

Project Report

PROG8630-22S-Sec2-Data Visualization
and Reporting

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August 5, 2022

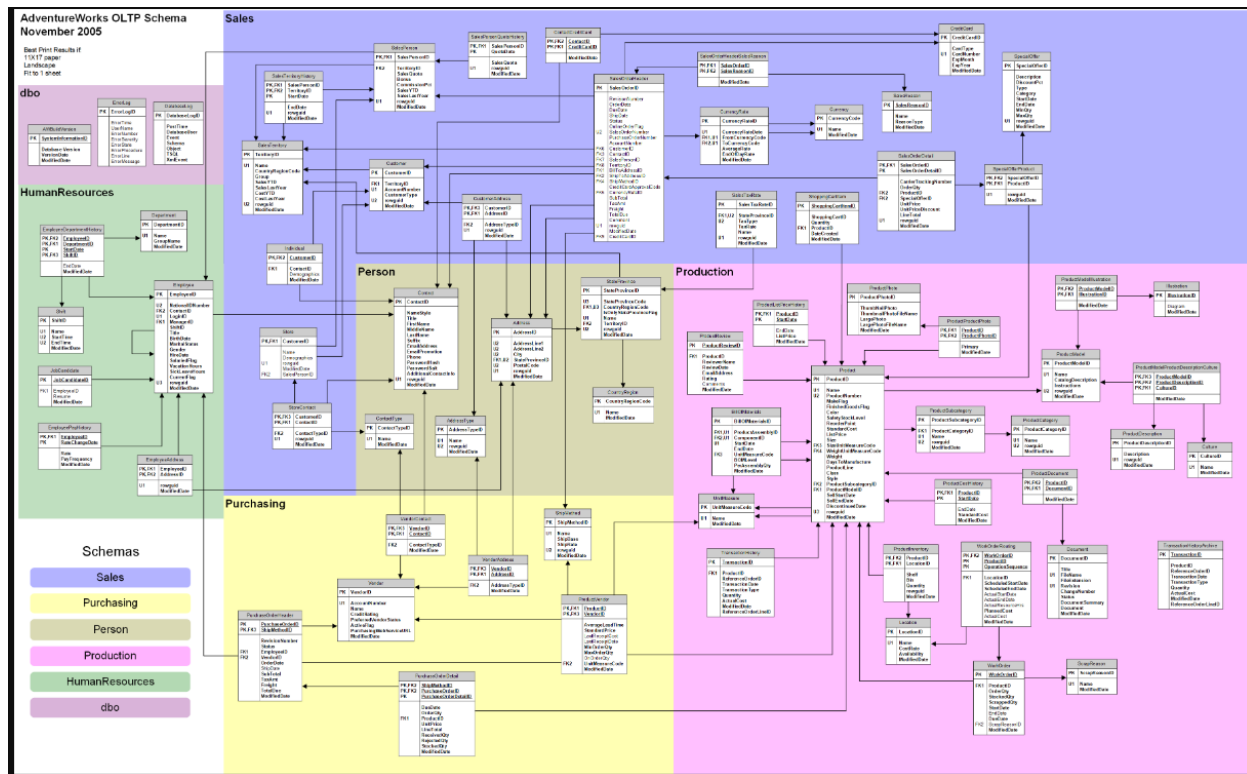
Introduction

Adventure Works Cycles (AWC) is a Microsoft Sample database that is used for OLTP and OLAP training purposes in SQL server database management system.

AWC is an fictious international manufacturer and seller of bicycles and accessories. The company's headquarters is located in Bothell, Washington, USA and have 3 main regional sales offices in America, European and Pacific. AWC would like to expand their sales to their best customers, extending their product availability through an external web site, while maintaining the lower production costs. AWC sales mainly come from two sales channels, such as resellers and internet/online. There are three major product categories for AWC online sales namely bikes, clothing and accessories & components. The core income for AWC is obtained by selling three main brands of bikes such as mountain bikes, road bikes and touring bikes bicycles. An additional income is generated by selling cycling accessories such as bottles, caps, gloves, jerseys, and components namely bike racks, brakes chains, handlebars, etc.

Four main departments comprise the AWC:

- Production: Products manufactured and sold by adventure works cycles.
- Sales: Customers and sales-related data. AWC has two types of customers: consumers who buy products from the adventure works cycles online store and retail or wholesale stores that buy products for resale from adventure works cycles sales representatives. The sales department is classified by various departments where they have the regional sales offices. The regional sales offices are located in United States, Canada, Australia, Germany and France.
- Procurement: Vendors from who parts and products are purchased.
- Human resources: employees of adventure work cycles [1].



Entity-Relation Diagram of AWC

Reference:

- 1- <https://docs.microsoft.com/en-us/sql/samples/adventureworks-install-configure?view=sql-server-ver16&tabs=ssms> 'AdventureWorks sample databases', Jan 2022.

Company Strategy (The purpose of Analyzing different Departments)

Adventure Works Cycles is looking to broaden its market share by targeting their sales to their best customers, extending their product availability through an external Web site, and reducing their cost of sales through lower production costs.

Sales and Marketing Analysis

As stated above, the company's strategy is broadening its market. In his regard, three main questions are introduced:

- **Is the company's sale performance growing? It's a fact that by tracking the growth of your sales, you also track the growth of your company. following KPIs are considered:**
 - sales volume
 - profitability
- **What are the popular productions? To answer this question, we consider following KPI:**
 - Sales performance by product

- **has the company been successful in attracting loyal customers? To answer this question, we consider followings KPIs**
 - the number of customers' order frequency who make one order, two orders, three orders and so forth in a specific year.

Production Analysis

In this segment company focuses on increasing products and reducing the cost of products. So, three main questions are derived here:

- **what is the company production capacity? To answer this question, we consider following KPIs:**
 - YTD Production volume.
 - on time Production per category.
- **which part of the assembly is taking more time in production, and if lead time can be reduced?**
 - Production Lead Time. (The latency between the initiation and completion).
- **where is improvement needed so that production costs are reduced? To answer this question, we consider following KPIs:**
 - Actual cost distribution over different parts of the assembly line
- **how money is the company wasting on discarded products and what is the trend? To answer this question, we consider following KPIs:**
 - Waste cost by year.
 - Waste percent.

Purchasing Analysis

The company wants procurement teams to drive value beyond cost savings. As a result, procurement leaders are constantly looking for ways to improve their procurement process and make it more sustainable. So, three main questions are derived here:

- **What is the Supplier lead time for suppliers? Supplier lead time is the amount of time that elapses between the time a supplier receives an order and the time when the order is shipped.**
 - $\text{Supplier lead time} = \text{Delivery time (Goods and receipts delivery)} - \text{Order time (PO acceptance)}$
- **How is the vendor's quality? The vendor's quality is calculated in terms of the quality of delivered products and delivery time. we consider two KPIs for this purpose:**
 - Supplier defect rate: The percent of rejected items per order
 - Delay in delivery: whether suppliers are delivering at the right time.
- **Which are the most important suppliers for the company? Vendors that have a significant portion of the company's purchase costs are critical for the company. this metric helps the company to review all aspects of its relationship with these suppliers and try to cut costs by getting offers from other supplier competitors Following KPIs are considered in this regard:**
 - Top 5 vendors from point of total price of all POs.

Human resource Analysis

Undoubtedly, AWC knows that employees play a significant role in advancing the company's strategies. So, the HR department tries to provide a creative and satisfied environment for staffs. to evaluate the HR performance, following questions are introduced:

- **How was the quality of Hirings? To answer this question, we consider the rate of people left the company in a specific time and employees was fired by company. The following KPIs are considered:**
 - Turnover rate (voluntary and dismissal rate).
- **What is the absent rate of employees and how much it cost for the company? To answer this question, calculate absence rate of employees due to delays, sick leave, or excused or unexcused absences. This indicator can help plan for future absences or adjust the business strategy to prevent them. the following KPIs is considered for this purpose:**
 - Absent Rate: number of working days in which the employee was absent by their total number of working days.
 - Absent cost: employees hourly pay rate by employee's absences.
- **How frequently has the company raised employees' salaries? This question can be a factor in employee satisfaction. To answer this question, we consider following KPI:**
 - Number of raises for each employee per their work duration.

Proposed Layout in Proposal

Sales and Marketing

Is the company's sale performance growing?

- *sales volume*
- *profitability*

What are the popular productions?

- *Sales performance by product*

Has the company been successful in attracting loyal customers (Who make more orders)?

- *Number of orders for each customer within a specific duration.*

Production

what is the company production capacity?

- *YTD Production volume.*
- *on time Production per category.*

which part of the assembly is taking more time in production, and if lead time can be reduced?

- *Production Lead Time.*

where is improvement needed to reduce costs?

- *Actual cost distribution over different parts of the assembly line*

How much does waste cost?

- *Waste cost by year.*
- *Waste percent.*

Procurement

What is the Supplier lead time for suppliers?

- *Supplier lead time = Delivery time (Goods and receipts delivery) – Order time (PO acceptance)*

How is the vendor's quality?

- *Supplier defect rate: The percent of rejected items per order*
- *Delay in delivery: whether suppliers are delivering at the right time.*

Which are the most important suppliers for the company?

- *Top 5 vendors from point of total price of all POs*

Human resources

How was the quality of Hirings?

- *Turnover rate (voluntary and dismissal rate).*

What is the absent rate of employees and how much it cost for the company?

- *Absent Rate*
- *Absent cost: employees hourly pay rate by employee's absences.*

How frequently has the company raised employees' salaries?

- *Number of raises for each employee per their work duration.*

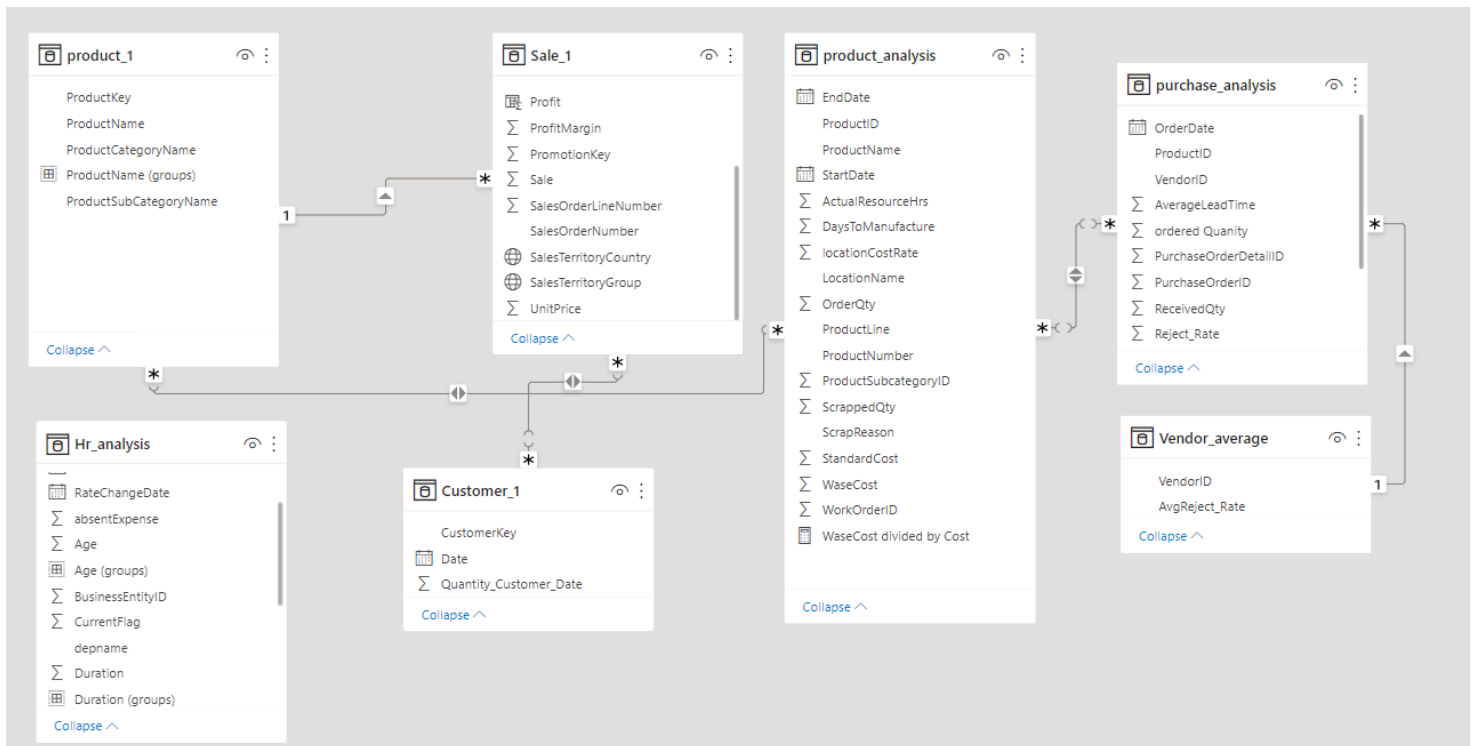
AWC Dashboard Schema

ETL rocess and data model

Data is imported from SQL Server where the database was installed. To reach desire tables, tables were joined and the result of select query directly imported to the power BI.

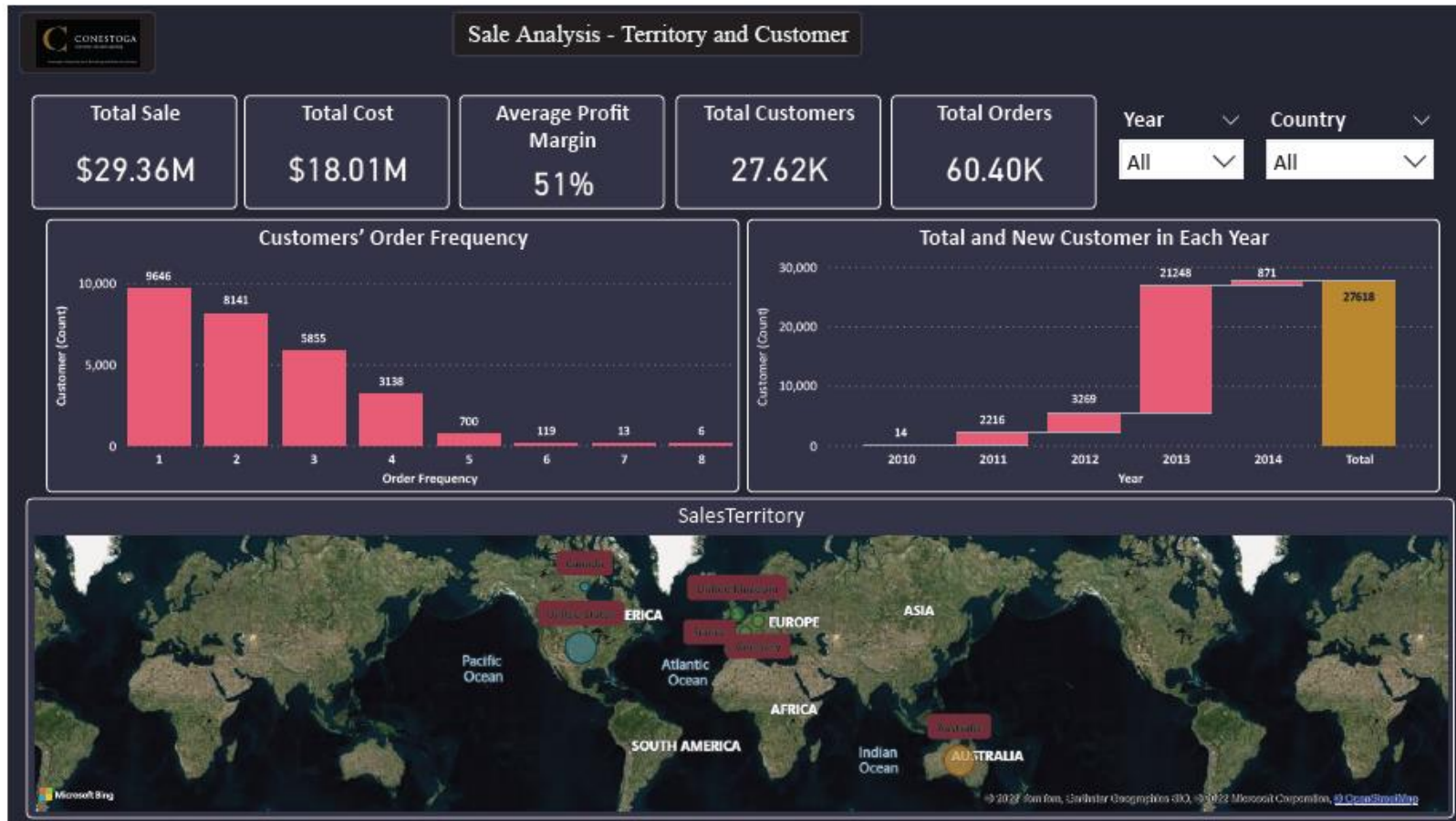
- Production Location - Has Production assembly data, 1.e. Parts used to manufacture each product are defined here with an assembly location category
- Production Product - Data related to products, their physical details, price, etc.
- Production ProductCategory - Products and their defined categories
- Production ProductSubcategory - Products and their subcategories
- Production ProductInventory - Inventory data of the produced products
- Production ScrapReason - Waste Data related to manufacturing
- Sales SalesOrderDetail - Transactional Sales Data
- Sales order Header- Transactional Sales Data
- Sales-Territory- Sales Territory information
- Vendor, Product Vendor- Vendor inforamtion
- Employees- employees information

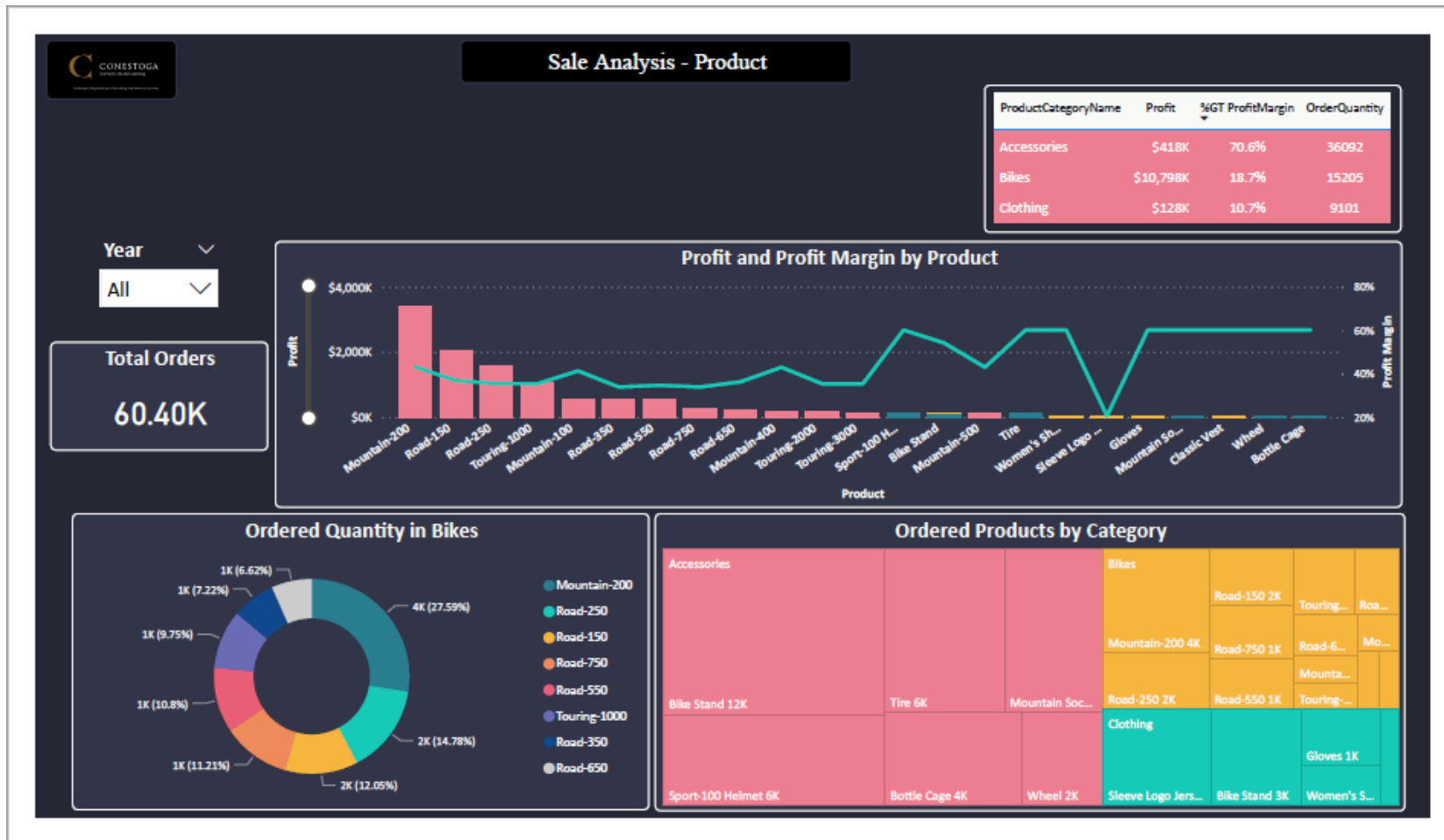
Below picture shows Provided Data model from AWC database. The HR dimension could have relationship with Sale Table through Salespersons. However, it was out of our purpose in this Analysis.



Layout of the dashboard

Sales Analysis





Tools and Description

Sales layout includes two pages: **Sales analysis by territory and Customer** and **Sales analysis by product**.

Sales analysis by territory and Customer

Map and slicer country: demonstrates the market of this company. United States, Canada, Australia, Canada, France, and Germany are countries where this company sells products.

Cards: gives Aggregate calculations of different metrics. Like Total Sales, Total customers, Total Profit, Total profit margin, and total orders.

Bar chart: shows how many orders customers placed in a specific period (all years or a specific year). This can be a good metric for measuring loyal customers in the company.

Waterfall Chart shows the trend of attracting customers. This chart gives a comprehensive view of new and total customers and is analyzed in conjunction with the bar mentioned earlier.

Slicer Year: allows seeing data demonstrated in graphs and charts in a specific year.

From demonstrated statics, we can conclude that the United States and Australia are the most critical markets that makeup about 60 percent of the total revenue. However, we can see a significant increase in the gross sale of the company in Canada during 2014 (from 6% in 2010 to 20% in 2014).The company earned excellent sales and profit in 2013 when the gross sale reached 16.5 million dollars. However, the sale significantly decreased in the next year (45000 \$). As expected, the company's success in attracting new customers was huge, so about 20000 new customers were added to the company. The worst performance was recorded in 2014 (after the first year) with 870 new customers.

Sales analysis by territory and Customer

The company products include three product categories: Bikes, Accessories, and clothes. Each type is divided into subcategories; for example, mountain bikes, road, and touring bikes comprise the bike category. Accessories contain wheels, tires, seats, headlights, etc. cloths include sucks, shorts, and sleeves.

Table: It gives an overall view of sales performance by-products.

Line and stack column Chart: it compares profit and profit margin for the products. The bar chart depicts the yield, and the line chart shows the profit margin.

Dunat Chart: Bicycles have prominent status in the company's product portfolio. So, comparing bikes from a sales aspect is a good idea. We can understand which bikes are more popular among customers. A donut chart is suitable for this purpose.

Treemap chart: gives a good view of ordered products by category.

Slicer Year: allows seeing data demonstrated in graphs and charts in a specific year.

From demonstrated statics, we can conclude that Accessories play the most crucial role in the company's profit margin, although bikes provide more profit. The metrics also show that mountain-200 is the most popular bike among the customers.

Production Analysis

Different lines like Welding, painting, Assembly, etc., comprise the Production department. Three important metrics for analyzing the production department are waste, the contribution of each line in product cost, and manufacturing time.

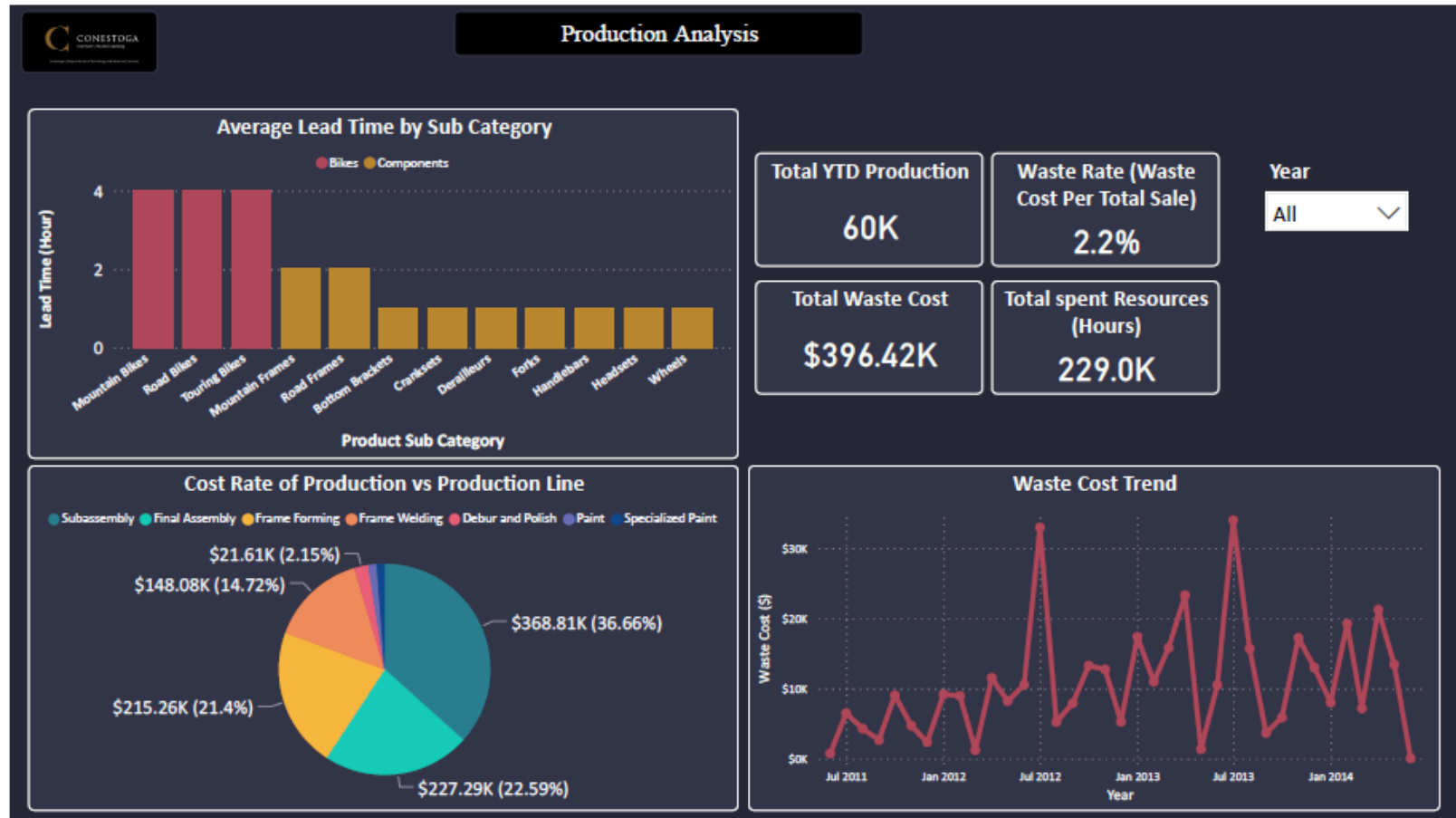
Bar chart: lead time is the latency between initiating and completing a product. This chart shows the average lead time for each subcategory. It should be noted that products here are categorized to bikes and components (accessories and elements of a final product bike).

Pie Chart: gives the contribution of each line to the final product cost.

Line Chart: shows the trend of waste cost. The waste cost is calculated by multiplying scrapped items by their unit price. This chart comprehensively indicates the company's performance in controlling waste.

Cards: gives Aggregate calculations of different metrics. Total wastes, Waste per Sale and total work hours labors

From statistics, we can conclude that the company was not successful in controlling the waste because the line charts show a sinusoidal trend. Moreover, total waste has a 2.2% of total sales, which seems to be considerable. The company should hire more workers in the subassembly line because it takes 36% percent of manufacturing time. According to the bar chart information, it is evident that bikes as final products spent more time in production.



Procurement Analysis

Different Vendors supply AWS materials. AWC likes to know which vendors have the most contribution to its purchase cycle, How fast its vendors in providing the materials, and how their quality is. In this regard, vendors' average lead time, defects (rejected items) rate, and total transaction among vendors and the company are considered for analyzing this department.

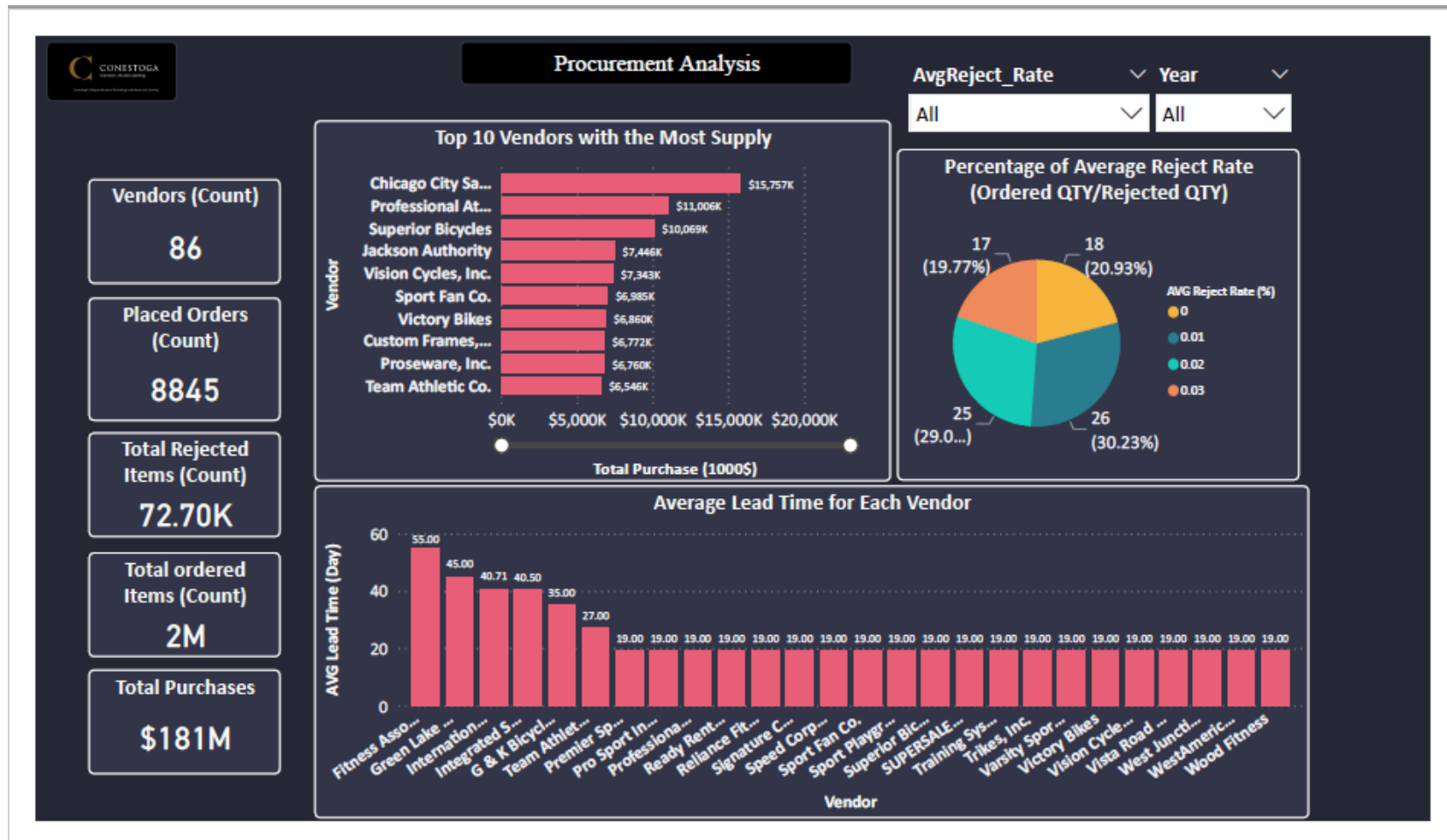
The horizontal bar chart shows the top ten vendors with the highest transactions.

The vertical bar chart shows the average lead time for the top 8 vendors with the highest latency in delivering the products.

Pi chart: shows the share of vendors in total defects. The average defect rate is summarized into four categories (0,0.01,0.02,0.03 percent). The reject rate is calculated by multiplying the rejected items by ordered items. It should be noted that the results were rounded to get a shorter category.

Cards: gives Aggregate calculations of different metrics like total purchases, total vendors, totally ordered items

From statistics, we can conclude that the company works with suitable suppliers because the products reject rate for all vendors are less than 0.03 percent which can be a reasonable rate. Moreover, the company should push the top six vendors with the highest average lead time to decrease this high latency. Finally, the company should have particular attention to the top three vendors with the highest transaction.



Human Resources Analysis

HR department success is measured by two important KPIs: Turnover rate (Employees left the company voluntarily or got fired) and employee health situation. For this purpose, we estimated employees' sick leave hours and the cost put on the company as well as the rate of turnover from 2010 to 2014.

The vertical bar chart: shows sick leave hours by employee's department category. This category can give helpful information on the distribution of health issues in different departments.

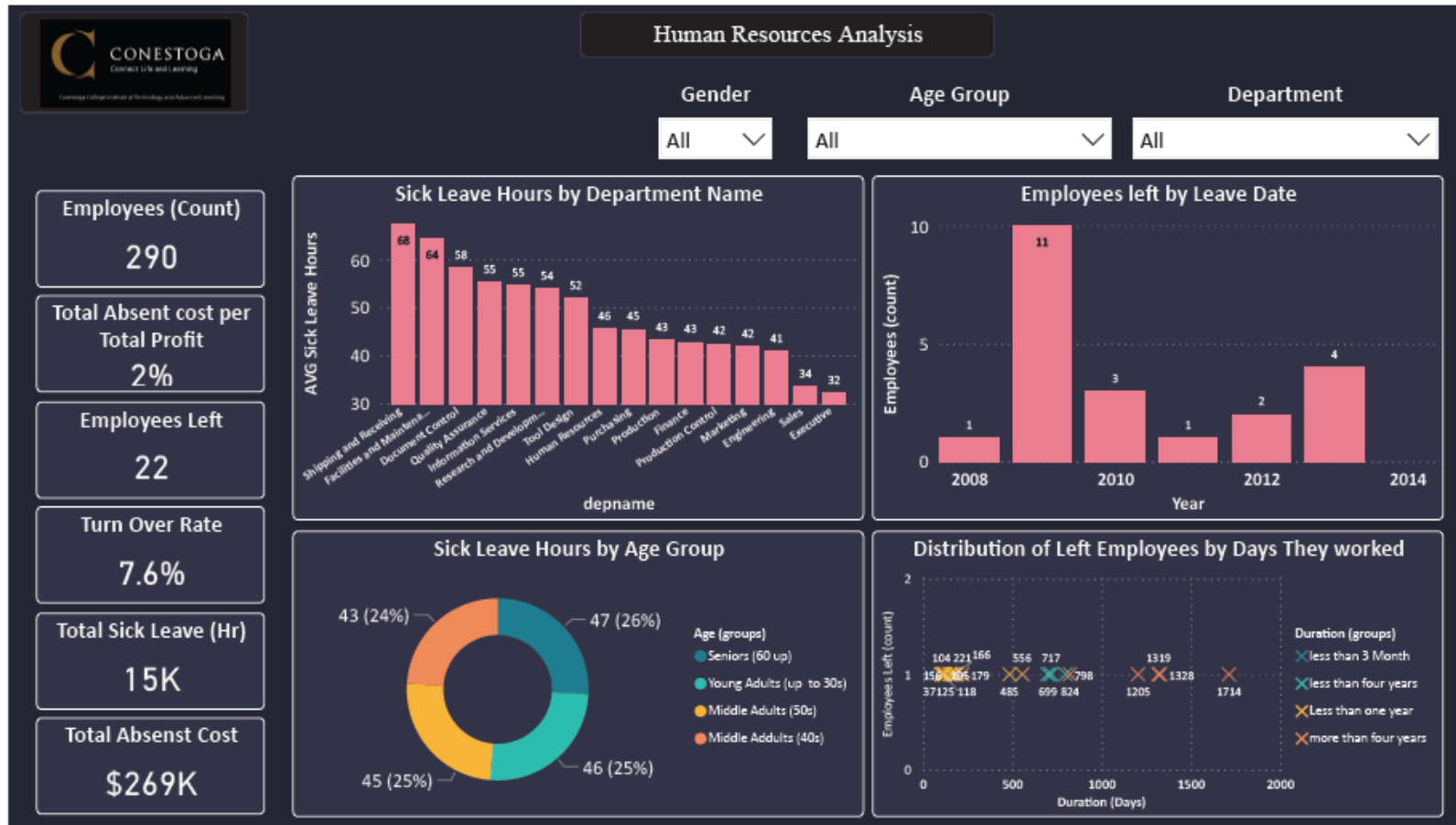
Vertical bar chart: this bar chart shows the number of employees who left the company each year.

Scatter chart: is a good choice for showing employees' distribution by their time working for the company.

Dunat chart: gives: information on which age groups have more health issues.

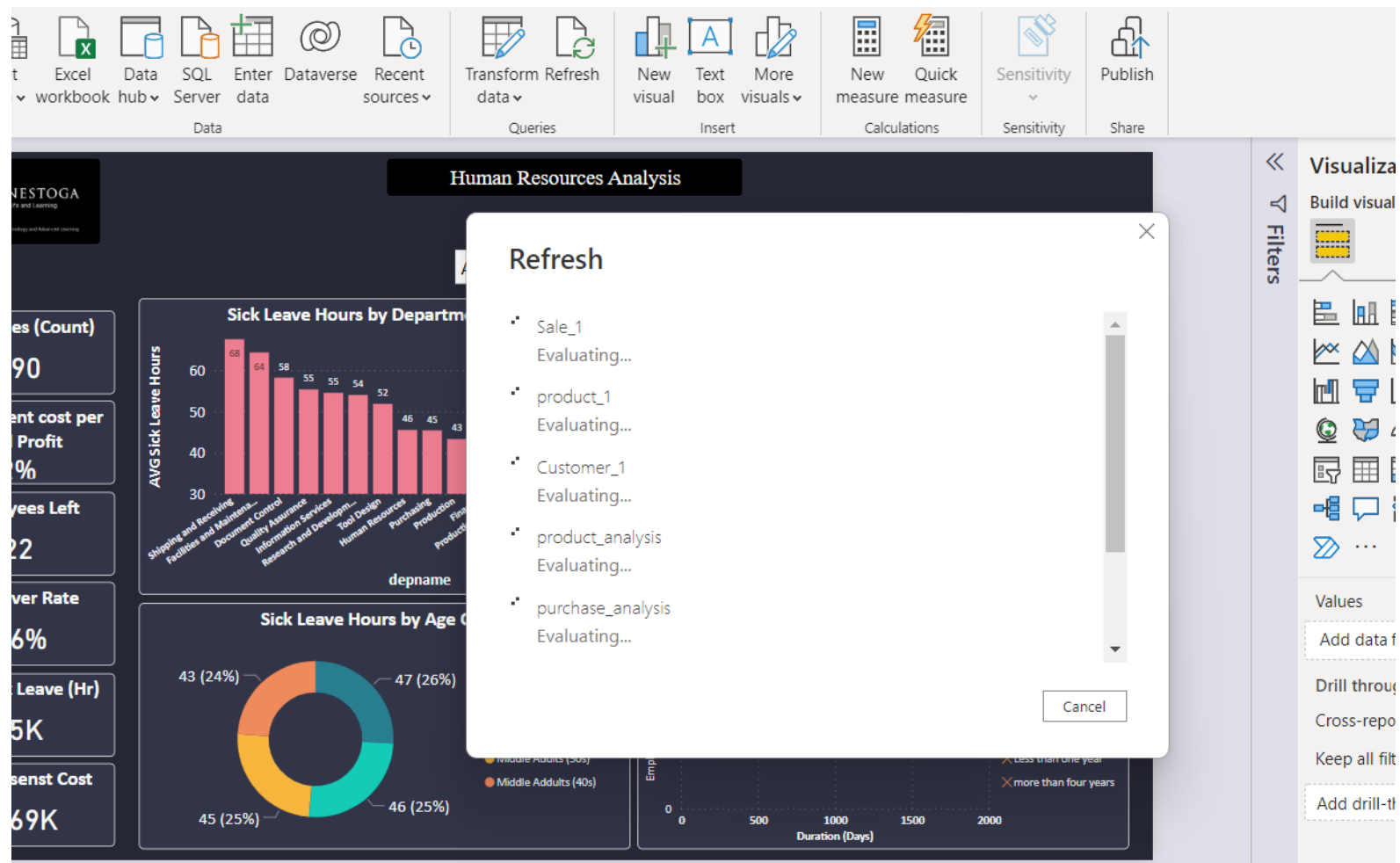
Cards: gives Aggregate calculations of different metrics like total employees, total employees left the company, total sick leave hours, and their cost to the company.

Statistics show that 7.6% of hired employees left the company. According scatter chart, most of these employees left the company within nine months of their hire date, which questions the HR department's performance. Employees that work in the shipping and maintenance department used more sick leave hours. However, the donut chart does not show any meaningful relation between employees' age and health status.



Updating data and improvements/revisions to the dashboard

As mentioned in ETL process, data imported from SQL server software and then a data model provided for this analysis (relationship among tables were created by MODEL TOOLS in power Bi). As a result, by clicking REFRESH BUTTON (as shown in below picture) system automatically refresh data by connecting to the source.



Below images show a failed and a successful connection to the source.

