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**ASIA PACIFIC UNIVERSITY
OF TECHNOLOGY & INNOVATION**

BIS INDIVIDUAL ASSIGNMENT

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MODULE NAME : Business Intelligence Systems

MODULE ID : CT 122-3-2-BIS

HAND OUT DATE : 16th August 2021

HAND IN DATE : 29th October 2021

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Abstract

Data Analysis tools have been a powerful tool for industries in making data-driven decisions, monitoring progress, and predicting future outcomes. The incorporation of data-driven concepts in the core of business would be beneficial for the company to understand its current progress, issues and provide a recommendation to improve the business overall. The main objectives of this paper are to research the case studies that focus mainly on:

- Understanding the company problem in the low sales and customer performance
- Providing visualization of the current business progress using visualization tools
- Provides several recommendations to assist the company in improving the sales and customer performances.

This paper will provide a step-by-step process in generating a cube that will be used in the visualization tool to create a dashboard and scorecard that can be used to understand the problems and recommendations for Alpine Works Cycles.

1.0 Introduction

Business Intelligence has played a crucial role in the 21st century in the business industry. Business Intelligence combines data mining techniques, business analytics, data visualization, data tools, and infrastructure, allowing companies to make data-driven decisions (*Business Intelligence: What It Is & Its Importance*, n.d.). More data-driven decisions help discover new knowledge, eliminate resource waste, and improve the company's adaptability to changes in the market (*Business Intelligence: What It Is & Its Importance*, n.d.).

The history of the Business Intelligence system dates back to 1958, where an IBM researcher Hans Peter Luhn, later named Father of Business Intelligence, published a paper "A Business Intelligence System," describing an automated system that can assist in a different area of the organizations (Luhn, 1958). The invention of the hard disk in 1956 helped create the first database management system, which was referred to as a decision support system. In 1970, a few business intelligence vendors popped up with tools that allow clients to access data easily. But the BI tool was too hard to use as the technology was new and clumsy (Heinze, 2020).

In 1989, there was a competition for vendors in the Business Intelligence field to develop a new and improved BI tool using the faster and newer data warehousing. In the following years of development, this phase will be known as Business Intelligence 1.0 (Heinze, 2020).

As technology was improving and more vendors entered the market, Business Intelligence 1.0 was when clients could produce reports and visualize their product using the BI tool. However, the downside of BI 1.0 was that the BI tool was usually too hard to be used by the average user. Although highly skilled and expert users can only generate most reports, the delivery of the report was long as most of the data was siloed (Heinze, 2020). This led to Business Intelligence 2.0, where most complexity and speed issues are resolved (Heinze, 2020). Furthermore, new versions of BI tools are created with the implementation of cloud computing, the evolution of NOSQL, and larger database models (Rodriguez, 2016).

Business Intelligence 3.0 existed due to the transition of BI tools from IT-centric users to business-centric users that are self-serviceable and able to create visually appealing dashboards. In 2021, we are currently in Business Intelligence 4.0 as there is more new technology such as machine learning, artificial intelligence, and the Internet of Things. Implementing this new technology helps enhance reporting techniques further as machines can predict, make more precise decisions, and discover unknown insights into the data in the future (Rodriguez, 2016).

1.1 Company Profile

Alpine Works Cycles is a multinational outdoor sporting goods manufacturer and an original equipment manufacturer (OEM) that mainly focuses on manufacturing multiple bicycle models and outdoor sporting goods such as sports gloves, helmets, sports shoes, and many more.

Alpine Works Cycles has a workforce of 310 employees where 29 of them are sales representatives of Alpine Works Cycles.

Alpine Works Cycles is based in Bothell, Washington, United States of America (USA). Alpine Works Cycles has multiple reseller stores in Australia, Canada, France, Germany, Great Britain, and the US. They also provide to normal and corporate customers around the world through its internet e-commerce platform.

Based on the dataset given by Alpine Works Cycles, it is assumed that the reseller sales are not performing due to the high product costs, and product price is set too low for reseller sales compared to the internet sales. It is also assumed that the company issues are due to company internal mismanagement, such as employees not achieving the desired Key Performance Index (KPI) target. Last and not least, it is assumed that the company is pushing too much advertising for its product that drives the company to waste a lot of money.

1.2 Aims & Objectives

Aims

To perform data analysis, generate dashboards to understand and provide recommendations for the low sales and customer performance of Alpine Works Cycles.

Objectives

1. To perform data visualization to understand the current situation of Alpine Works Cycles.
2. To understand the reason for the downfall of sales and customer performance in Alpine Works Cycles.
3. To generate a cube for the dashboards that will assist the company in understanding the current situations.
4. To utilize the use of data mining to give recommendations to the company to make more informed and decisive decisions.

2.0 Methodology

CRISP-DM

CRISP-DM stands for Cross-Industry Standard Process for Data Mining which is an industry-independent process model for data mining (*CRISP-DM - Data Science Process Alliance*, n.d.). The figure below is a diagram of CRISP-DM.

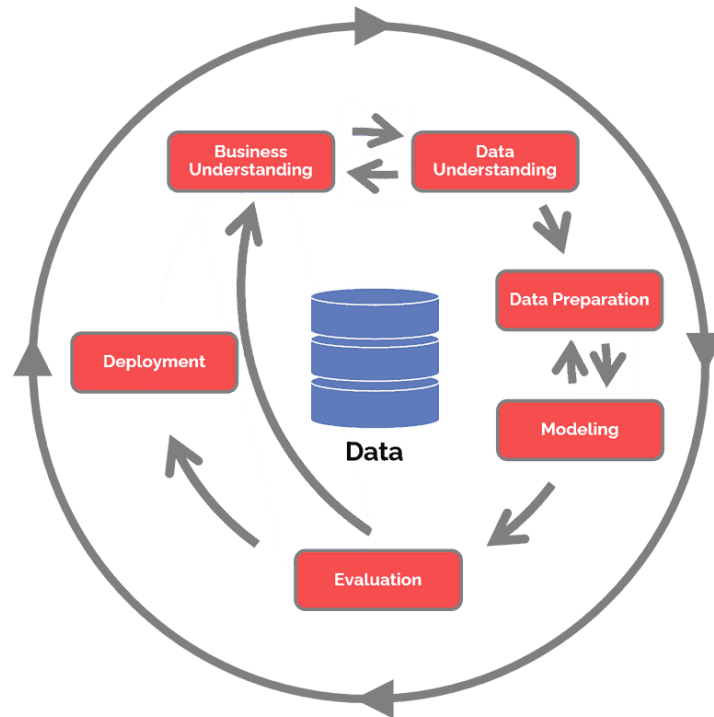


Figure 1: CRISP-DM Diagram (*CRISP-DM - Data Science Process Alliance*, n.d.)

CRISP-DM contains six phases that are important in the data mining process:

I. Business Understanding

The first step is Business Understanding, where the teams understand the business objectives and goals overall. In this Alpine Works Cycles Dataset, we can determine that the business objectives are to improve sales and customer performance. Its goal is to understand the reason for low sales and customer performance and make a new decision that will enhance the performance. This is because currently, the company is not performing very well in their sales even after changes in the company structure. Once all the objectives and goals are determined. It will produce a plan that specifies the budget, the people involved, and the

software to be used. This project will be using Microsoft Power BI tools, Microsoft Visual Studio, and Microsoft SQL Server Management Studio to understand the dataset given.

II. Data Understanding

The second phase represents data understanding, where the data analyst understands the dataset given by Alpine Works Cycles. The first step is the collection of initial data, where the data is inserted and loaded into the Microsoft SQL Server Management Studio. The following steps are Describing Data and Exploring Data. The data will be reviewed to understand the data source and the variables in each table present in the Alpine Works Cycles datasets. The data will then be verified, and any findings will be recorded.

III. Data Preparation

The third phase is data preparation, where specific tables or variables will be selected from the Alpine Works Cycles Dataset for the data analysis. The selected data will perform data pre-processing to remove any missing, noisy, or inconsistent data. Once data pre-processing is done, the dataset can proceed to the next phase. No integrating data is needed as Alpine Works Cycles only provided one dataset.

IV. Modeling

The fourth phase is modeling, where the development of the model happens. Many types of models can be generated, such as predictive, association, and cluster type models. It is usually based on the business needs. For the Alpine Works Cycles, it will be developing several cubes in Microsoft Visual Studio 2019 that will be used in Microsoft Power BI Tool. After several cubes have been developed, it will proceed to the next stage.

V. Testing and Evaluation

The fifth phase is evaluation and testing, where the model will be evaluated and reviewed. This process is needed to prevent missing out on any crucial data or attributes required for the data analysis. For the Alpine Works Cycles, the cube will be evaluated to find the best cube overall and check if it matches the business objectives and goals. The development of the cube will be reviewed based on the variables needed to create the dashboard and scorecard in Microsoft Power BI Tool. In this stage, the data analyst will decide to either continue to refine the cube or proceed to the next step.

VI. Deployment

The last phase is Deployment, where the model is deployed to the enterprise to be used in real-time. For the Alpine Works Cycles, it will create dashboards and scorecards using the Microsoft Power BI Tool to allow the company to understand the data more accessible. The deployment phase does not mean the end, but much maintenance needs to be done. Deployment can be as simple as generating a report or implementing a new model for the system to use.

3.0 Business Intelligence System

Business Intelligence System is a tool that data scientists use to understand data by performing data analysis to evaluate large and complex data into meaningful information and to discover new knowledge that can help the business to progress and improve further. Business Intelligence System is used effectively to support strategies, improve tactical and operational insight while also monitoring the ongoing progress based on the decision made by the company itself (*What Is Business Intelligence?*, n.d.).

In a Business Intelligence system, there are four components that make a BI Tool. The four components are:

- a. Data Warehouse
 - Contains historical data of the company that is organized and summarized, which can span more than five years
- b. Business Analytics
 - Tools that help users to transform data into information such as queries and data mining tool
- c. Business Performance Management
 - Allow the user to monitor, measure, and evaluate critical performance indicators
- d. User Interface
 - Provide a Graphical View of the performance like a dashboard

3.1 Microsoft Power BI

Microsoft Power BI is a business analytics service that Microsoft developed. The main goals of the Microsoft Power BI tool are to provide an interactive dashboard and business intelligence capabilities with a simple interface for the newcomer to learn and create their unique dashboard and reports of their analysis. Microsoft Power BI provides services such as data warehouse capabilities which include data preparation, data analysis, and interactive dashboards (*Data Visualization / Microsoft Power BI, n.d.*).



Figure 2: Logo of Microsoft Power Business Intelligence Tools (*Data Visualization / Microsoft Power BI, n.d.*)



Figure 3: Example of a dashboard in Power BI Tool (*Data Visualization / Microsoft Power BI, n.d.*)

Comparison with other Business Intelligence Tools

Comparison

Microsoft Power BI	Tableau
Developed by Microsoft	Developed by Tableau Software
Suitable for a small, medium, and large organization	Ideal for a medium and large organization
Used by newcomer and experienced user	Recommended for highly skilled or experienced users to use it
Concentrates more on reporting and analytical modeling but is not able to store data	Information can be stored by using the Tableau server.
Uses Data Analysis Expressions (DAX) for calculating and measuring columns	Deploys Multidimensional Data Expressions (MDX) for measures and dimensions
References: (Taylor, 2021)	

Table 1: Comparison between Power BI and Tableau

Advantages

Microsoft Power BI	Tableau
Cheap subscription fee	Less cost of training
Provide real-time dashboard updates and features for dashboard visualization	Very easy to create visualizations and provides features of visualization
Data sources are connected to the cloud, which is secure	Good customer service support
Provide fast deployment, hybrid configuration, and secure environment.	Able to manage a large volume of data
Easy to learn	Able to create dashboards, reports, and stories
References: (Taylor, 2021)	

Table 2: Advantages between Power BI and Tableau

Disadvantages

Microsoft Power BI	Tableau
Only able to share dashboards and reports with users with the same email domains.	High Operating Cost
Unable to change or alter imported data that uses the real-time database	No change management
Unable to accept file sizes larger than 1 GB.	Expensive compared to other tools.
Dashboard never accepts user, account, or other entity parameters.	Importing custom visualization is a bit difficult.
References: (Taylor, 2021)	

Table 3: Disadvantages between Power BI and Tableau

3.2 Visual Studio

Visual Studio is a product that Microsoft developed, and it is an integrated development environment (IDE) that can be used to develop mobile applications, web-based applications, and websites (*Visual Studio 2019 Community Edition*, n.d.). Visual Studio is supported in both Mac and Windows Operating systems. It also provides support for many programming languages such as C#, Visual Basic, C++, and many more that can be accessed by extensions (*Visual Studio 2019 Community Edition*, n.d.).



Figure 4: Logo of Visual Studio 2019 (*Visual Studio 2019 Community Edition*, n.d.)

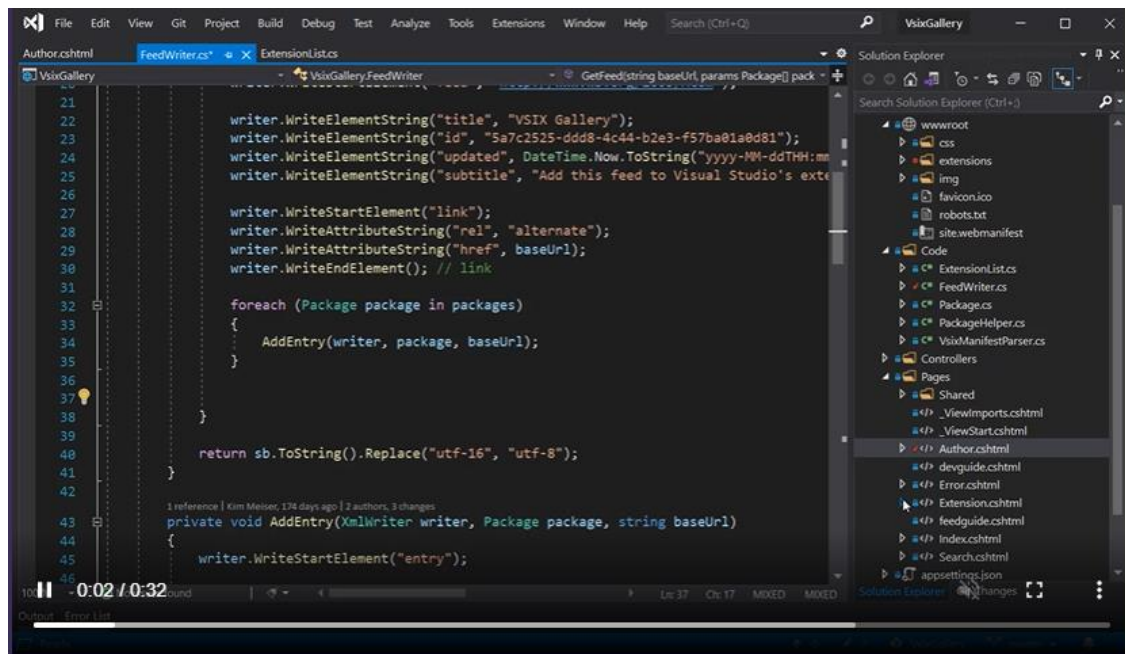


Figure 5: Example of Visual Studio 2019 Interface (*Visual Studio 2019 Community Edition*, n.d.)

There are three types of Visual Studio which are Community Edition, Professional Edition, and Enterprise Edition (*Visual Studio 2019 Community Edition*, n.d.). Although all three editions have pros and cons, this assignment will be using the community edition as it is free to use, and it provides all the necessary tools needed to perform all the tasks required in this assignment.

3.3 Microsoft SQL Server Management Studio

Microsoft SQL Server Management Studio is also a product that Microsoft developed, and it is an integrated environment used to oversee any SQL infrastructure from SQL Server to Azura SQL Database. SQL Server Management Studio (SSMS) is used for monitoring, configuring, and managing all components within the database (*Download SQL Server Management Studio (SSMS)*, n.d.). Microsoft SQL Server Management Studio is very popular to be used by database developers and administrators because it is cost-free, advanced user experience, various add-in options, and is easy to install.



Figure 6: Microsoft SQL Server Management Studio Logo (Waseem, 2020)

4.0 Business Intelligence Solution (BI Solution)

4.1 Data Source (Microsoft SQL Server Management Studio)

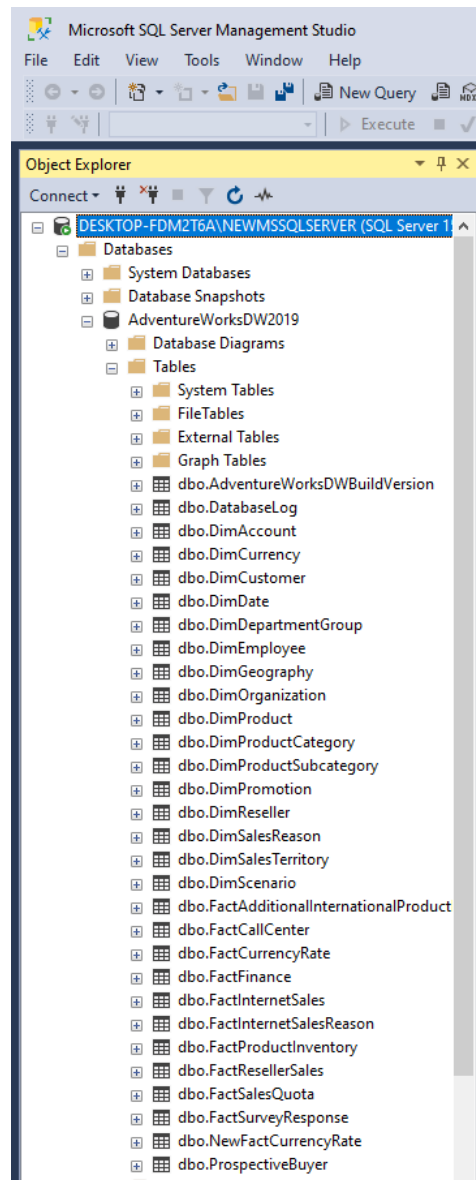


Figure 7: Data Source in Microsoft SQL Server Management Studio

Figure 7 above represents the dataset from Alpine Works Cycles that is uploaded to Microsoft SQL Server Management Studio. The “AdventureWorkDW2019” is the dataset from Alpine Works Cycles which contains a total of 30 tables, and a selected few will be used to perform data analysis for this project.

4.2 Data Source View

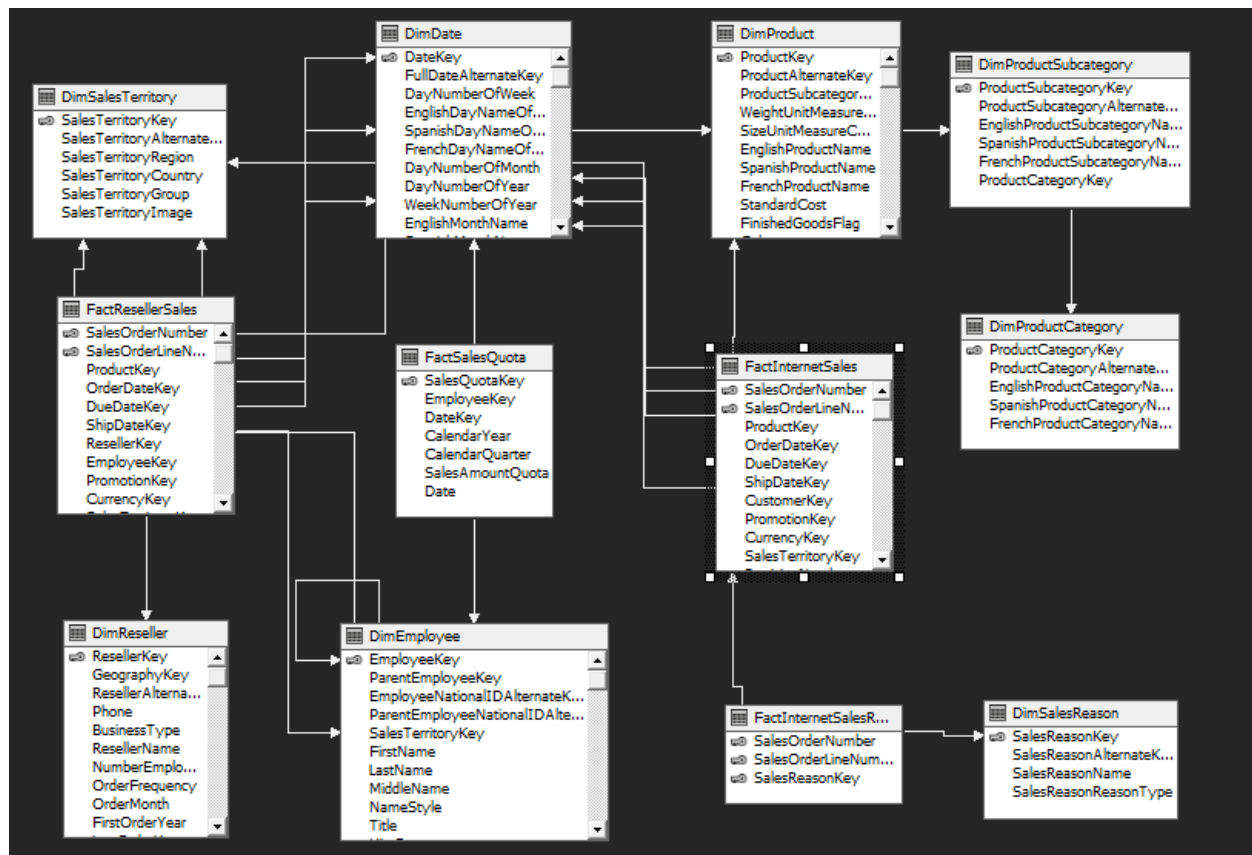


Figure 8: Data Source View in Visual Studio 2019

Figure 8 above represents the Data Source View that consists of 12 tables that will be used for this analysis. Not all the table that is present in the figure above because the tables that are not included are not essential enough that will assist in the improvement of the analysis or does not meet the business objectives. For this data source view, it is created by using Visual Studio 2019 and Microsoft SQL Server Management Studio after selection of the 12 tables as shown above figure.

4.3 Cube Structure

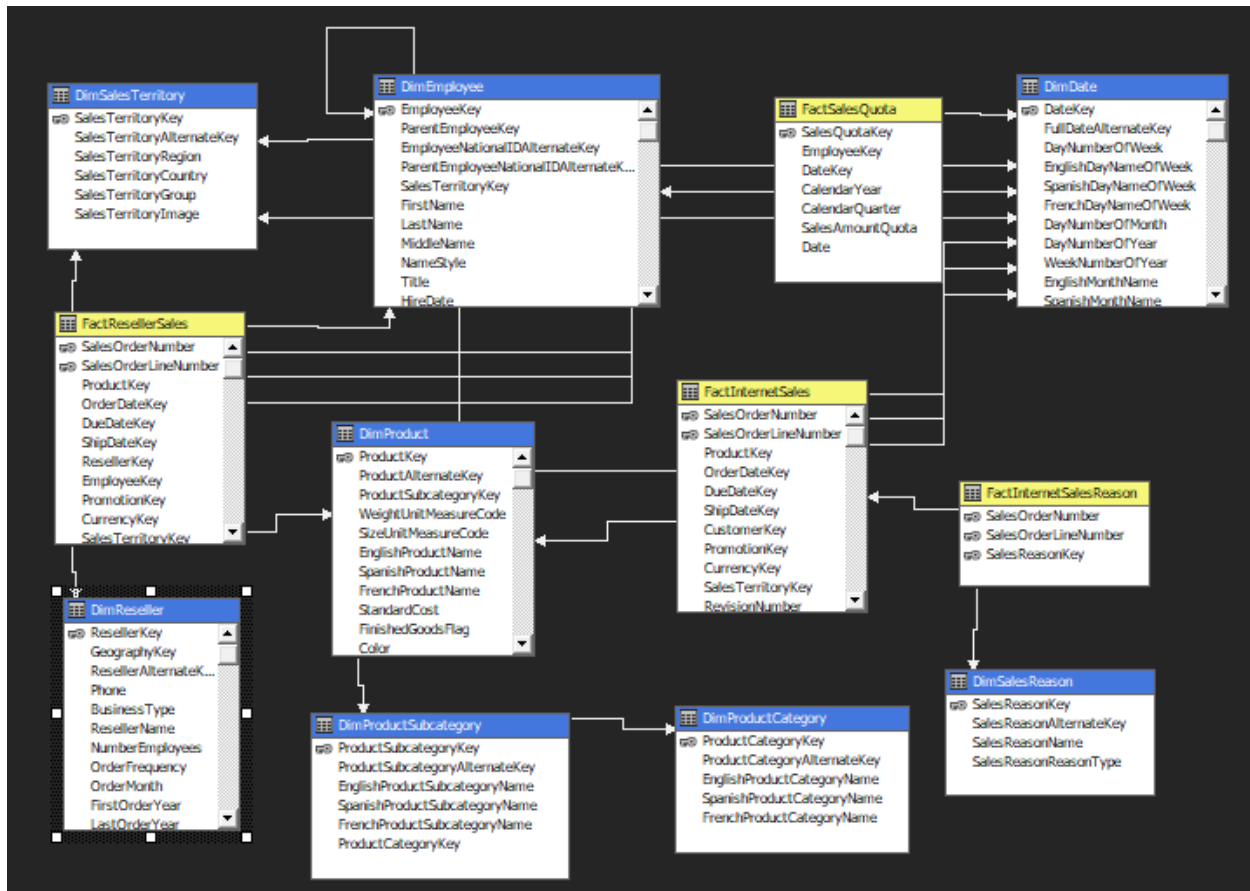


Figure 9: Cube Structure

Figure 9 above represents the cube for Alpine Works Cycles. The cube structure represents all the fact tables and the dimension table that have relationships between other fact or dimension tables. The cube is developed using Visual Studio 2019 and Microsoft SQL Server Management Studio. The cube is essential as it allows the Microsoft Power BI Tool to access the variable in the Dimension Table or Fact Table.

4.4 Usage of Dimensions

Dimensions

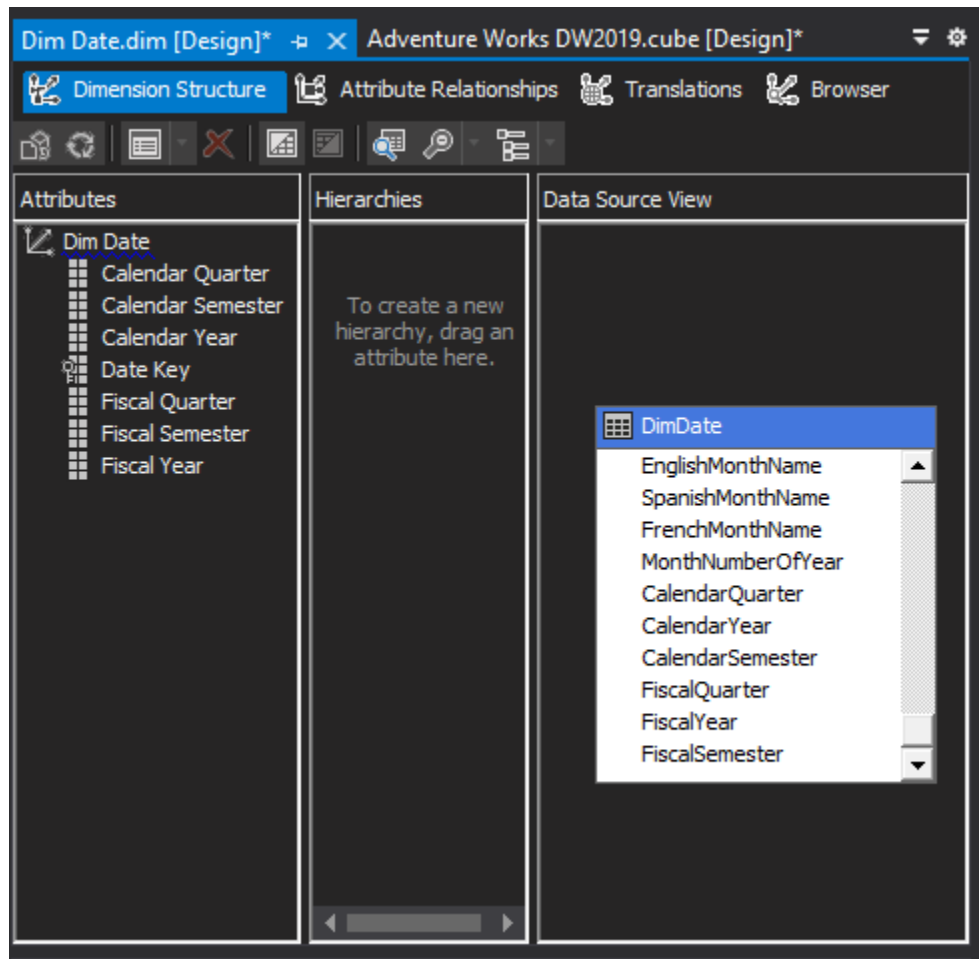


Figure 10: Dimension Date

For the first dimension, which is Dimension Date, we will be using variables such as “Calendar Year”, “Calendar Semester”, “Calendar Quarter”, “Fiscal Year”, “Fiscal Semester”, and “Fiscal Quarter”. To be able to use the variable listed above, we will have to drag the variable from the “DimDate” Table to the Attributes section, as shown in the figure above.

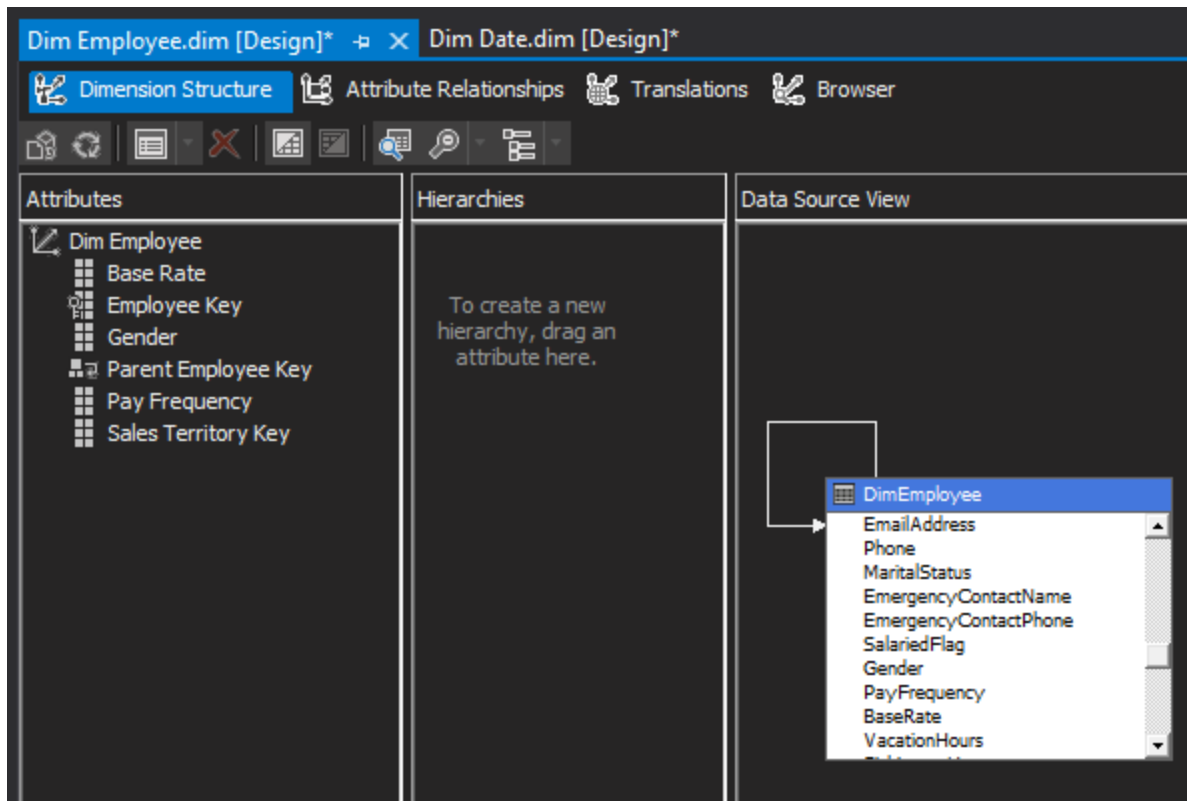


Figure 11: Dimension Employee

For the Dimension Employee, we will be using variables such as “Base Rate”, “Gender”, “Pay Frequency”, and “Sales Territory Sales”. To be able to use the variable listed above, we will have to drag the variable from the “DimEmployee” Table to the Attributes section, as shown in the figure above.

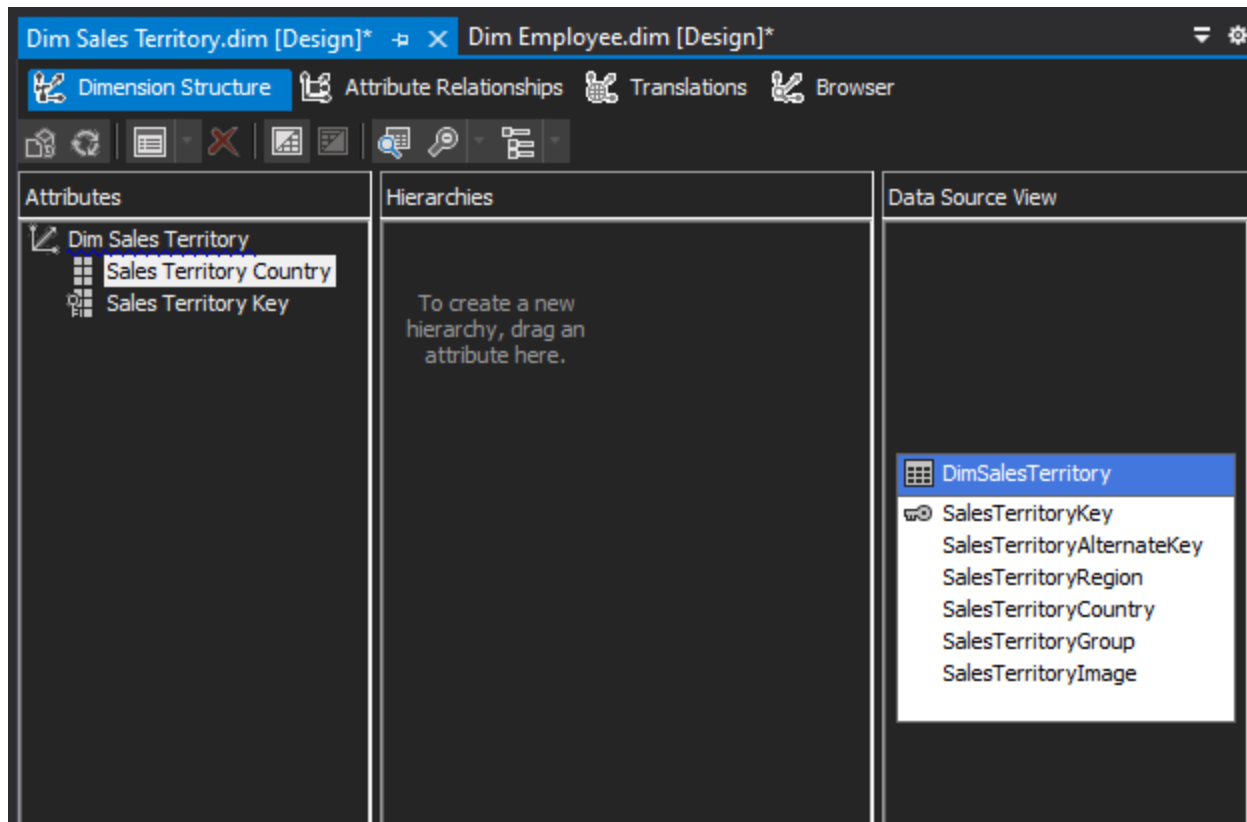


Figure 12: Dimension Sales Territory

For the Dimension Sales Territory, we will be using variables only “Sales Territory Country”. To be able to use the variable listed above, we will have to drag the variable from the “DimSalesTerritory” Table to the Attributes section, as shown in the figure above.

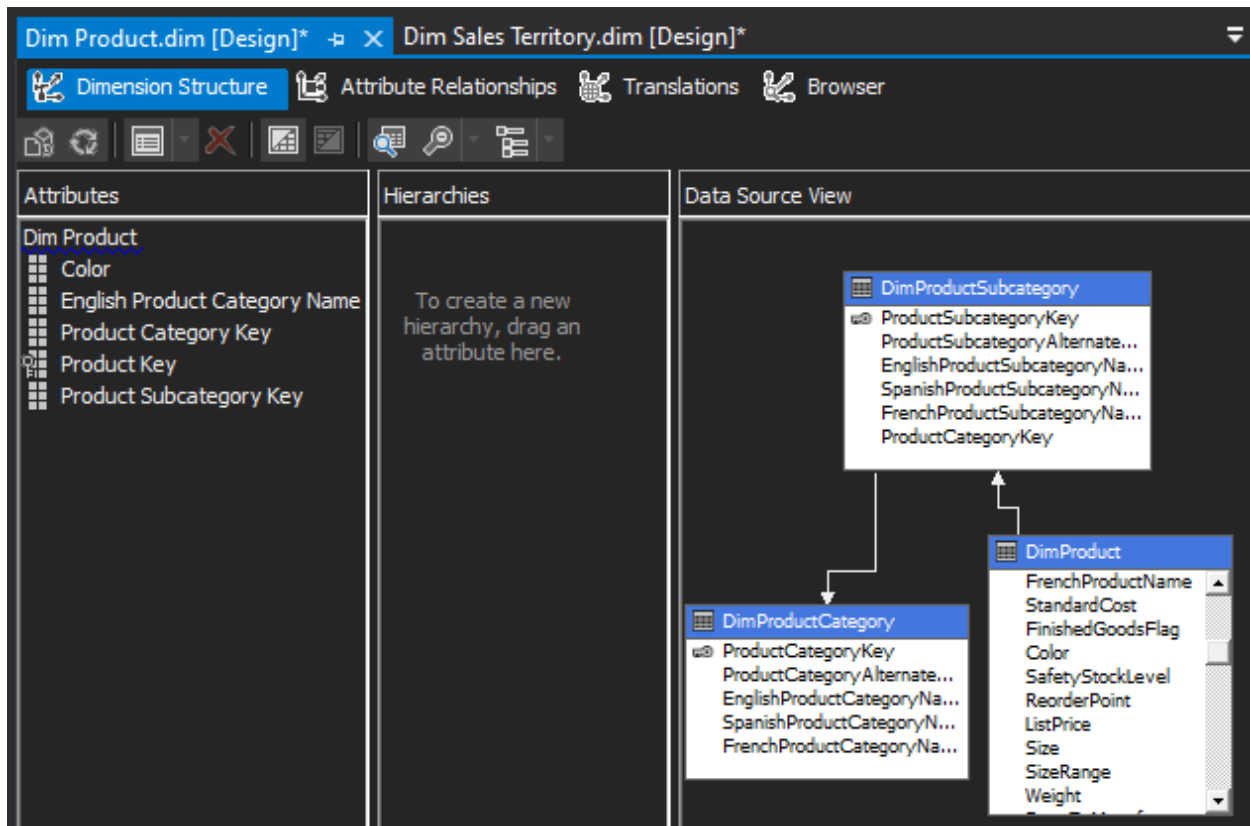


Figure 13: Dimension Product

For the Dimension Product, we will be using variables such as “English Product Category Name” and “Color”. To be able to use the variable listed above, we will have to drag the variable from the “DimProduct” Table to the Attributes section, as shown in the figure above.

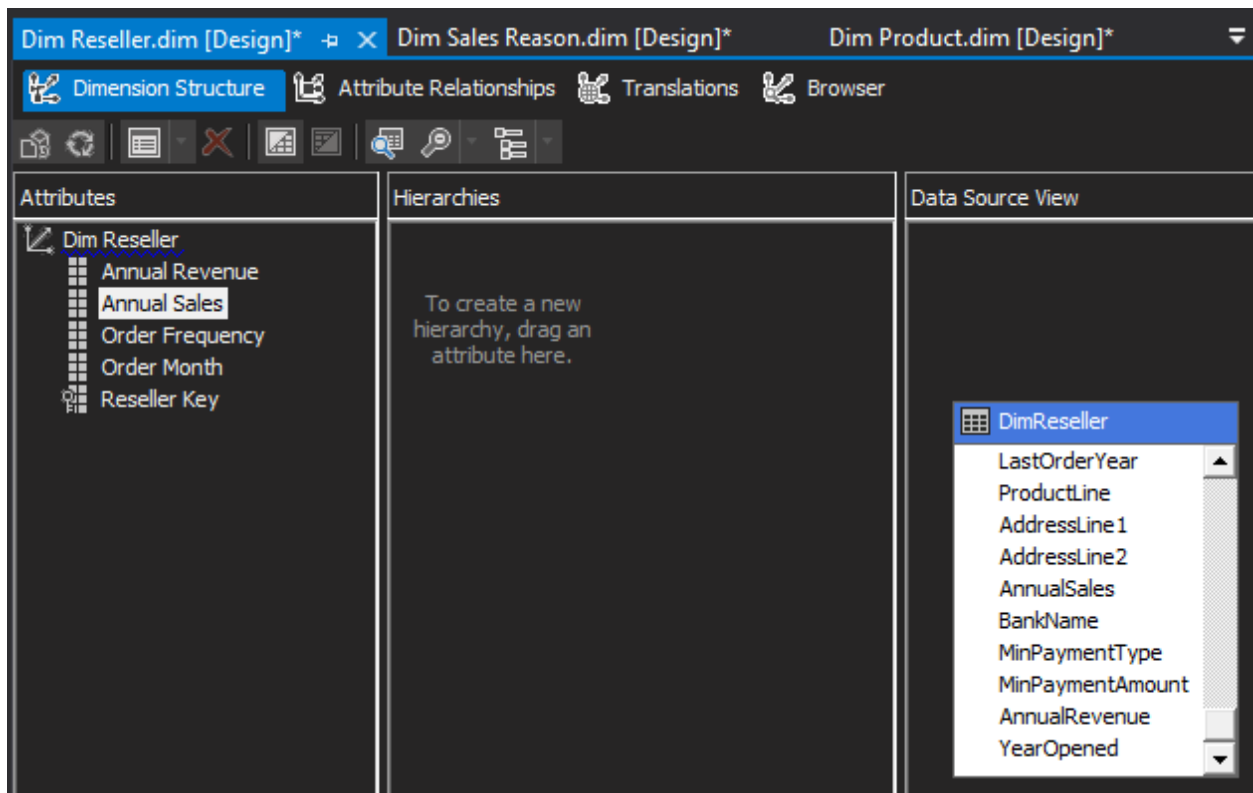


Figure 14: Dimension Reseller

For the Dimension Reseller, we will be using variables such as “Annual Sales”, “Annual Revenue”, “Order Frequency”, and “Order Month”. To be able to use the variable listed above, we will have to drag the variable from the “DimReseller” Table to the Attributes section, as shown in the figure above.

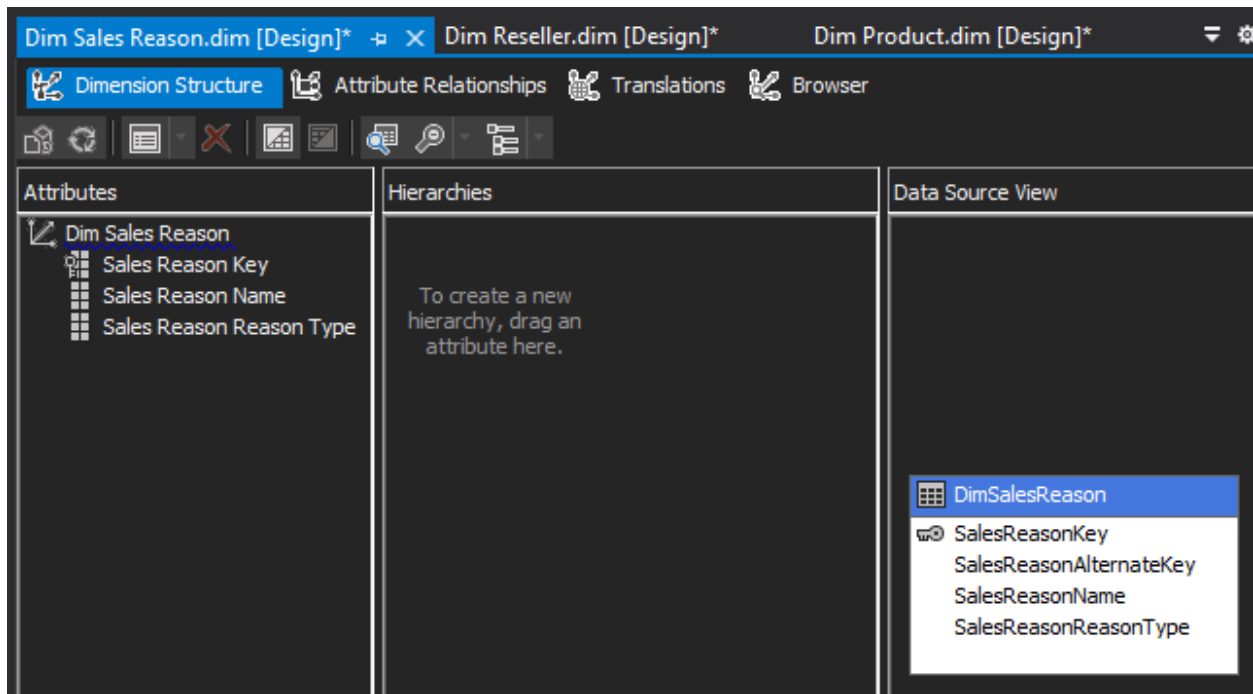


Figure 15: Dimension Sales Reason

For the last dimension, which is Dimension Sales Reason, we will be using variables such as “Sales Reason Name” and “Sales Reason Reason Type”. To be able to use the variable listed above, we will have to drag the variable from the “DimSalesReason” Table to the Attributes section, as shown in the figure above.

5.0 Business Intelligence Report (Analysis)

This section represents the Business Intelligence Report, which will generate two dashboards to explain the business performance of Alpine Works Cycles. It is also able to show the ongoing problem that Alpine Works Cycles is facing at the moment. The two dashboards are Reseller Sales Performance and Internet Sales Performance.

5.1 Reseller Sales Performance Dashboard

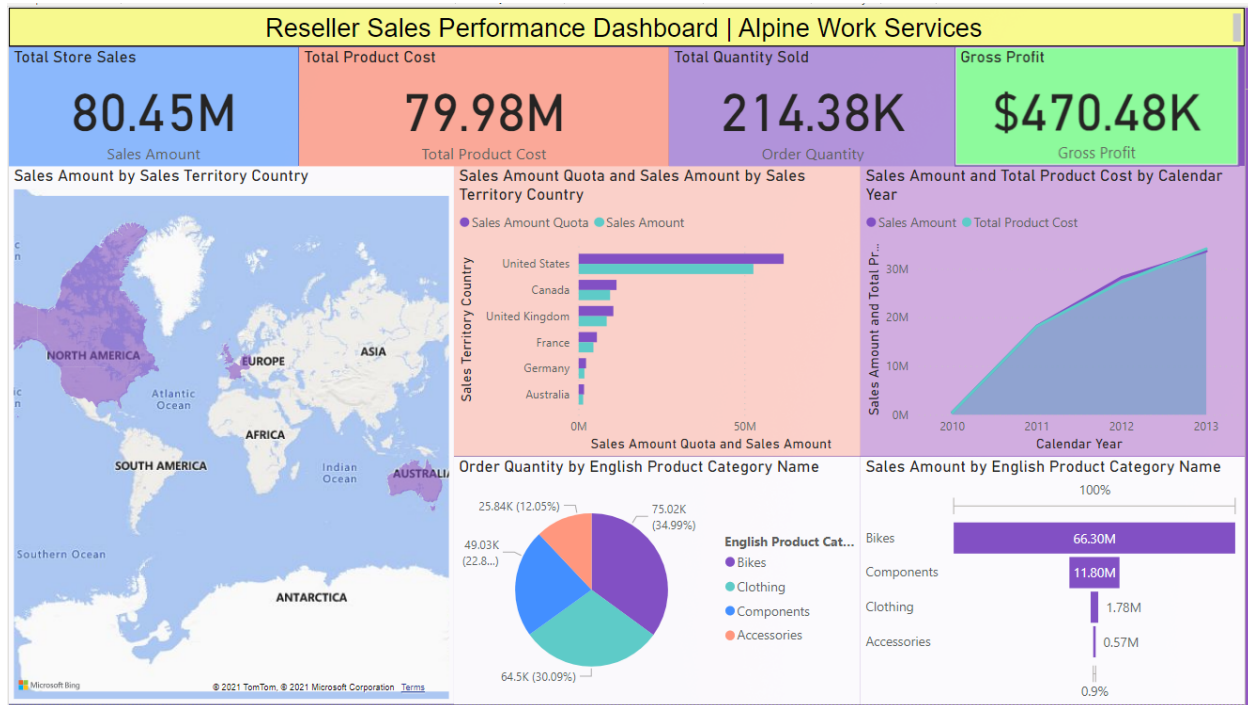


Figure 16: Reseller Sales Performance Dashboard

Figure 16 represents the Reseller Sales Performance Dashboard, which shows all the required information. In the Dashboard, we can see four scorecards and five graphs, below will explain in detail:

- Blue Scorecard represents the Total Sales Amount for Reseller Sales
- Orange Scorecard represents the Total Product Cost for Reseller Sales
- Purple Scorecard represents the Total Quantity Sold for Reseller Sales
- Green Scorecard represents the Gross Profits for Reseller Sales
- Graph 1 (Bottom Left) represents the maps where all the Reseller Sales product sold at
- Graph 2 (Centre Middle) represents the total sales amount versus sales quota

- Graph 3 (Bottom Middle) represents order quantity based on product category
- Graph 4 (Centre Right) represents the total sales amount and the total product cost
- Graph 5 (Bottom Right) represents sales amount based on product category

Based on the dashboard, there are several factors that are causing poor sales and customer performance in Alpine Works Cycles. Some are the factors are:

- High Product Cost and Low Product Price
 - As shown in the dashboard above, the total sales amount has demonstrated good growth overall on a year-to-year basis, but the total product cost to sell the product is much higher than selling on the internet. Furthermore, the product price can be seen to be too low until it caused the company to not gain any profit in 2013. This causes the company to have a lesser gross profit overall after deducting all the product costs.
- Sales Representative employees not meeting their KPI target for Sales Quota
 - Graph 2 (Centre Middle) in the Reseller Sales Performance Dashboard shows the Sales Quota versus Reseller Sales Amount based on Country. All the reseller stores in the world are not able to meet their KPI target for Sales Quota. This causes the company to not meet its expected earning and profit at the end of the year.

Based on all the factors that are causing poor sales and customer performance in Reseller Sales, it will be best to follow the recommendation below to keep the Reseller Sales improving in the future. Some of the recommendations are:

- Upskill sales representative employees (Recommendation 1)
 - This decision can put a massive burden on company profits in the short term, but it is able to provide a long-term benefit in the future.
 - Based on the Sales Quota that was placed by Alpine Works Cycles, the company can invest to upskills its sales representative employees to improve their business and communication skills. This is important to enhance employee skills as they will be able to attract customers with their excellent customer service in the future.
- Increase Product Price (Recommendation 2)
 - This decision can improve company profits, but it can pose a risk of losing customers to competitors.
 - This move is essential as the high production cost has been causing the company to lose out on a good amount of profit margin.

- Reduce KPI target for Sales Quota to acceptable levels (Recommendation 3)
 - This decision can reduce the company sales and profit expectations but able to improve employees' morale.
 - KPI is in place to keep employees to meet their target sales at the end of the day. Reducing the KPI target for Sales Quota based on the country is able to reduce the stress and burden of the sales employees and able to improve employee morale overall.
- Give benefit to employees that met their KPI target for Sales Quota (Recommendation 4)
 - This decision can reduce the company's profit but able to improve employees' morale and sales performances overall.
 - Although the KPI target for Sales Quota might be high, the company should boost employee morale by giving good benefits when it comes to meeting their KPI target. This is essential as it is able to push employees to work harder for better rewards from the company.
- Transition the company to sell Alpine's products online (Recommendation 5)
 - This decision can help reduce operating cost and product cost overall, but it may pose a risk of losing older customers that has very little knowledge of online shopping.
 - Moving the company to sell its products online is better as it reduces operating costs overall compared to reseller store sales.

5.2 Internet Sales Performance Dashboard

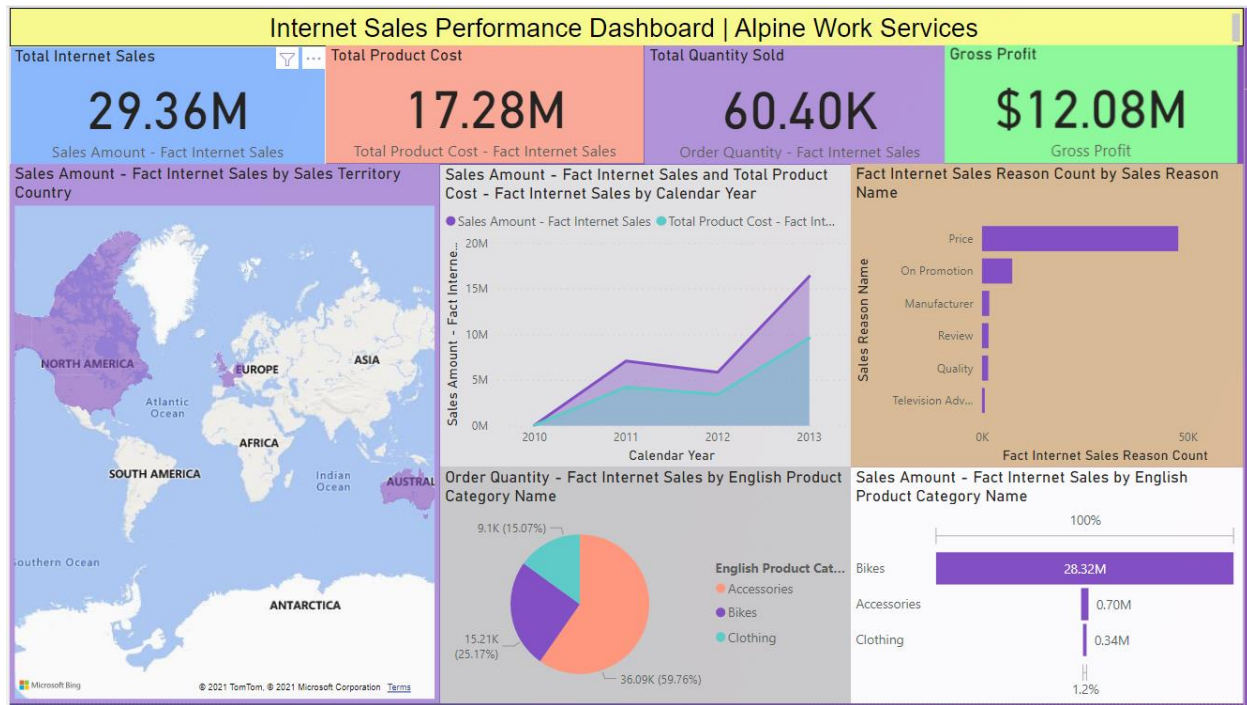


Figure 17: Internet Sales Performance Dashboard

Figure 17 represents the Internet Sales Performance Dashboard, which shows all the required information. In the Dashboard, we can see four scorecards and five graphs, below will explain in detail:

- Blue Scorecard represents the Total Sales Amount for Internet Sales
- Orange Scorecard represents the Total Product Cost for Internet Sales
- Purple Scorecard represents the Total Quantity Sold for Internet Sales
- Green Scorecard represents the Gross Profits for Internet Sales
- Graph 1 (Bottom Left) represents the maps where all the Internet Sales are from
- Graph 2 (Centre Middle) represents the total sales amount versus total product cost
- Graph 3 (Bottom Middle) represents order quantity based on product category
- Graph 4 (Centre Right) represents sales reason based on reason name
- Graph 5 (Bottom Right) represents sales amount based on product category

Based on the dashboard, there are several factors that are causing poor sales performance and customer performance in Alpine Works Cycles. Some are the factors are:

- Customers do not know the company is selling online

- Although internet sales only represent 26.73% of all sales in Alpine Works Cycles, it is still the most profitable method of selling Alpine's products.
- Spending on television advertisements that do not improve sales
 - Out of 60k products sold, only 730 products are sold with the help of television advertisements. This shows that television advertisements are not effective.
- Low amount of high-quality rating from customer
 - Out of 60,000 products sold, only 1151 products were sold because of the excellent quality of the product sold.

Based on all the factors that are causing poor sales and customer performance in Internet Sales, it will be best to follow the recommendation below to keep Internet Sales improving in the future. Some of the recommendations are:

- Reduce funding in the television advertisement (Recommendation 1)
 - This decision can help reduce wastage of company funding and invest in new opportunities that can benefit the company.
 - Investing in other opportunities is better than wasting too much money on television advertisements when no improvement in sales can be seen.
- Invest more in the quality of the product (Recommendation 2)
 - This decision can be a massive burden on company profits in the short term, but it is able to provide a long-term benefit in the future.
 - Not much customer buys Alpine products due to their quality but for their competitive prices. Improving the quality can further enhance customer satisfaction and brand loyalty.
- Promote selling on the internet (Recommendation 3)
 - Selling on the internet has helped the company to increase its profit margin overall. This is because product cost is cheaper when selling online compared to store sales. This can be done by promoting the company's online store using advertisements.

6.0 Conclusion

Based on this report, it can be concluded that the data analysis for Alpine Works Cycles has been completed. This report has described the Business Intelligence histories and shown all the necessary tables and variables needed to generate the cube to be used for the Power BI tool. The report also shows two dashboards to make it easier for the company to understand the problem currently being faced by Alpine Works Cycles.



Based on the dashboard, the main problem of the poor performance for sales and customer is due to the high production cost for the reseller sales and poor management of the advertisement to boost customer performance in the internet sales. The dashboard has shown all the company's problems and provided a sufficient amount of recommendations for Alpine Works Cycles to improve for their poor sales and customer performance that the company is currently facing. With the adequate amount of recommendations, it can assist Alpine Works Services in solving the business problems overall.

Report Total Word Count: 3662 words.

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Progress Review Template

Week No	Discussion/Review area	Remarks	Lecturer Signature
3	<ul style="list-style-type: none"> • <u>Have read and understood the assignment report structures, marking scheme, and requirements</u> • <u>Downloaded all the software required but not installed to the pc</u> • <u>Rewatch the video to prevent missing out on any information</u> 		
6	<ul style="list-style-type: none"> • <u>Still in progress to check and determine the benefit of each fact and dimension</u> • <u>Still in progress to find strong evidence on the assumption by creating meaningful visualization</u> • <u>All software is installed and working as intended</u> • <u>Has started doing the report documentation</u> 		
9	<ul style="list-style-type: none"> • <u>Strong evidence has been found based on the assumptions by using visualization</u> • <u>Still on progress for the report documentation</u> • <u>The cube has been developed and refined</u> 		
12	<ul style="list-style-type: none"> • <u>Report documentation has been completed</u> • <u>The cube has been developed successfully based on the business objective and goals</u> • <u>Two dashboards have been successfully developed that are able to understand the current situation in Alpine Works Cycles</u> 		