart, application, table

Description automatically generatedTable

Description automatically generated

Figure 25: Dicing According to Insurance type, Year and Vendor

Figure 26: Dicing according to Vendor and Year

### **Pivot**

Chart, histogram

Description automatically generatedHere the sub-cube has been pivoted among the year, insurance type and state dimensional axis accordingly to get a newer views of the claimed amount measure from various perspectives [1]. First the claimed amount is viewed according to Year and State, then according to State and Insurance Type, and finally according to the Year and Insurance Type

Figure 27: Pivot to view according to Year, State

Graphical user interface, chart

Description automatically generated with medium confidence

Figure 28: Pivot to view according to Insurance Type, State

Chart

Description automatically generated

Figure 29: Pivot to view according to Year, Insurance Type

# **SQL Server Reporting Service (SSRS) Reports**

SQL Server Reporting Services (SSRS) is a reporting tool that allows you to generate structured reports with tables, graphs, images, and charts. These reports are kept on a server and may be accessed at any time using user-defined criteria. The Microsoft SQL Server Services package includes it [1].

Graphical user interface, application

Description automatically generatedThe web portal of a Reporting Services report server is a web-based experience. The portal allows you to move between the components of your report server instance and see reports, mobile reports, and KPIs. A single report server instance can also be managed via the web interface.

Figure 30: SSRS Web portal

## Building the Reports

Report Builder is a self-contained program that you or an administrator installs on your computer. It may be downloaded through the Microsoft Download Center, a SQL Server 2016 Reporting Services report server, or a SharePoint site with Reporting Services integration [1].

Initially before creating the report in report builder, the data source and the data set must be created. Then the tables, matrices and charts can be created accordingly.

When creating the data source, the data warehouse is selected by making a connection with the SQL server. Then the data source created gets a proper name and is added as the data source.

In the creation of the data set, the previously used data source is selected and the necessary data fields from the table are taken via a query or using the GUI to select the needed fields. In this scenario a proper query is written to extract the necessary fields out of the source.

Finally, using the created dataset, tables, matrices or charts and graphs can be created by using the necessary wizards.

### Graphical user interface, application Description automatically generatedCreating the Data Source

Figure 31: Creating the data source

Graphical user interface, text, application, email

Description automatically generated

Figure 32: Setting up the connection

### Creating the Data Set

Graphical user interface, text, application, email

Description automatically generatedIn this scenario a query is written to get the necessary fields out of the source and into the data set.

Figure 33: Creating the data set

### Creating Tables Matrices and Charts

Graphical user interface

Description automatically generated with medium confidenceA wizard like the following is present for the creation of tables, matrices, and charts in the report builder.

Figure 34: Table create wizard

## **Report Demonstrations**

The following reports have been created and deployed to the SSRS web portal,

* [Report 1: Report with a matrix.](#_Report_1:_Report)
* [Report 2: Report with more than one parameter.](#_Report_with_more)
* [Report 3: SSRS drill-down report.](#_Report_3:_SSRS)
* [Report 4: SSRS drill-through report.](#_Report_3:_SSRS)
* [Extra Report: Report with one parameter.](#_Report_4:_SSRS)

(CTRL + Click on the above bookmarks to move to the necessary report)

### **Report 1: Report with a matrix.**

Table

Description automatically generatedText

Description automatically generatedA matrix is like a table, except it is set up to display data in columns and rows, with aggregate data at the intersections [1].

Figure 35: Matrix build

Figure 36: Matrix build query

Table

Description automatically generated

Figure 37: Matrix

### **Report with more than one parameter.**

Multiple parameters in SSRS enable users to dynamically filter SSRS reports using multiple parameter values. Here selection of multiple values per parameter has also been enabled [1].

2 Parameters and 3 datasets have been used.

* Fruadulent\_claims\_dataset – Contains the data fields needed for the report build.
* PolicyTypesList – Contains the policy types to be used in the first parameter dropdown.
* Text

  Description automatically generatedA picture containing text

  Description automatically generatedGraphical user interface, application

  Description automatically generatedCustomerNameList – Contains customer names filtered by policy types for parameter two.

Figure 38: Customer name list query

Figure 39: Multi-parameter data set query

Figure 40: PolicyTypeList query

Figure 41: Multi Parameter Report build

Graphical user interface, application, Word

Description automatically generatedGraphical user interface, application

Description automatically generated

Figure 42: Selecting values for parameter 2

Figure 43: Selecting values for parameter 1

Table, calendar

Description automatically generated with medium confidence

Figure 44: Multi-parameter report build

In the report builder, the following expression has been added to the cells where measures are displayed, and null values are expected to occur. This replaces the null value with 0.

=IIf(IsNothing(Sum(Fields!<<field name>>.Value)), 0, Sum(Fields!<<field name>>.Value))

### **Report 3: SSRS drill-down report.**

Text

Description automatically generatedGraphical user interface, application

Description automatically generatedBy adding plus and minus icons on a text field in a paginated report, you may allow users to conceal and expose items interactively. This is referred to as a drilldown action. In a table or matrix, you may show or hide static rows and columns, as well as group-related rows and columns [1].

Figure 45: Drill down report's dataset query

Figure 46: Drill down report build

Table, calendar

Description automatically generated

Figure 47: Before drilling-down

Table, calendar

Description automatically generated

Figure 48: After drilling-down, expansion occurs when the plus sign is clicked

### **Report 4: SSRS drill-through report.**

A Drill-through report 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 [1].

* The first report contains a column graph that summarize policy-types details related to the given measures.
* When the consumer presses a policy-type, a link to the risk segmentations of that type is executed and a column graph that summarize risk segmentations are shown.
* Graphical user interface, application

  Description automatically generatedText

  Description automatically generatedGraphical user interface, text, application

  Description automatically generatedWhen the consumer selects a risk segment, a tabular report of all the customer details of that risk segment will be shown.

Figure 49: Drill through first level report build

Figure 50: Drill through first level dataset query

Figure 51: Setting the action to link level 2

Graphical user interface, application

Description automatically generatedGraphical user interface

Description automatically generatedText

Description automatically generatedA parameter (@Insurance\_Type) has been setup in the level 2 report to get the value passed from the level 1 report and filter the fields according to that value.

Figure 52: Drill through second level report build

Figure 53: Setting the action to link level 3

Figure 54:Drill through second level dataset query

Text

Description automatically generated2 parameter (@Insurance\_Type) has been setup in the level 2 report to get the value passed from the level 1 report and filter the fields according to that value.

Figure 55:Drill through last level dataset query

Graphical user interface, application

Description automatically generated

Figure 56: Drill through last level report build

#### Table Description automatically generatedChart Description automatically generatedChart, bar chart Description automatically generated**Drill - through flow**

Figure 57: Drill Through L3 report

Figure 58: Drill Through L1 report

Figure 59: Drill Through L2 report

### **Extra Report: Report with one parameter.**

A single parameter has been setup to take the needed insurance type (@Insurance\_Type). This parameter can receive multiple values.

Graphical user interface, application

Description automatically generatedA second dataset is used to provide the needed insurance types for the parameter’s drop down.

Figure 60: Single parameter report build

Table

Description automatically generated

Figure 61: Single parameter report

# **Insurance Claims Dashboard**

A Business Intelligence dashboard is a visual representation of data. It is a visual presentation on a single computer screen that includes two or more graphs or charts. All levels of management utilize dashboards to acquire a clear view of many parts of the business in a single, succinct manner.

Graphical user interface

Description automatically generatedA business dashboard is an easy and aesthetically pleasant approach to consume data that provides at-a-glance insights based on key performance indicators (KPIs).

Figure 62: Dashboard

# **References**

|  |  |
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