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# ***POWER BI***

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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](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.

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## ***POWER QUERY EDITOR***

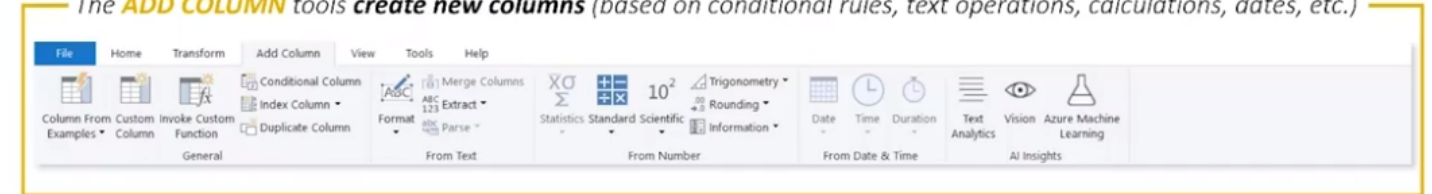
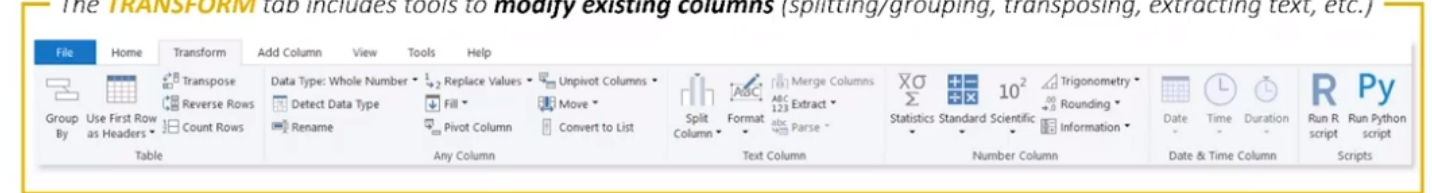
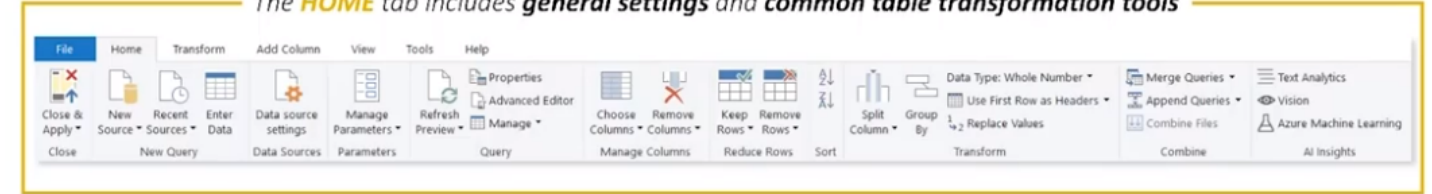
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The tools I used and the tasks I performed in the Power Query Editor are as follows:

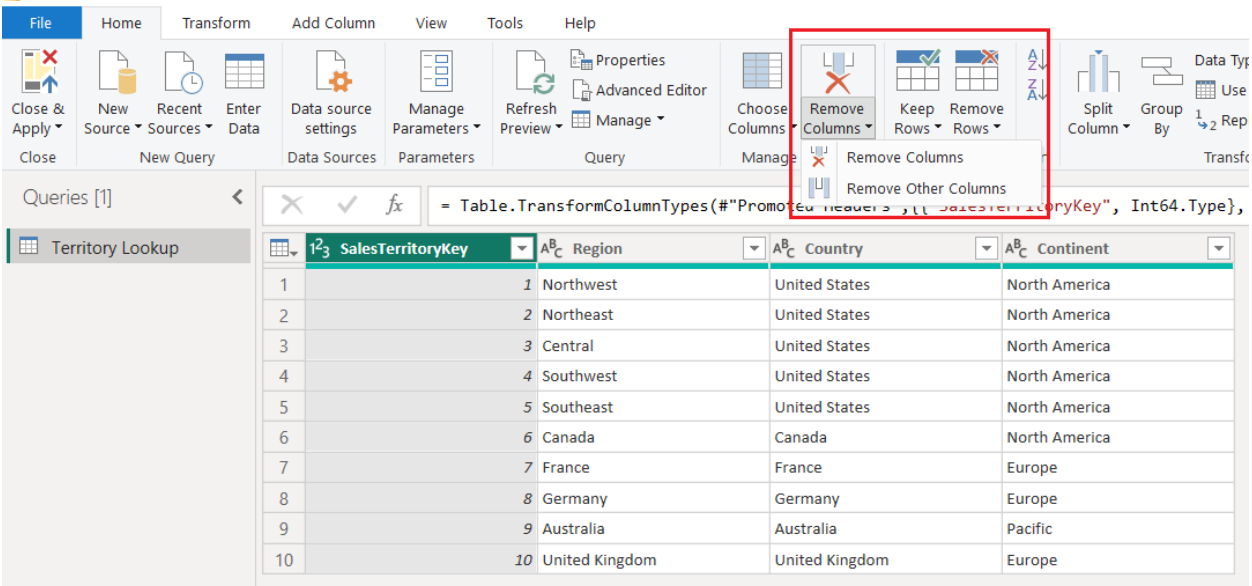
- ❖ Connected to the data source and **imported the dataset** consisting of several CSV files

- ❖ **Transformed** 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.
  - Formatting 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 be used to **Automate** the consolidation process.

The screenshot displays the Microsoft Power Query Editor interface. At the top, the ribbon includes tabs for File, Home, Insert, Modeling, View, Optimize, and Help. The 'External Tools' pane is visible on the right side of the ribbon. Below the ribbon, the 'Query Editing Tools' section contains various transformation and calculation options, with a note indicating these are for 'Table transformations, calculated columns, etc.'. The 'Formula Bar' is labeled as containing 'M' code. On the left, the 'Queries Pane' lists all queries, including 'Customer Lookup'. The main area shows a 'Table Preview' of a data table with columns: Customer Key, Profile, First Name, Last Name, Birth Date, and Marital Status. The 'Table Name & Properties' pane on the right shows the selected query's name and properties. The 'Applied Steps' pane on the right lists the sequence of transformations applied to the data, such as 'Promoted Headers', 'Changed Type', 'Column Reorder', 'Capitalized Each Word', 'Inserted Full Name Column', 'Inserted Text Before Column', 'Renamed Columns', 'Inserted Text Between Columns', 'Renamed Column1', 'Capitalized Each Word1', 'Inserted Year', 'Renamed Column2', 'Added Conditional Columns', 'Filtered Rows', and 'Removed Columns'.



PowerBI-ETL-DataModel-DAX-Dashboard



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# DATA MODEL

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**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**.

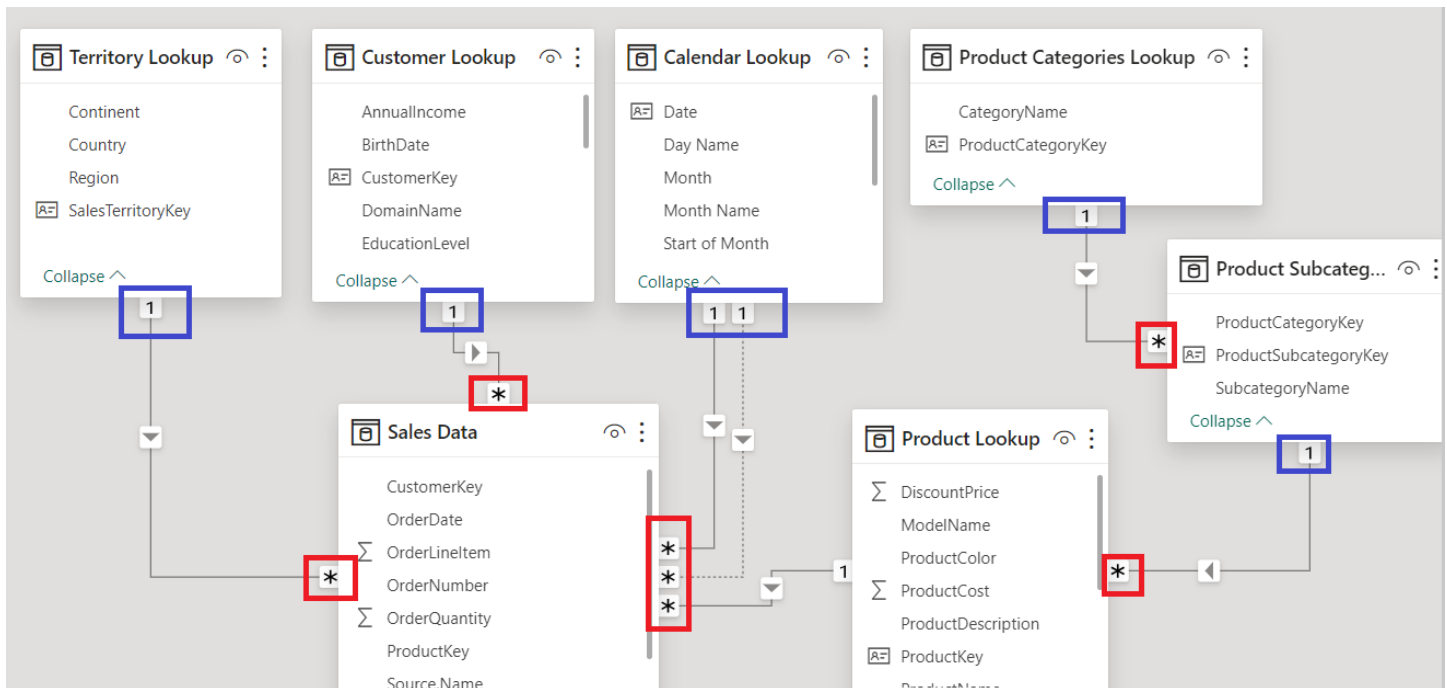
I created a **Normalized database** for my data model, which means each table should serve a specific purpose. For example the table customer\_lookup contains data only about customers (their name, occupation, education level), the table product\_lookup contains data only about products (the product 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).



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## DAX

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**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 (such 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 datababases 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	LOGICAL Functions	TEXT Functions	FILTER Functions	TABLE Functions	DATE & TIME Functions	RELATIONSHIP Functions
Functions used for <b>aggregation</b> or <b>iterative, row-level</b> calculations	Functions that use <b>conditional expressions</b> (IF/THEN statements)	Functions used to <b>manipulate text strings</b> or <b>value formats</b>	Functions used to <b>manipulate table</b> and <b>filter contexts</b>	Functions that <b>create</b> or <b>manipulate tables</b> and <b>output tables</b> vs. <b>scalar values</b>	Functions used to <b>manipulate date &amp; time values</b> or handle <b>time intelligence</b> calculations	Functions used to <b>manage &amp; modify table relationships</b>
<b>Common Examples:</b> <ul style="list-style-type: none"> <li>SUM</li> <li>AVERAGE</li> <li>MAX/MIN</li> <li>DIVIDE</li> <li>COUNT/COUNTA</li> <li>COUNTROWS</li> <li>DISTINCTCOUNT</li> </ul> <b>Iterator Functions:</b> <ul style="list-style-type: none"> <li>SUMX</li> <li>AVERAGEX</li> <li>MAXX/MINX</li> <li>RANKX</li> <li>COUNTX</li> </ul>	<b>Common Examples:</b> <ul style="list-style-type: none"> <li>IF</li> <li>IFERROR</li> <li>AND</li> <li>OR</li> <li>NOT</li> <li>SWITCH</li> <li>TRUE</li> <li>FALSE</li> </ul>	<b>Common Examples:</b> <ul style="list-style-type: none"> <li>CONCATENATE</li> <li>COMBINEVALUES</li> <li>FORMAT</li> <li>LEFT/MID/RIGHT</li> <li>UPPER/LOWER</li> <li>LEN</li> <li>SEARCH/FIND</li> <li>REPLACE</li> <li>SUBSTITUTE</li> <li>TRIM</li> </ul>	<b>Common Examples:</b> <ul style="list-style-type: none"> <li>CALCULATE</li> <li>FILTER</li> <li>ALL</li> <li>ALLEXCEPT</li> <li>ALLSELECTED</li> <li>KEEPFILTERS</li> <li>REMOVEFILTERS</li> <li>SELECTEDVALUE</li> </ul>	<b>Common Examples:</b> <ul style="list-style-type: none"> <li>SUMMARIZE</li> <li>ADDCOLUMNS</li> <li>GENERATESERIES</li> <li>DISTINCT</li> <li>VALUES</li> <li>UNION</li> <li>INTERSECT</li> <li>TOPN</li> </ul>	<b>Common Examples:</b> <ul style="list-style-type: none"> <li>DATE</li> <li>DATEDIFF</li> <li>YEARFRAC</li> <li>YEAR/MONTH</li> <li>DAY/HOUR</li> <li>TODAY/NOW</li> <li>WEEKDAY</li> <li>WEEKNUM</li> <li>NETWORKDAYS</li> </ul> <b>Time Intelligence:</b> <ul style="list-style-type: none"> <li>DATESYTD</li> <li>DATESMTD</li> <li>DATEADD</li> <li>DATESBETWEEN</li> </ul>	<b>Common Examples:</b> <ul style="list-style-type: none"> <li>RELATED</li> <li>RELATEDTABLE</li> <li>CROSSFILTER</li> <li>USERELATIONSHIP</li> </ul>

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# DASHBOARD

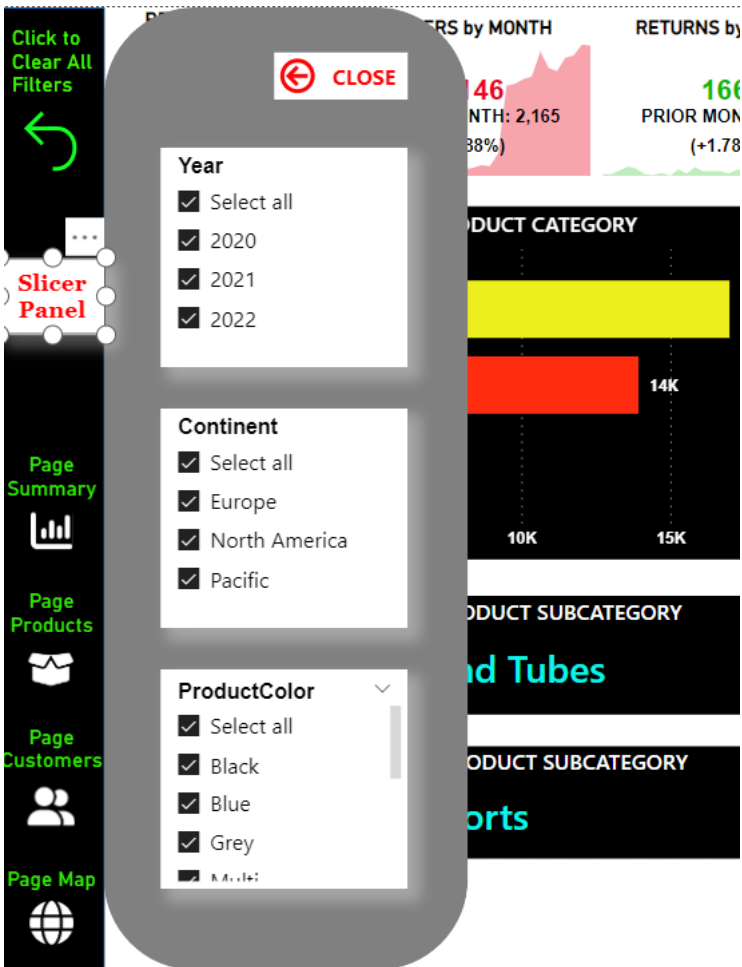
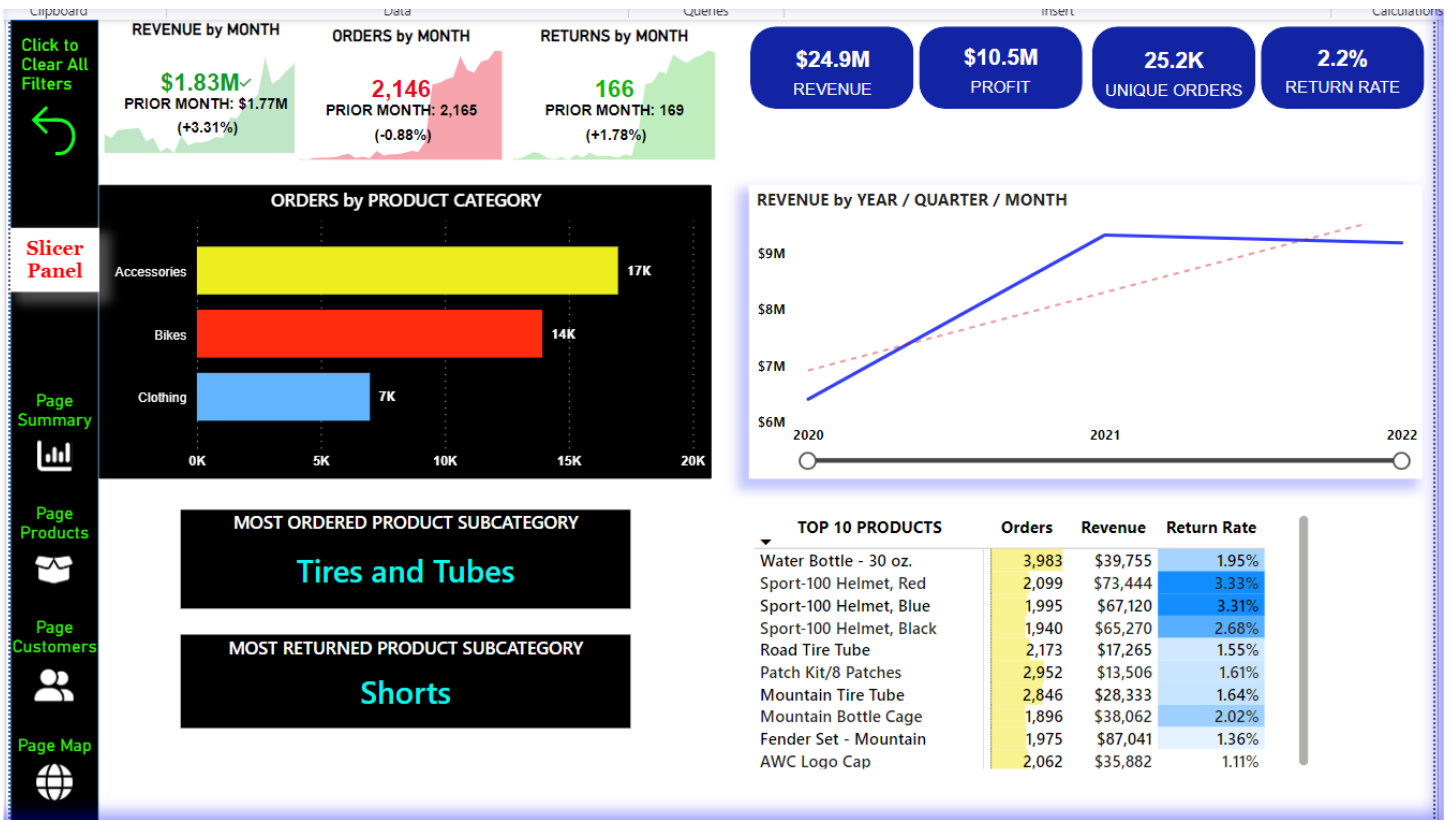
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I created an interactive **Dashboard** to enable data visualization. This dashboard includes the tab “**Summary**”, tab “**Product Details Drillthrough**”, tab “**Customer Details**”, and tab “**Map**”.

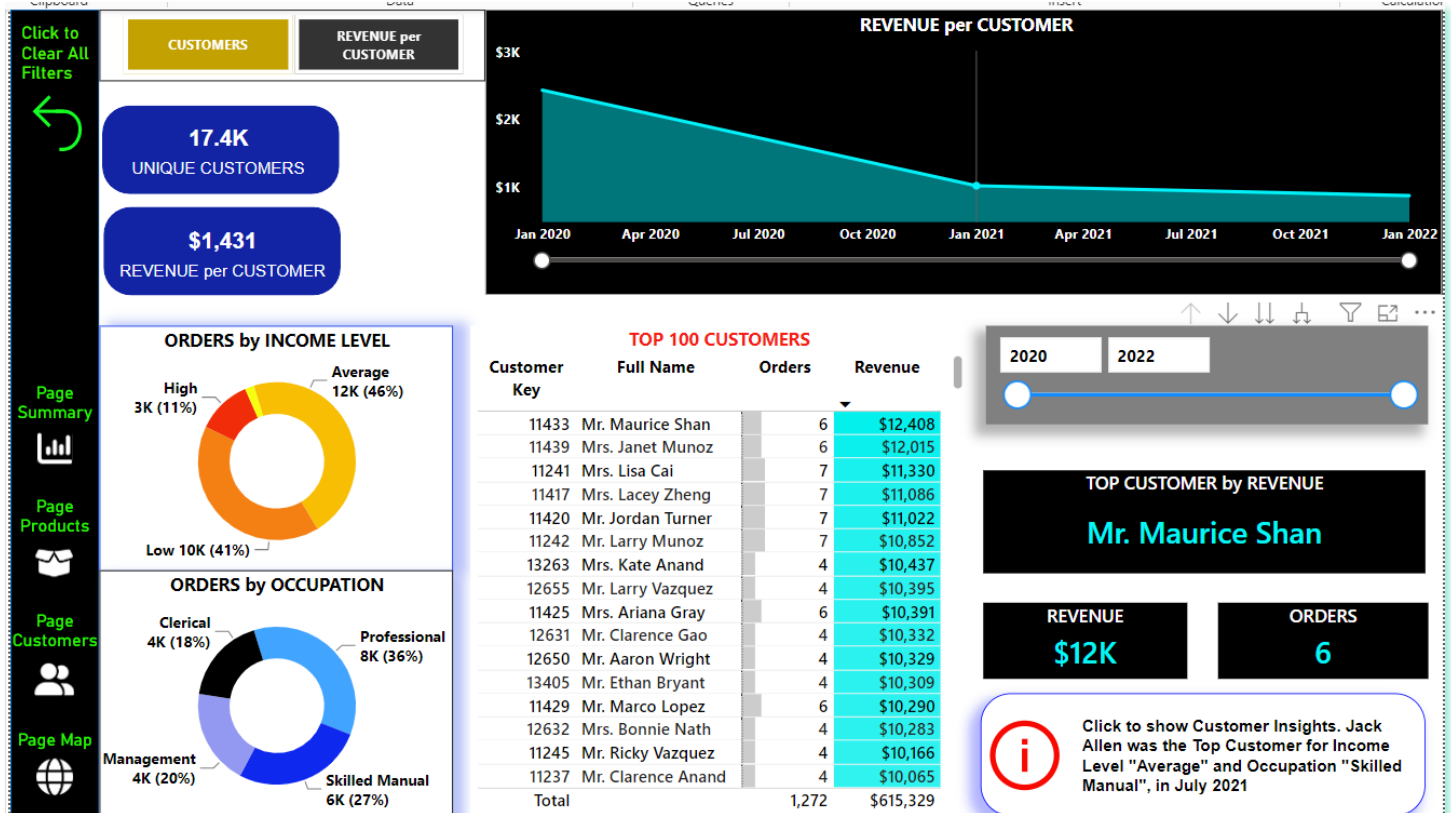
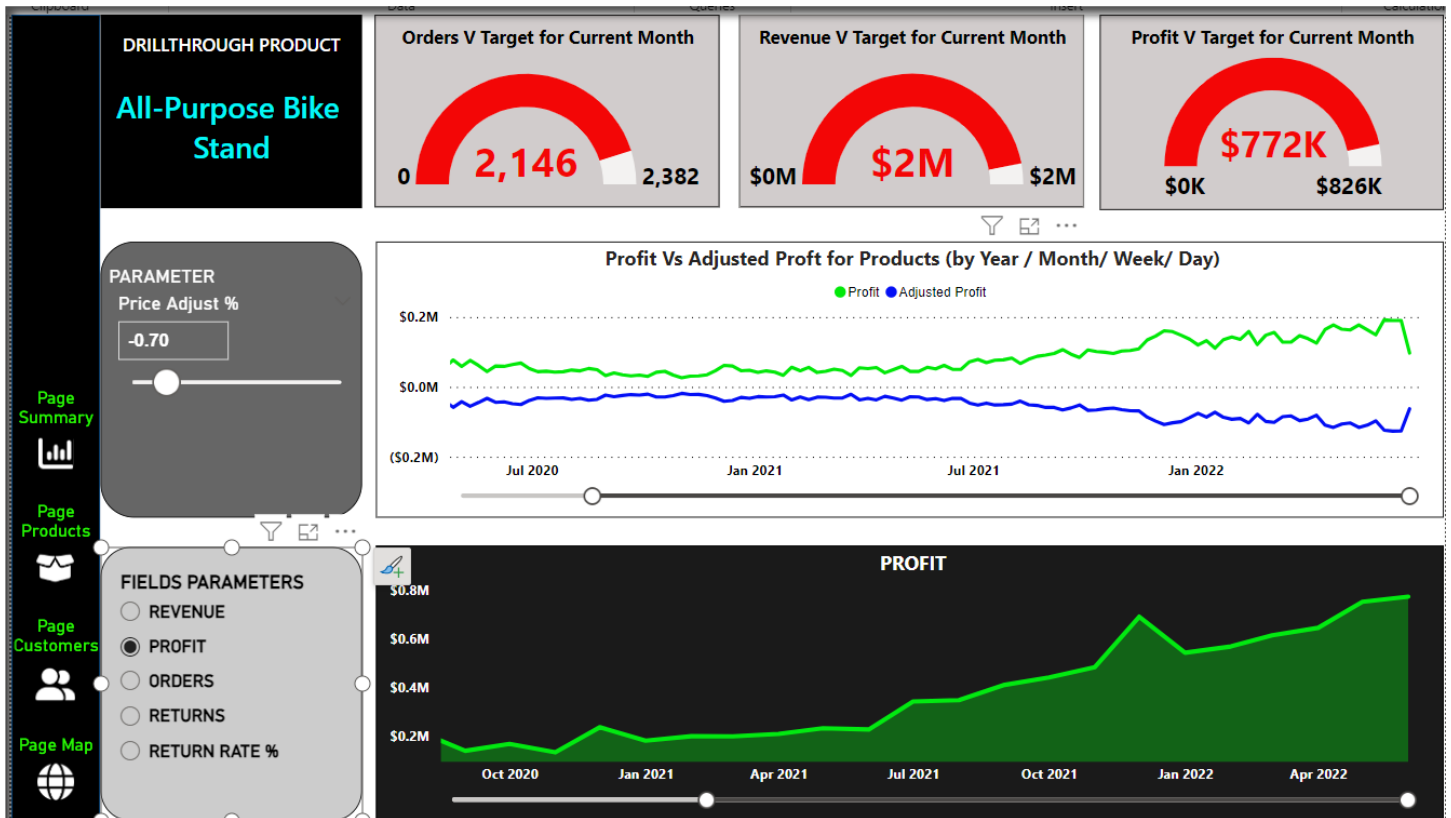
The data visualizations I created are as follows:

- ❖ **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)









Select all

Europe

North America

Pacific

ORDERS by COUNTRY



Page Summary



Page Products



Page Customers



Page Map



Microsoft Bing

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