POWER BI

The Power BI file for my project can be downloaded in **Github** (saved as **PowerBI-ETL-DataModel-DAX-Dashboards.pbix**) by clicking on this website link:

https://github.com/fernando5w/PowerBI_project

My project involves using Power BI the Business Intelligence tool to analyse data for a manufacturing company that produces cycling equipment and accessories.

The **dataset** I used consists of various CSV files containing informaton about sales transactions, returns, products, customers and geographic locations for sales.

Power BI is used to track the company's **KPI** for sales, revenue, sales orders, returns and profit. In addition Power BI is used to compare **geographic performance by country, analyse product trends, and to identify high value customers.**

My Power BI dashboard displays the following 4 tabs:

- Tab "Summary"
- Tab "Product Details Drillthrough"
- Tab "Customer Details"
- Tab "Map"

I used Power BI to do the following:

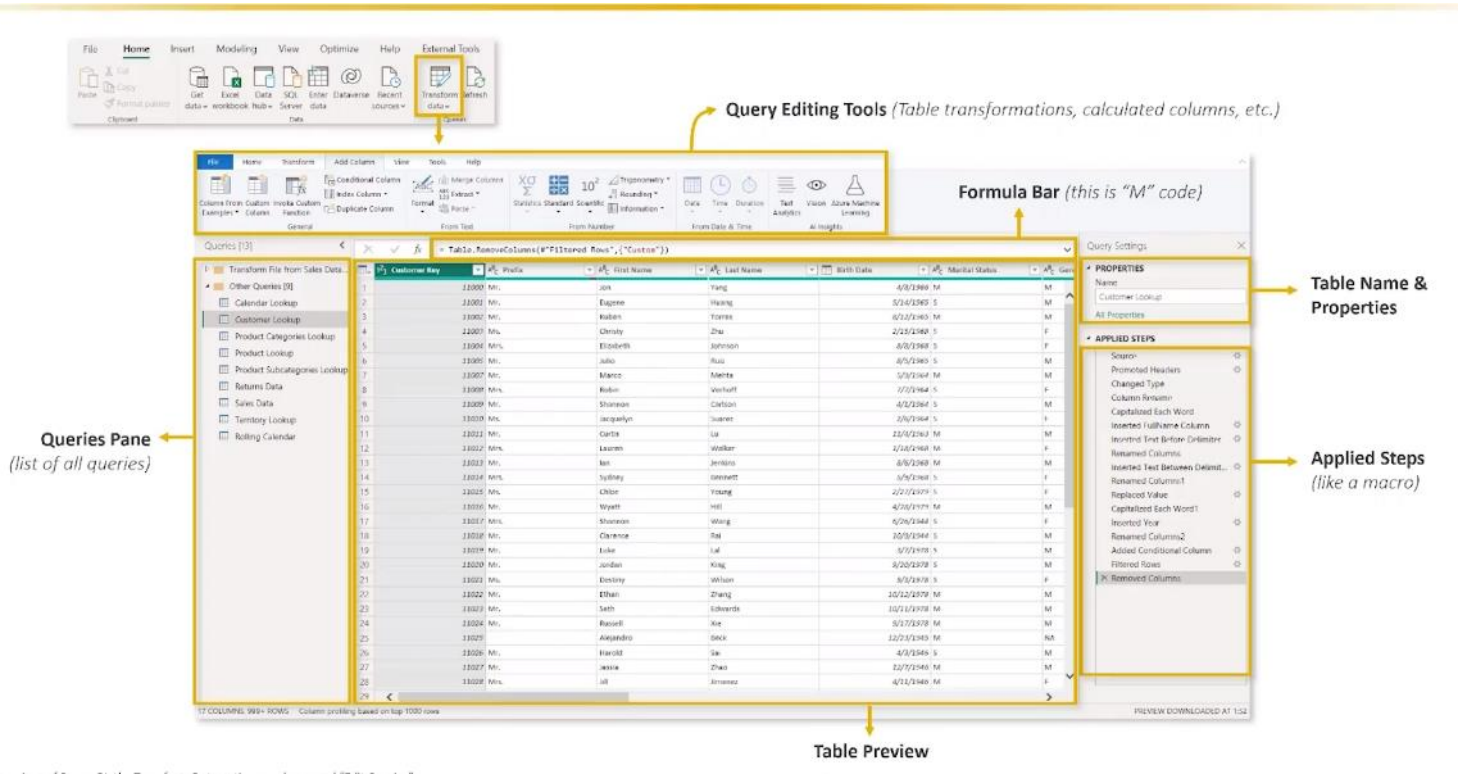
- **ETL** (Extract, Transform, Load) activities by using **Power Query Editor**. I uploaded the dataset and transformed the data (i.e. data cleaning).
- Created a **Relational Data Model** (by connecting **relationships** between several tables from different data sources).
- Used **DAX** for data analysis by creating **Calculated Columns** and **Measures.**
- Created **interactive Dashboards** in order to visualize the data.

POWER QUERY EDITOR

The tools I used and the tasks I performed in the Power Query Editor are as follows:

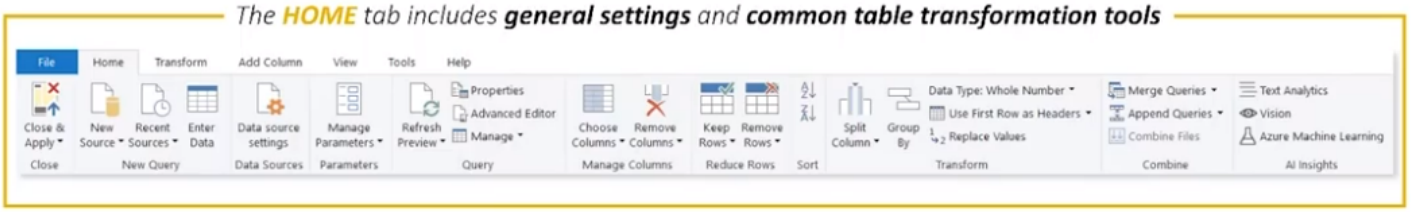
- Connected to the data source and **imported the dataset** consisting of several CSV files

- **Transfromed** the Data and performed the **ETL process**
- Changed the **Data Type** of some columns
- Created new columns and updated existing columns of data by using **Text Tools.** For example
  - **Splitting the text** in a column into separate new columns based on a delimiter.
  - Formating the text in a column to be all **uppercase** or **lowercase** or **capitalize** each word
  - Using **TRIM() function** to eliminate leading spaces or trailing spaces in text
  - **Extracting characters** from text based on delimiters or other criteria
  - **Merge** several text columns into a single column
- Used **Statistics Number Tools** to explore columns with numeric data.
- Used **Rounding Tools** to round the values in a number column
- Applied **Standard Number Tools** to do operations like Multiply, Divide, Subtract, Add and Percentage.
- Created a **Calendar Table** from a single column of dates by using **Date & Time Tools**. For example creating columns for Year, Month number, Month name, Day name, Quarter
- Created **Conditional Columns** based on IF – THEN Test conditions
- Created **Calculated Columns**
- Applied **Group By** to summarise data in tables.
- Used **Append Files From Folder** in order to consolidate and append several data tables. This can also used to **Automate** the consolidation process.

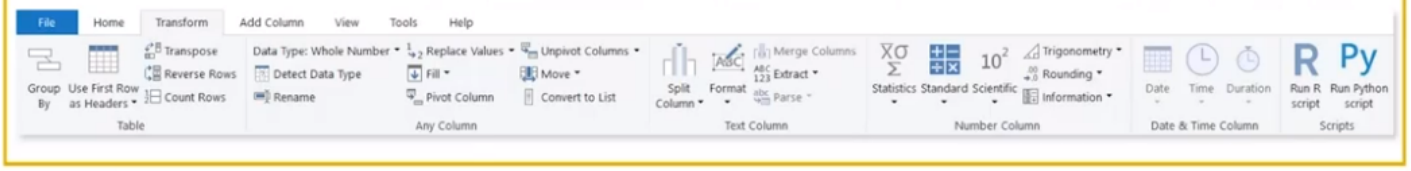


QUERY EDITING TOOLS

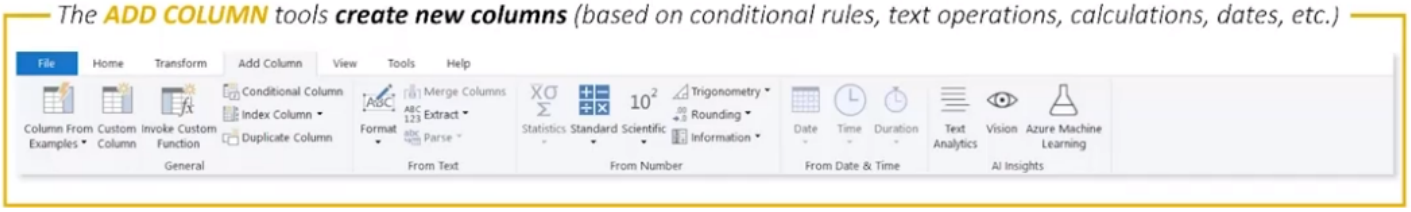
*The **HOME** tab includes **general settings** and **common table transformation tools***

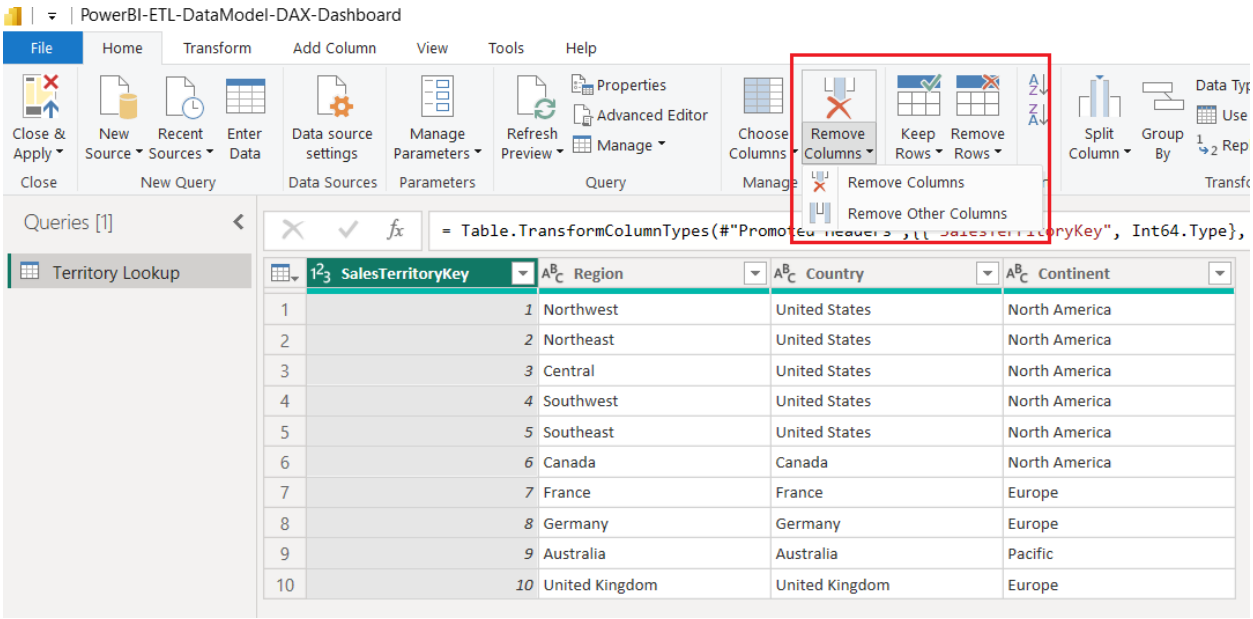


*The **TRANSFORM** tab includes tools to **modify existing columns** (splitting/grouping, transposing, extracting text, etc.)*



*The **ADD COLUMN** tools **create new columns** (based on conditional rules, text operations, calculations, dates, etc.)*





	SalesTerritoryKey	Region	Country	Continent
1	1	Northwest	United States	North America
2	2	Northeast	United States	North America
3	3	Central	United States	North America
4	4	Southwest	United States	North America
5	5	Southeast	United States	North America
6	6	Canada	Canada	North America
7	7	France	France	Europe
8	8	Germany	Germany	Europe
9	9	Australia	Australia	Pacific
10	10	United Kingdom	United Kingdom	Europe

DATA MODEL

Data Modelling in Power BI can be defined as saving data from different data sources into tables (Data Tables and Lookup Tables) and then creating relationships between those tables. The **relationships** form connections between the tables based on a common field column (which are called **Primary Keys** and **Foreign Keys**).

The **advantages of using a data model** for data analysis are:

- we can upload **large datasets for millions of rows** into a data model
- data models can use tables from **various different data sources (for example the web, pdf, SQL)** which can be combined to enable better data analysis
- we can define **custom hierarchies** in the data model which enable us to drill down into the fine detailed data in the Power BI charts and visualizations. For example a **Date Hierarchy** enables us to drill down to visualize a chart by year, quarter, month or day.

There are two types of tables in the data model. The **Lookup Tables** contain text to describe the data. For example Table Customer_Lookup contains data about the customer's occupation, education level and income level. The Lookup Tables contain **Primary Keys**.

The **Data Tables** contain quantitative values. For example Table Sales Data contains data about the order quantity sold. The Data Tables contain **Foreign Keys**.

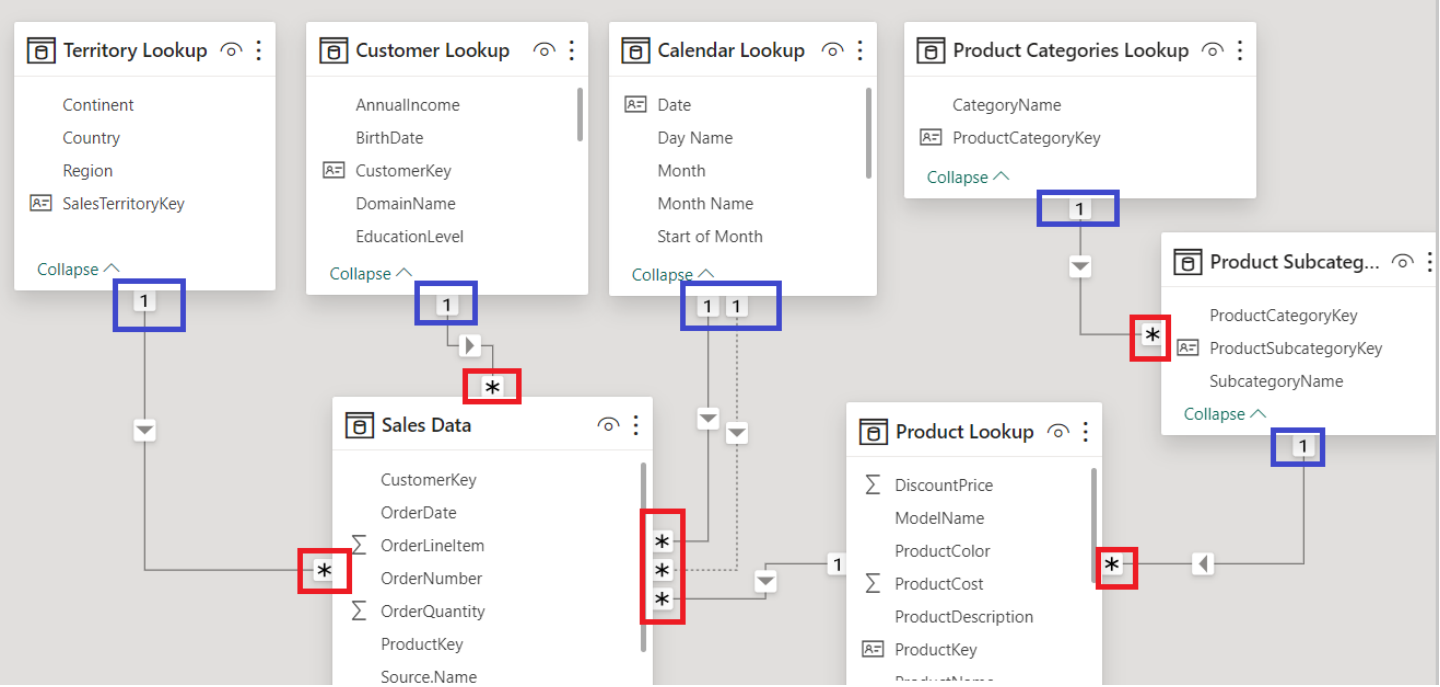
I created a **Normalized database** for my data model, which means each table should serve a specific purpose. For example the table customer_lookup contains data only about customers (their name, occupation, education level), the table product_lookup contains data only about products (the product colour, product cost) and the table Sales Data contains data only about sales (order quantity, order date)

In my data model I used only the **One-To-Many cardinality** to create relationships between the Lookup Tables and Data Tables.

The advantage of using a Data Model in Power BI is that this enables us to use **multiple separate tables in a single data visualization or for data analysis**. If we did not use a Data Model then we must consolidate multiple tables into a single large table by using formulas like VLookup. This is time consuming, inefficient and prone to errors.

Another advantage of using a Data Model in Power BI is that this enables us to create multiple tables from **various different data sources**. For example data from websites, PDF files, SQL Server or CSV files.

The Data Model I created for this project was based on a **Snowflake Schema** (as shown below).



DAX

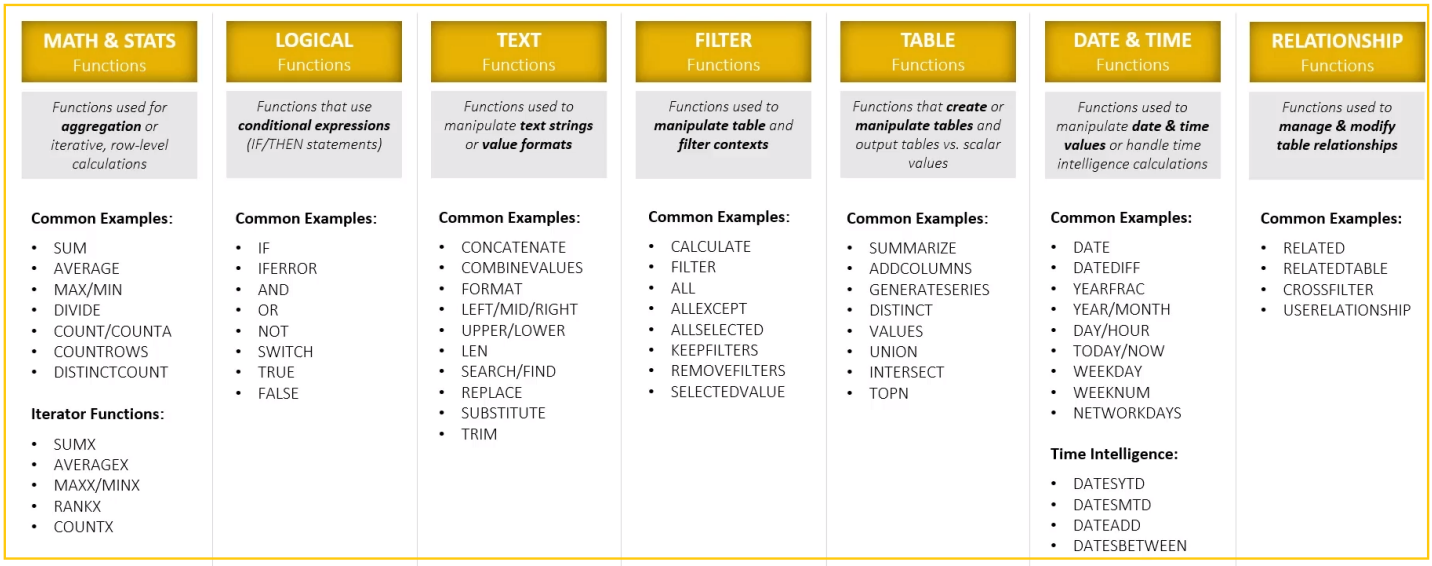
DAX stands for **Data Analysis Expressions** and is the formula language used to create metrics which are included in the Data Model. DAX enables us to perform **deeper data analysis**.

The DAX functions are used to create **Calculated Columns** in tables of the Data Model, and **Measures** in the Power BI visuals (suach as a chart or matrix). The Calculated Columns are used to filter data whereas Measures are used to aggregate data values (for example SUM, COUNT, AVERAGE).

The DAX functions work with relational databababases and enable us to create complicated metrics which simple formulas are not able to achieve. DAX can be used to nest several Measures to create powerful **Measure Trees**.

Some of the **DAX functions** I used for my project are shown in the table below. These include:

- Time Intelligence Functions - DATESYTD( ), DATESMTD( ), DATEDIFF( )
- Iterator Functions - SUMX( ), COUNTX( ), RANKX( )
- Filter Functions - CALCULATE( ), FILTER( ), ALL( ), DISTINCT( )
- Relationship Functions - RELATED( )
- Table Functions - DISTINCT( )
- Logical Functions - IF( ), NOT( ), AND( ), OR( )
- Statistical Functions - SUM( ), COUNT( ), DISTINCTCOUNT( ), COUNTROWS( )
- Text Functions - CONCATENATE( ), LEFT/RIGHT( ), UPPER/LOWER( ), REPLACE( )
- Date & Time Functions - DATEDIFF( ), YEAR/MONTH/DAY( ), WEEKDAY/WEEKNUM( )



MATH & STATS Functions

*Functions used for **aggregation** or iterative, row-level calculations*

Common Examples:

- SUM
- AVERAGE
- MAX/MIN
- DIVIDE
- COUNT/COUNTA
- COUNTROWS
- DISTINCTCOUNT

Iterator Functions:

- SUMX
- AVERAGEX
- MAXX/MINX
- RANKX
- COUNTX

LOGICAL Functions

*Functions that use **conditional expressions** (IF/THEN statements)*

Common Examples:

- IF
- IFERROR
- AND
- OR
- NOT
- SWITCH
- TRUE
- FALSE

TEXT Functions

*Functions used to manipulate **text strings** or **value formats***

Common Examples:

- CONCATENATE
- COMBINEVALUES
- FORMAT
- LEFT/MID/RIGHT
- UPPER/LOWER
- LEN
- SEARCH/FIND
- REPLACE
- SUBSTITUTE
- TRIM

FILTER Functions

*Functions used to **manipulate table** and **filter contexts***

Common Examples:

- CALCULATE
- FILTER
- ALL
- ALLEXCEPT
- ALLSELECTED
- KEEPFILTERS
- REMOVEFILTERS
- SELECTEDVALUE

TABLE Functions

*Functions that **create** or **manipulate tables** and output tables vs. scalar values*

Common Examples:

- SUMMARIZE
- ADDCOLUMNS
- GENERATESERIES
- DISTINCT
- VALUES
- UNION
- INTERSECT
- TOPN

DATE & TIME Functions

*Functions used to manipulate **date & time values** or handle time intelligence calculations*

Common Examples:

- DATE
- DATEDIFF
- YEARFRAC
- YEAR/MONTH
- DAY/HOUR
- TODAY/NOW
- WEEKDAY
- WEEKNUM
- NETWORKDAYS

Time Intelligence:

- DATESYTD
- DATESMTD
- DATEADD
- DATESBETWEEN

RELATIONSHIP Functions

*Functions used to **manage & modify table relationships***

Common Examples:

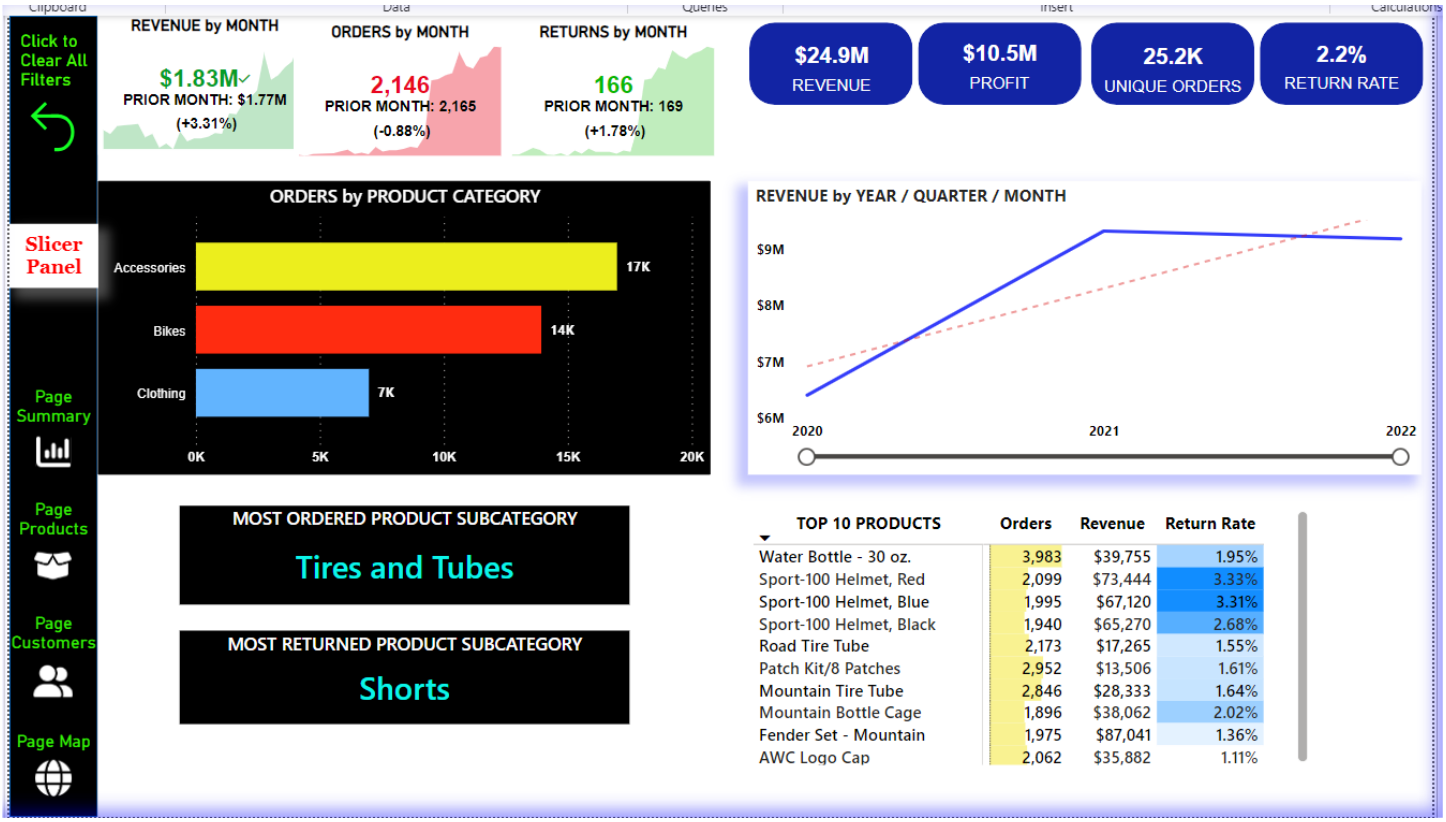
- RELATED
- RELATEDTABLE
- CROSSFILTER
- USERELATIONSHIP

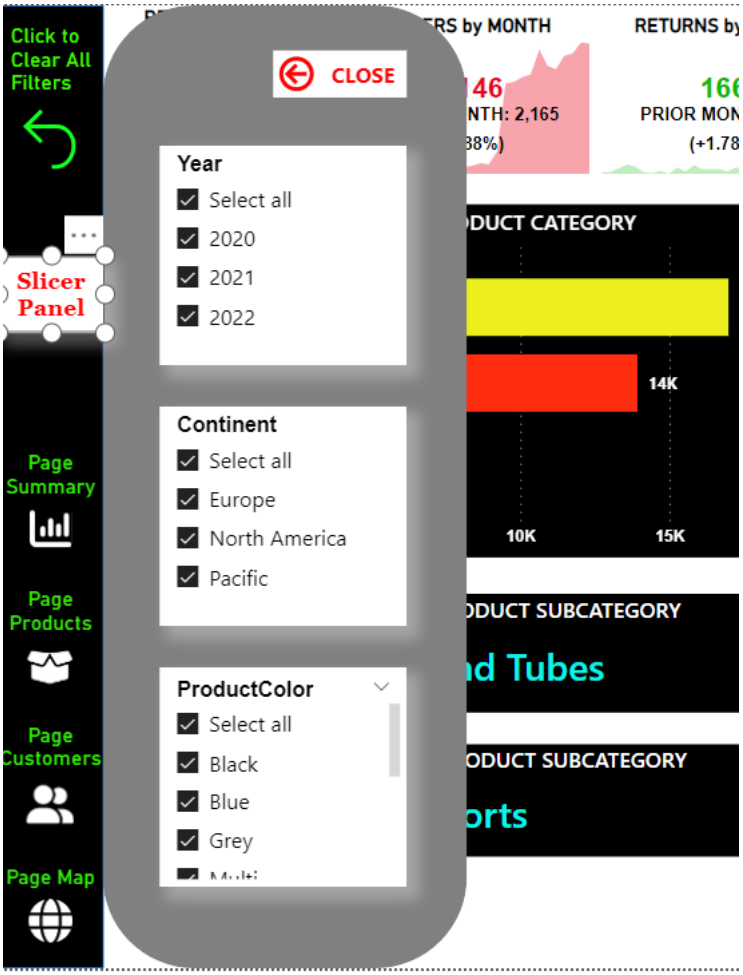
DASHBOARD

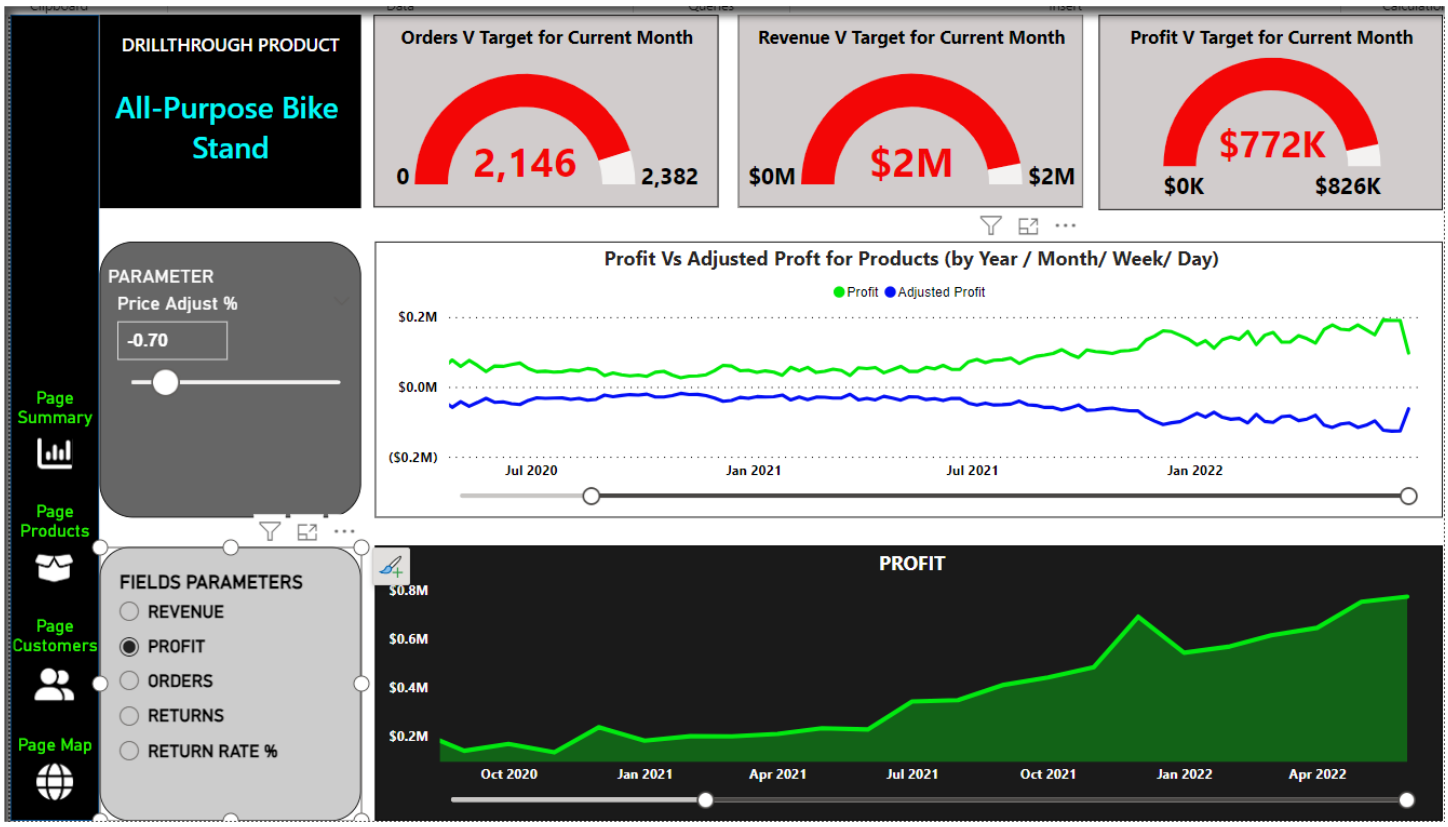
I created an interactive **Dashboard** to enable data visualization. This dashboard includes the tab **"Summary"**, tab **"Product Details Drillthrough"**, tab "**Customer Details"**, and tab **"Map.**

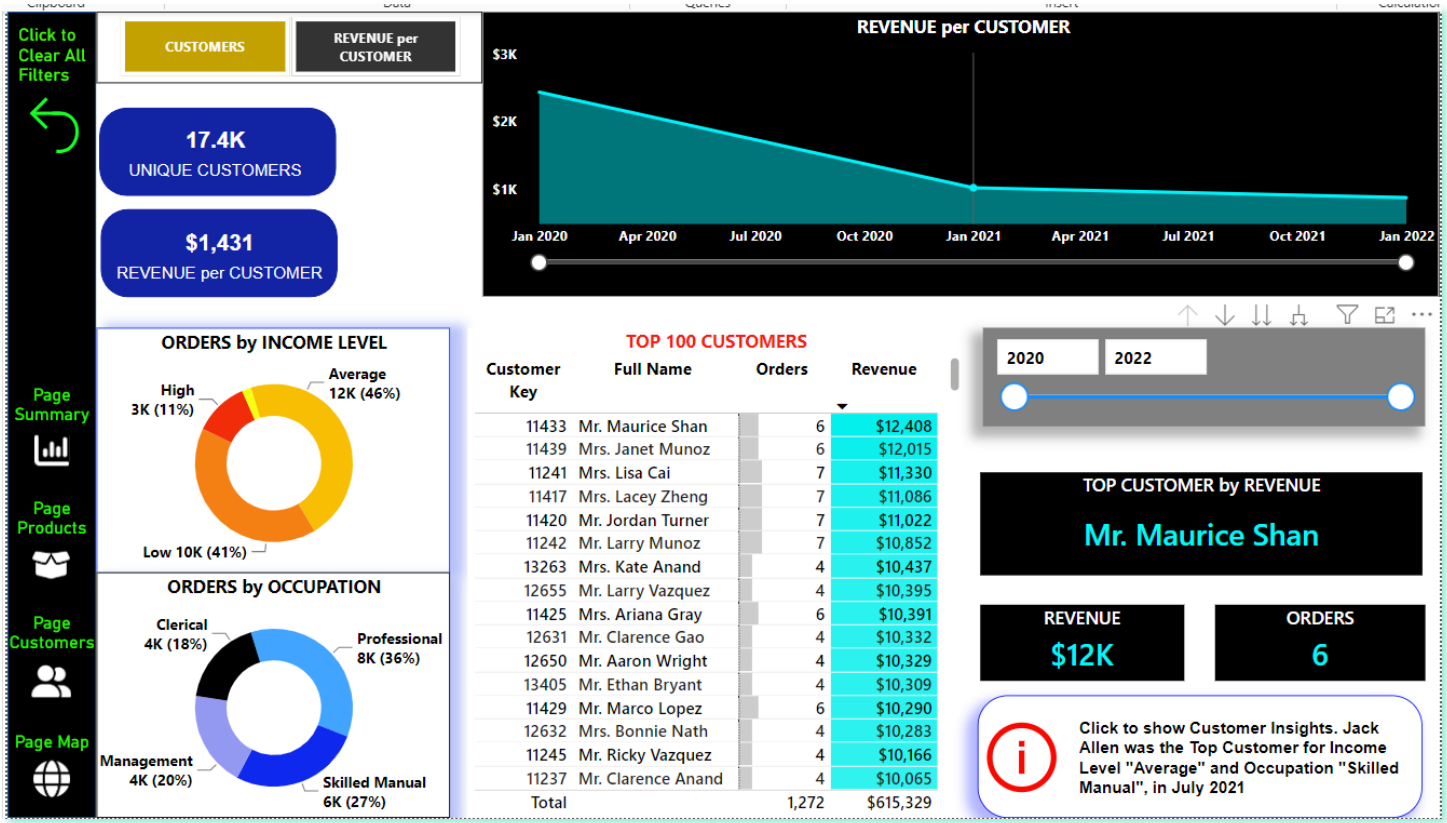
The data visualizations I created are as follows:

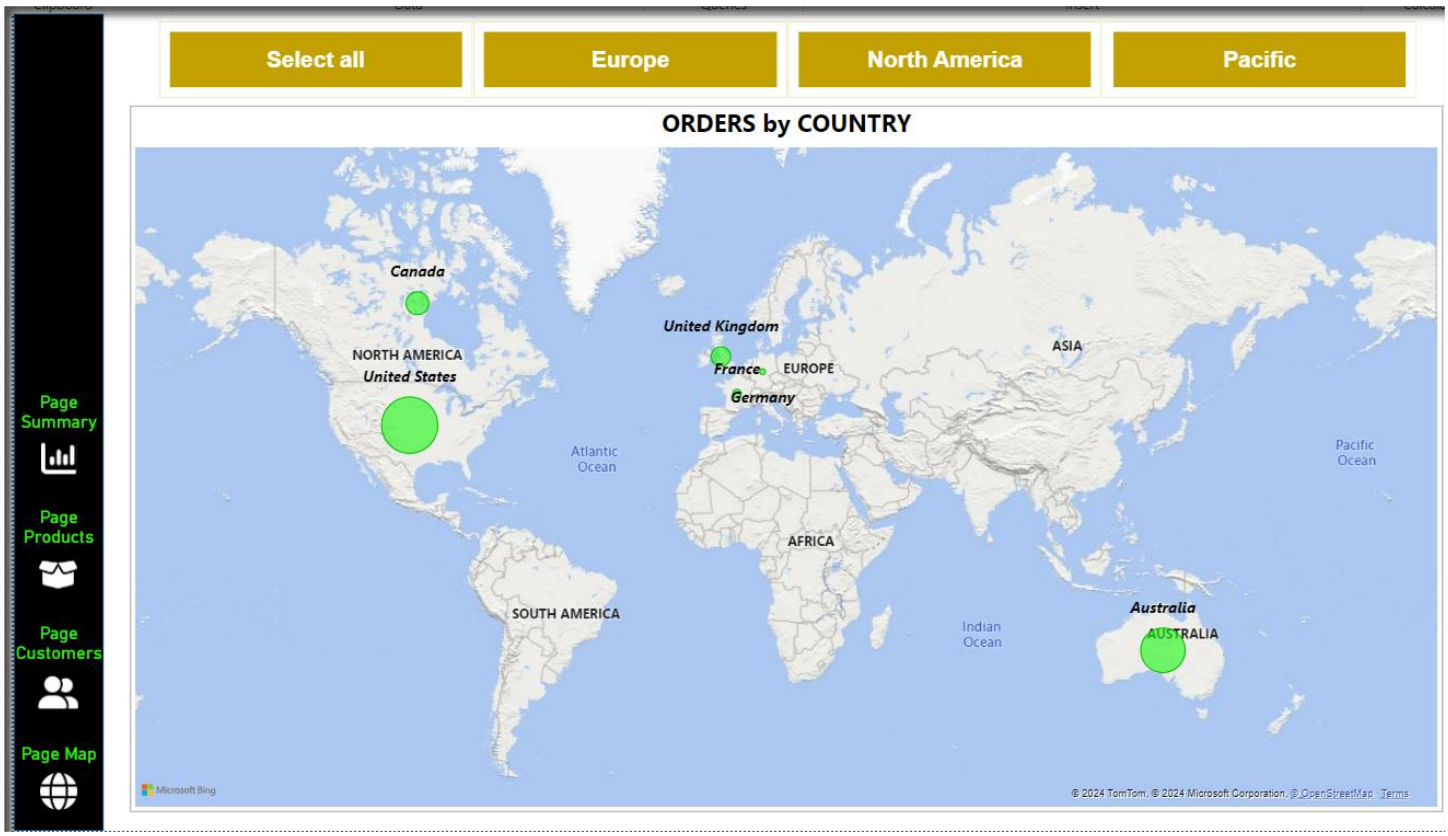
- **KPI Cards** for Revenue, Orders and Returns comparing current month values to the Target prior month values.
- **Maps** to display sales orders by country, as well as **Custom Tooltips** which are dynamic
- **Numeric Range Parameters** and **Fields Parameters** to enable users to interact dynamically with charts on a dashboard
- Applied various **Filters, Drills** and **Slicers** to the charts including the following:
  - **Slicers** which are visual filters displayed on the dashboard such as buttons or sliders
  - **Drill Down / Drill Up** is used to show data at different levels of granularity
  - **Drill Through** is enabled so we can click on a product name in the Matrix on page Tab "Summary" and this will then move us to the page Tab "Product Details which has been filtered for that specific chosen product name
  - **Visual Level Filters, Page Level Filters** and **Report Level Filters**
  - **Cross Filters between Charts** using "Edit Report Interactions"
- Created a **Slicer Panel** attached to a **Bookmark**
- **Matrix** to show detailed data in a table format with the ability to Drill Down or Drill Up. **Conditional Formatting** such as Data Bars is used to highlight Trends in the data.
- **Gauge Charts** to show the Actual profit in comparison to the Target profit for prior month
- **Donut Chart** to display the percentage of a whole, for example Sales Orders by Customer Income Level
- **Line Chart** showing trends in Revenue by year with the ability to drill down by quarter or month
- **Line Chart with a Date Slider** showing Revenue per Customer by quarter over 2020 and 2021
- **Horizontal Bar Chart** for Sales Orders by the Product Categories (bikes, clothing, accessories)


Click to Clear All Filters
REVENUE by MONTH
$1.83M
PRIOR MONTH: $1.77M
(+3.31%)
ORDERS by MONTH
2,146
PRIOR MONTH: 2,165
(-0.88%)
RETURNS by MONTH
166
PRIOR MONTH: 169
(+1.78%)
$24.9M
REVENUE
$10.5M
PROFIT
25.2K
UNIQUE ORDERS
2.2%
RETURN RATE
Slicer Panel
ORDERS by PRODUCT CATEGORY
Accessories
17K
Bikes
14K
Clothing
7K
0K
5K
10K
15K
20K
REVENUE by YEAR / QUARTER / MONTH
$9M
$8M
$7M
$6M
2020
2021
2022
Page Summary
Page Products
Page Customers
Page Map
MOST ORDERED PRODUCT SUBCATEGORY
Tires and Tubes
MOST RETURNED PRODUCT SUBCATEGORY
Shorts
TOP 10 PRODUCTS
Orders
Revenue
Return Rate
Water Bottle - 30 oz. 3,983 $39,755 1.95%
Sport-100 Helmet, Red 2,099 $73,444 3.33%
Sport-100 Helmet, Blue 1,995 $67,120 3.31%
Sport-100 Helmet, Black 1,940 $65,270 2.68%
Road Tire Tube 2,173 $17,265 1.55%
Patch Kit/8 Patches 2,952 $13,506 1.61%
Mountain Tire Tube 2,846 $28,333 1.64%
Mountain Bottle Cage 1,896 $38,062 2.02%
Fender Set - Mountain 1,975 $87,041 1.36%
AWC Logo Cap 2,062 $35,882 1.11%


Click to Clear All Filters
CLOSE
Year
Select all
2020
2021
2022
Slicer Panel
Continent
Select all
Europe
North America
Pacific
ProductColor
Select all
Black
Blue
Grey
14K
10K
15K
Page Summary
Page Products
Page Customers
Page Map


DRILLTHROUGH PRODUCT
All-Purpose Bike Stand
Orders V Target for Current Month
0
2,146
2,382
Revenue V Target for Current Month
$0M
$2M
$2M
Profit V Target for Current Month
$772K
$0K
$826K
PARAMETER
Price Adjust %
-0.70
Profit Vs Adjusted Proft for Products (by Year / Month/ Week/ Day)
Profit
Adjusted Profit
$0.2M
$0.0M
($0.2M)
Jul 2020
Jan 2021
Jul 2021
Jan 2022
Page Summary
Page Products
Page Customers
Page Map
FIELDS PARAMETERS
REVENUE
PROFIT
ORDERS
RETURNS
RETURN RATE %
PROFIT
$0.8M
$0.6M
$0.4M
$0.2M
Oct 2020
Jan 2021
Apr 2021
Jul 2021
Oct 2021
Jan 2022
Apr 2022


Click to Clear All Filters
CUSTOMERS
REVENUE per CUSTOMER
17.4K
UNIQUE CUSTOMERS
$1,431
REVENUE per CUSTOMER
REVENUE per CUSTOMER
$3K
$2K
$1K
Jan 2020
Apr 2020
Jul 2020
Oct 2020
Jan 2021
Apr 2021
Jul 2021
Oct 2021
Jan 2022
ORDERS by INCOME LEVEL
High 3K (11%)
Average 12K (46%)
Low 10K (41%)
ORDERS by OCCUPATION
Clerical 4K (18%)
Professional 8K (36%)
Management 4K (20%)
Skilled Manual 6K (27%)
TOP 100 CUSTOMERS
Customer Key
Full Name
Orders
Revenue
11433 Mr. Maurice Shan 6 $12,408
11439 Mrs. Janet Munoz 6 $12,015
11241 Mrs. Lisa Cai 7 $11,330
11417 Mrs. Lacey Zheng 7 $11,086
11420 Mr. Jordan Turner 7 $11,022
11242 Mr. Larry Munoz 7 $10,852
13263 Mrs. Kate Anand 4 $10,437
12655 Mr. Larry Vazquez 4 $10,395
11425 Mrs. Ariana Gray 6 $10,391
12631 Mr. Clarence Gao 4 $10,332
12650 Mr. Aaron Wright 4 $10,329
13405 Mr. Ethan Bryant 4 $10,309
11429 Mr. Marco Lopez 6 $10,290
12632 Mrs. Bonnie Nath 4 $10,283
11245 Mr. Ricky Vazquez 4 $10,166
11237 Mr. Clarence Anand 4 $10,065
Total 1,272 $615,329
2020
2022
TOP CUSTOMER by REVENUE
Mr. Maurice Shan
REVENUE
$12K
ORDERS
6
Click to show Customer Insights. Jack Allen was the Top Customer for Income Level "Average" and Occupation "Skilled Manual", in July 2021
Page Summary
Page Products
Page Customers
Page Map


Select all
Europe
North America
Pacific
ORDERS by COUNTRY
Canada
NORTH AMERICA
United States
United Kingdom
France
EUROPE
Germany
ASIA
Atlantic Ocean
Pacific Ocean
AFRICA
SOUTH AMERICA
Indian Ocean
Australia
AUSTRALIA
Page Summary
Page Products
Page Customers
Page Map
Microsoft Bing
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