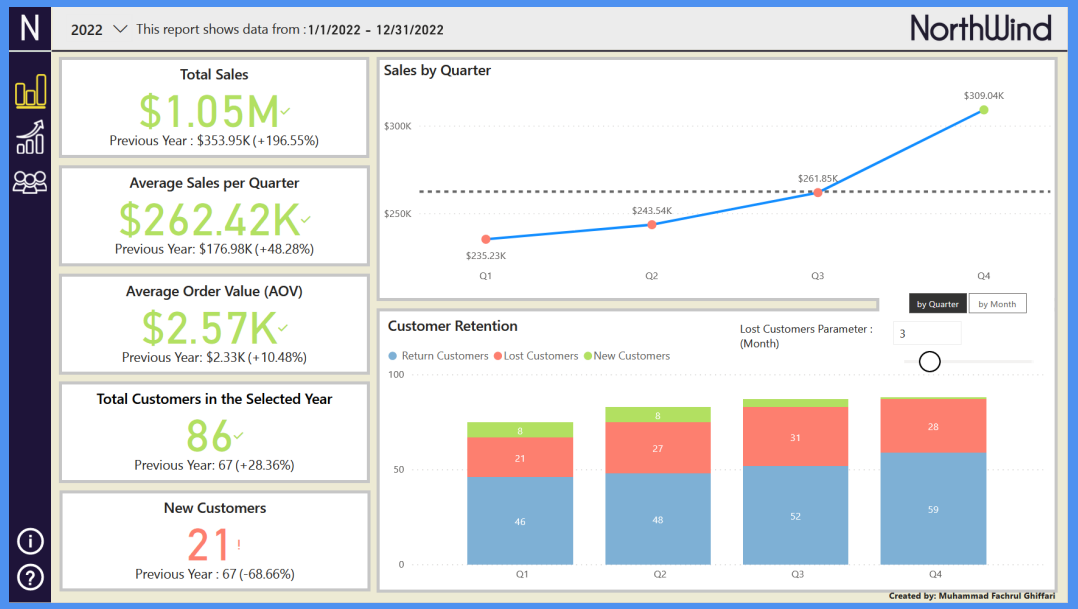

Northwind Dashboard

Muhammad Fachrul Ghiffari

• PowerBI • SQL • DAX • Python

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Content

1

Introduction

About Northwind

Northwind database is a sample relational database created by Microsoft. Northwind is a **fictional company that acts as a food supplier to retailers around the world.**

Northwind database contains tables and relationships that represent the different aspects of this business. This database is very important for the development of the company. For example, **data can help companies** to see **how the business is performing**, make **decisions based on facts**, **see patterns** that are happening, and **explore market opportunities**.

But can data that is still in the form of a database be used for these things?

Note: To make this project more interesting we changed the year in this database from 1997-1999 to 2021-2023. Then we changed the currency value according to the inflation that occurred in the USD from July 1997 to July 2021. We obtained the inflation values from the Bureau of Labor Statistics.

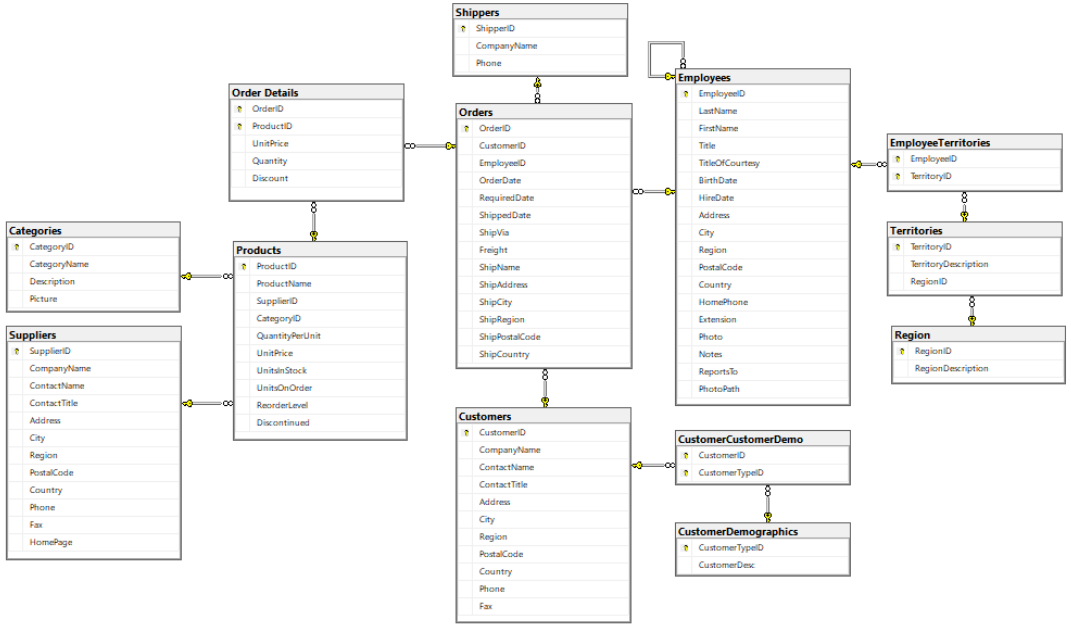
Executives need to view data quickly and easily

Dashboard makes it easy to view the data quickly and easily

Viewing data directly from the database can be time-consuming and challenging for individuals who are not familiar with database. One of them are executives/leaders. **Executives need to obtain quick insights into their business, which requires data to be visualized and available when needed**. Dashboard is the answer for this problem. **With a dashboard, executives can view data quickly and easily**.

Dashboards themselves consist of various types according to the needs of the users. However, we will create an executive dashboard to meet the needs of company leaders.

But there is another question: "What data will be displayed in the dashboard?"



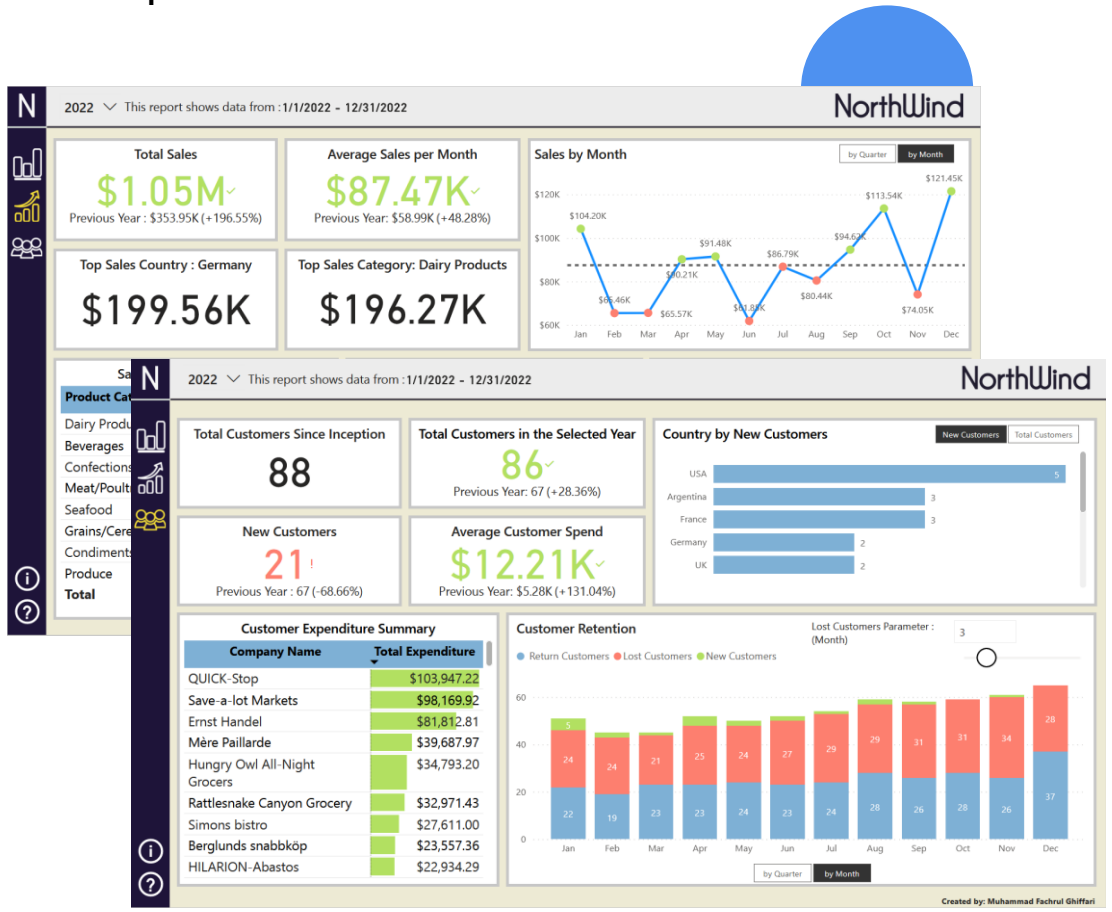
Sales and customers are an important part of the company's growth.

Executives can analyze that aspects using the Sales and Customers report

After exploring the data that exist in the Northwind database, there are 2 reports that can be created: Sales and Customers.

Both are crucial for the development of a company. Sales itself is the main source of revenue, and **good sales performance has a positive impact on business growth**. Meanwhile, customers are another important aspect of a business. **The more customers a company has or the more loyal they are to the company, the higher the sales** generated by the company.

With these two reports, company leaders can make quick decisions regarding sales and customers, for example: marketing strategies in potential countries to get new customers, adding or reducing product lines based on product category sales, rewarding loyal customers, and many others.



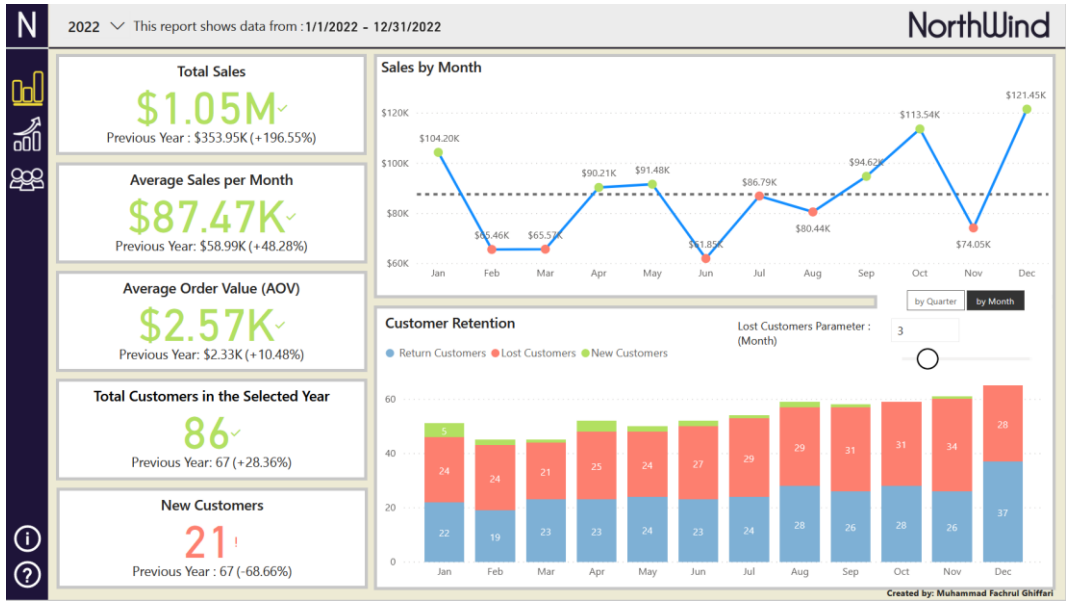
Sales & Customers Dashboard

Executives do not have a lot of time to analyze every detail

Main dashboard is needed to provide a clear summary

Executives/leaders certainly do not have much time to analyze sales and customers in detail. Therefore, a single page in the dashboard is needed to summarize these two aspects, and that's why we created the Main Dashboard. The Main Dashboard serves as the primary view that provides an overview of both Sales and Customers. **Only the key metrics are displayed in the Main Dashboard, allowing executives/leaders to quickly grasp the overall state of the business without having to analyze every detail.**

Meanwhile, the Sales and Customers Dashboard functions as a dashboard that provides more detailed explanations of the data. Executives/Company leaders can view these two dashboards when they feel the need to have a detailed overview.



Main Dashboard

Tools

SQL Server Management System (SSMS)

Python

We modify the data in the Northwind database to make it more appealing. The data we modified includes the year in the date columns and the currency, which we changed based on the Consumer Price Index from July 1996 to July 2021 (source: Bureau of Labor Statistics). **We made these changes using the SSMS application, which utilizes the T-SQL language**.

After the data was modified, we performed the process **of extracting data from SQL Server** on our PC and **loading that data onto a PostgreSQL Server in the cloud**. Due to the slight differences in language between T-SQL in SQL Server and SQL in PostgreSQL, we decided to **use Python for this process.**

```python
# Define a function to extract data from SQL Server
def extract():
    try:
        # Connect to SQL Server
        src_conn = pyodbc.connect(f'DRIVER={driver};SERVER={server_sqlserver}\SQLEXPRESS;DATABASE={db_src};UID={uid_src};PWD={pwd_src}')
        src_cursor = src_conn.cursor()
        # Execute query to select all table in Northwind Database on SQL Server except sysdiagrams
        src_cursor.execute("select  t.name as table_name"
                           " from sys.tables t where t.name NOT IN ('sysdiagrams')")
        src_tables = src_cursor.fetchall()
        # Rename "Order Details" table to "[Order Details]" to avoid error while reading data
        src_tables[7][0] = src_tables[7][0] = '[Order Details]'

        # Iteration to load each table to PostgreSQL
        for tbl in src_tables:
        # Query and load save data to dataframe
            df = pd.read_sql_query(f'select * FROM {tbl[0]}', src_conn)
            # Call load function
            load(df, tbl[0])
    except Exception as e:
        print("Data extract error: " + str(e))
    finally:
        # Close connection from SQL Server
        src_conn.close()

# Define a function to load data to PostgreSQL
def load(df, tbl):
    try:
        rows_imported = 0
        # You can use the code below to connect by filling in the target database variable
        ## engine = create_engine(f'postgresql://{user_postgresql}:{pass_postgresql}@{server_postgresql}:5432/{database_postgresql}')
        engine = create_engine(f'
        print(f'importing rows {rows_imported} to {rows_imported + len(df)}... for table {tbl}')
        # Rename '[Order Details]' table to 'Order Details'
        if tbl == '[Order Details]':
            df.to_sql(f'Order Details', engine, if_exists='replace', index=False)
            rows_imported += len(df)
            print("Data imported successful")
        else:
            df.to_sql(f'{tbl}', engine, if_exists='replace', index=False)
            rows_imported += len(df)
            print("Data imported successful")
    except Exception as e:
        print("Data load error: " + str(e))
    # Use this code below if your PostgreSQL has connection limits
""" finally:
        engine.dispose() """

try:
    # Call extract function
    extract()
except Exception as e:
    print("Error while extracting data: " + str(e))
```

Extract data from SQLServer and load data to PostgreSQL with Python

Tools

pgAdmin 4 Power BI

pgAdmin 4 is a management tool for PostgreSQL databases. **We use pgAdmin 4 to change the data types in the Northwind Database**. During the previous data loading process, the data types in the Northwind Database in PostgreSQL were not suitable, so we modified the data types using pgAdmin 4.

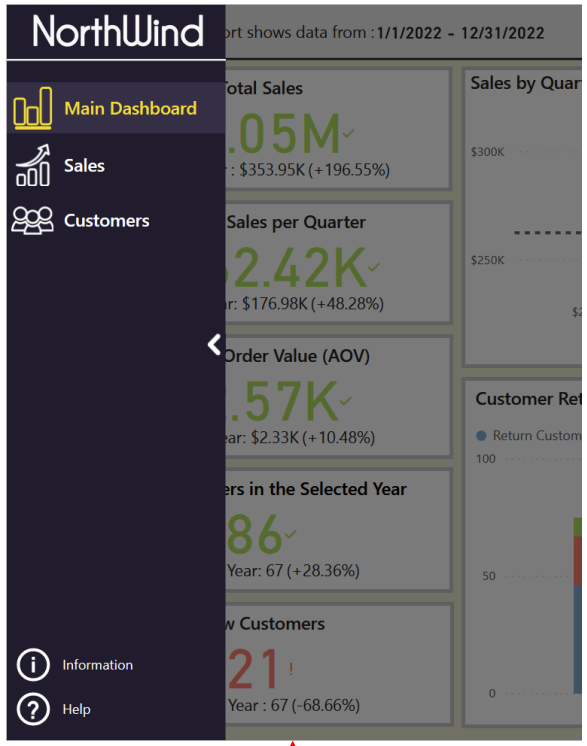
Next, the data visualized in PowerBI. Some metrics can be directly displayed by showing the related columns, while others require creating measures (using **DAX** language) to obtain them. In this presentation, we cannot display those measures/DAX because it would take up many slides. Therefore, in the "Metrics Highlight" section, we will only explain the function and logic of each metric.

```
LostCustomers =
VAR MaxPeriod = MAX(dimDate[Date])

VAR _Customers =
ADDCOLUMNS(
    Customers,
    "PurchasesUntilPeriod_",
    CALCULATE(
        [Running Total Sales],
        REMOVEFILTERS(dimDate[Date]),
        Orders[OrderDate] <= MaxPeriod
        ),
    "PurchasesXMonthBefore_",
    CALCULATE(
    [Total Sales],
    REMOVEFILTERS(dimDate),
    DATESINPERIOD(Orders[OrderDate],
                  MaxPeriod,
                  -1*[Lost Customers Parameter (Month) Value],
                  MONTH)
            )
    )

VAR _LostCustomers =
FILTER(
    _Customers,
    [PurchasesUntilPeriod_]>0 && [PurchasesXMonthBefore_]=0)

RETURN
IF([Current Customers per Month] > 0, COUNTROWS(_LostCustomers))
```

An example of using measures/DAX to find lost customers

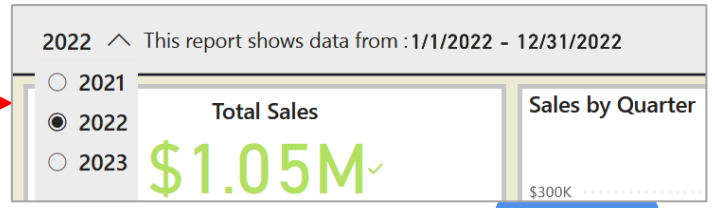
2

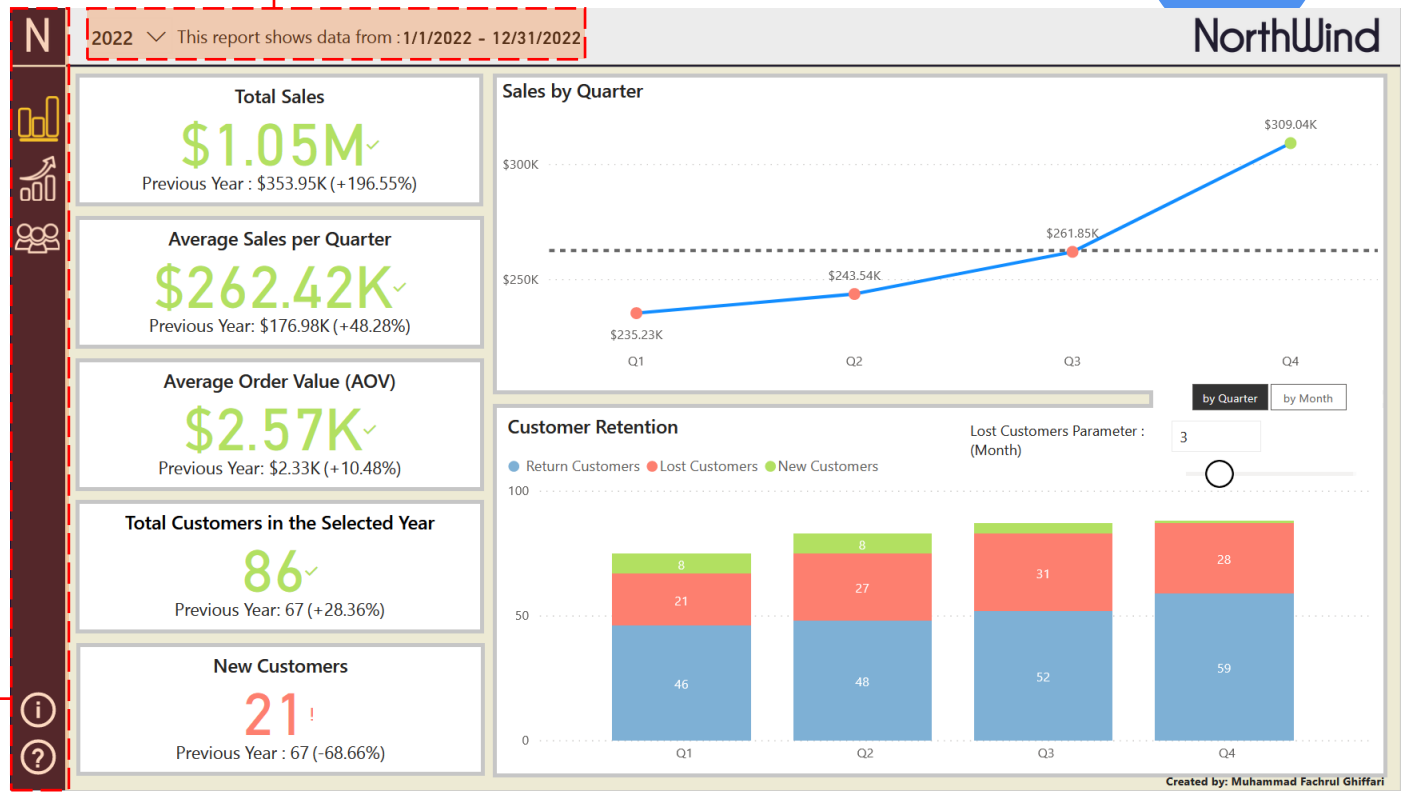
Dashboard Overview



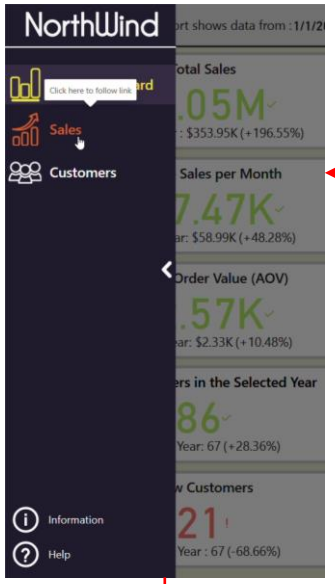
Side Menu
Click to open the side menu

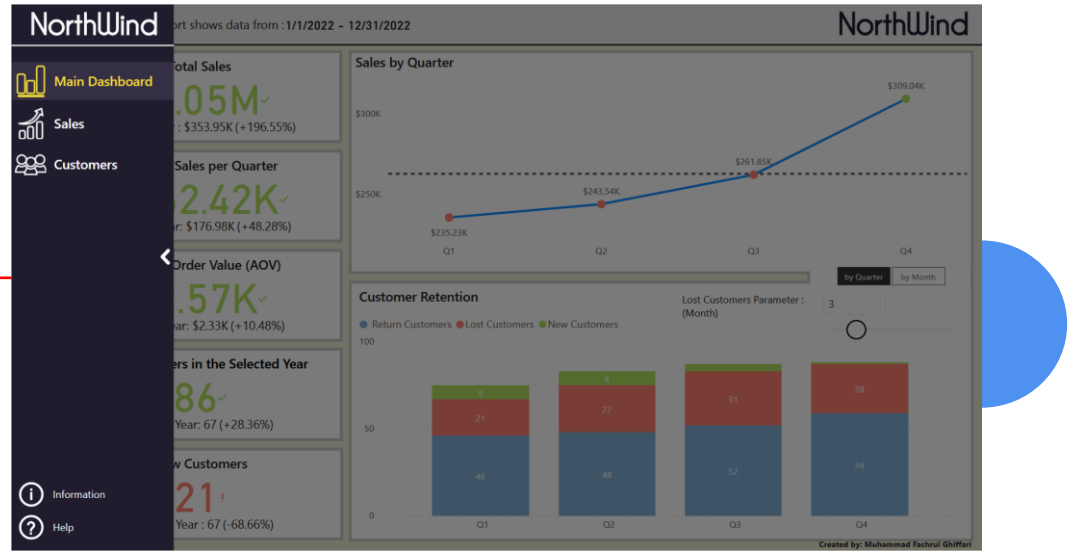
Year Filter
Filter the data in the opened report according to the selected year



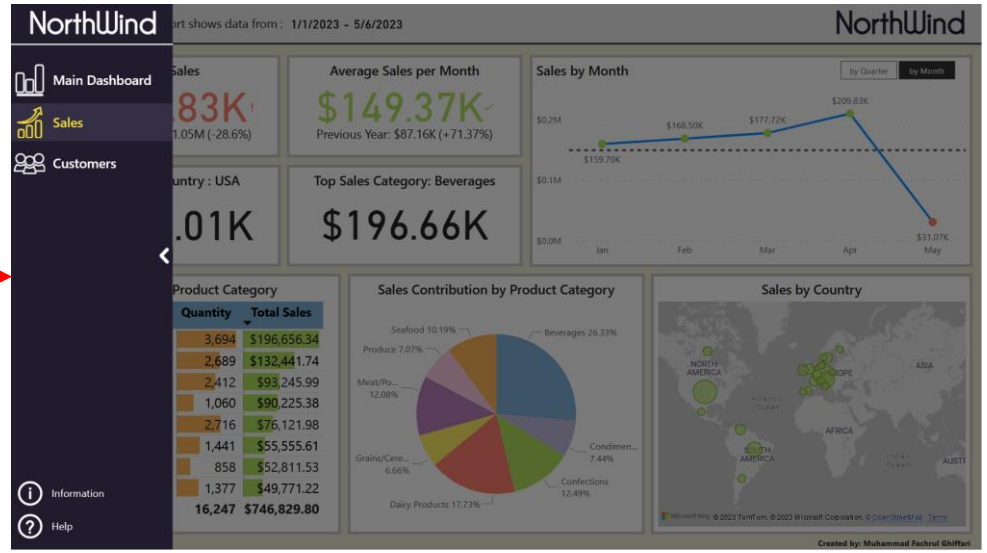


Navigation & Year Filter





Select the report page that you want to see, then click to open it



Navigation & Year Filter

Total Sales

Displays the **number of sales for the year**, along with the previous year's sales and the difference between them. If in that year the sales are greater, it will be displayed in green, otherwise it will be red.

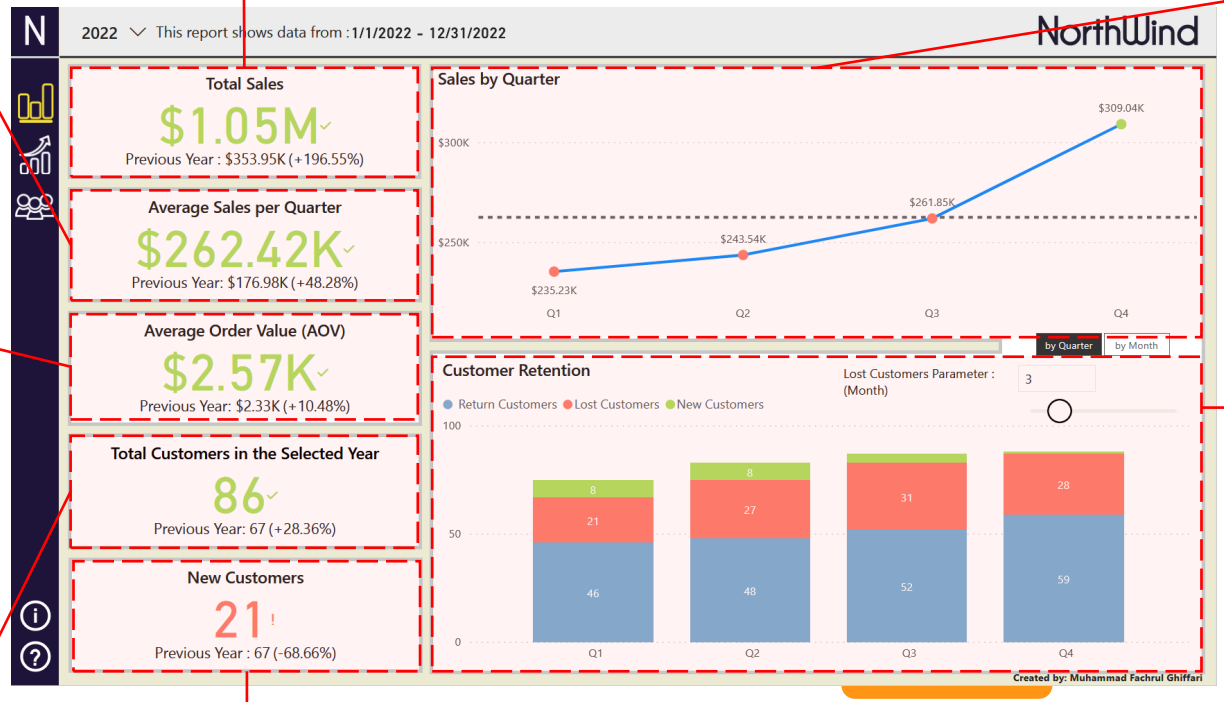
Sales by Quarter/Month

Displays **monthly/quarterly sales**. The dashed line represents the target of sales. If sales for a specific quarter/month are higher than the target, the data point will be displayed in green. Conversely, if it is lower, it will be displayed in red.

This chart can be used as a filter for the AOV, Total Customers, and New Customers metrics.

Average Sales per Quarter/Month

Displays **average sales per month/quarter** (Depending on what time unit is selected, which will be explained on the next slide), along with the previous year's average sales and the difference between them.



Customer Retention

Displays **new customers, return customers, and lost customers for each month/quarter**. New customers are displayed in green, return customers in blue, and lost customers in red.

Lost Customers are customers who do not make transactions for x months, the x parameter can be determined by the user (will be explained on the next slide).

This chart can be used as a filter for the AOV, Total Customers, and New Customers metrics.

Average Order Value (AOV)

Displays the **average sales per order**. It also displays the AOV in the previous period and the difference between them.

This metric can display AOV for a specific quarter/month by filtering it from the "Sales by Quarter/Month" or "Customer Retention" chart.

Total Customers in the Selected Year/Quarter/Month

Displays the **number of customers who placed orders during a specific period**, along with the number of customers in the previous period and the difference between the two. This metric can display the total customers in a particular month/quarter selected through the "Sales by Quarter/Month" or "Customer Retention" chart. If no month/quarter is selected, it will display the number of customers for that year.

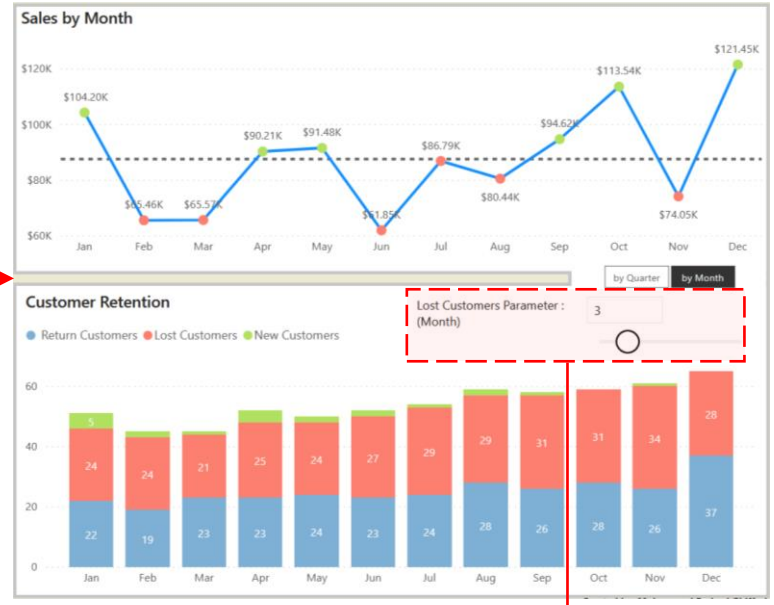
New Customers

Displays the **number of new customers during a specific period**, along with the number of new customers in the previous period and the difference between them. This metric can display number of new customers in a particular month/quarter selected through the "Sales by Quarter/Month " or "Customer Retention" chart. If no month/quarter is selected, it will display the number of new customers for that year.

Main Dashboard Metrics

X-Axis Slicer

User can select time unit on this slicer, which will be used on the X-axis in **Sales by Quarter/Month, Customer Retention** graphs, and change value in **Average Sales per Quarter/Month** card.



Lost Customer Parameter

As explained in the previous slide, the Customer Retention graph includes Lost Customers. Lost Customers are customers who have not made any transactions for x months. The **parameter x can be determined through this slicer**.

Main Dashboard Slicer

Total Sales

This metric is also displayed on the main dashboard.

Average Sales per Quarter/Month

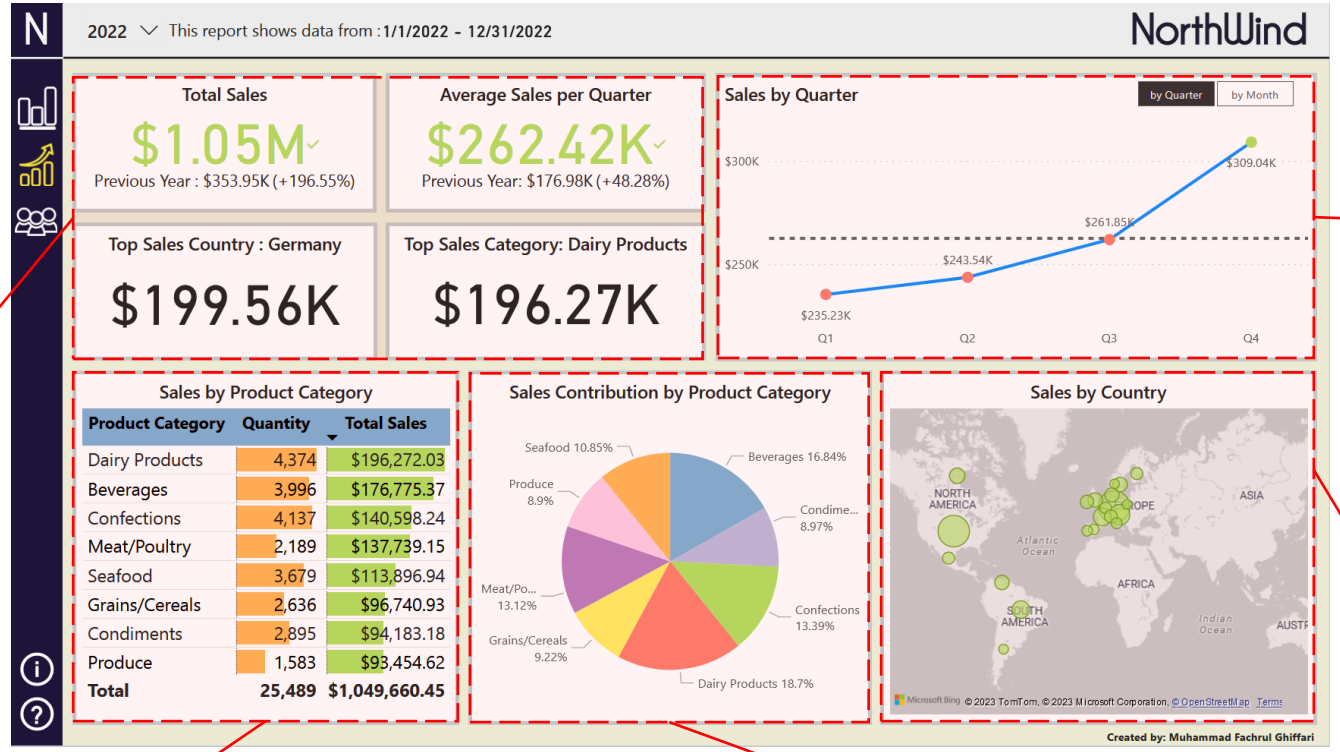
This metric is also displayed on the main dashboard.

Top Sales Category

Displays the **product category with the highest sales**, along with its sales value.

Top Sales Country

Displays **country with the highest sales**, along with its sales value.



Sales by Quarter/Month

This metric is also displayed on the main dashboard.

Sales by Country

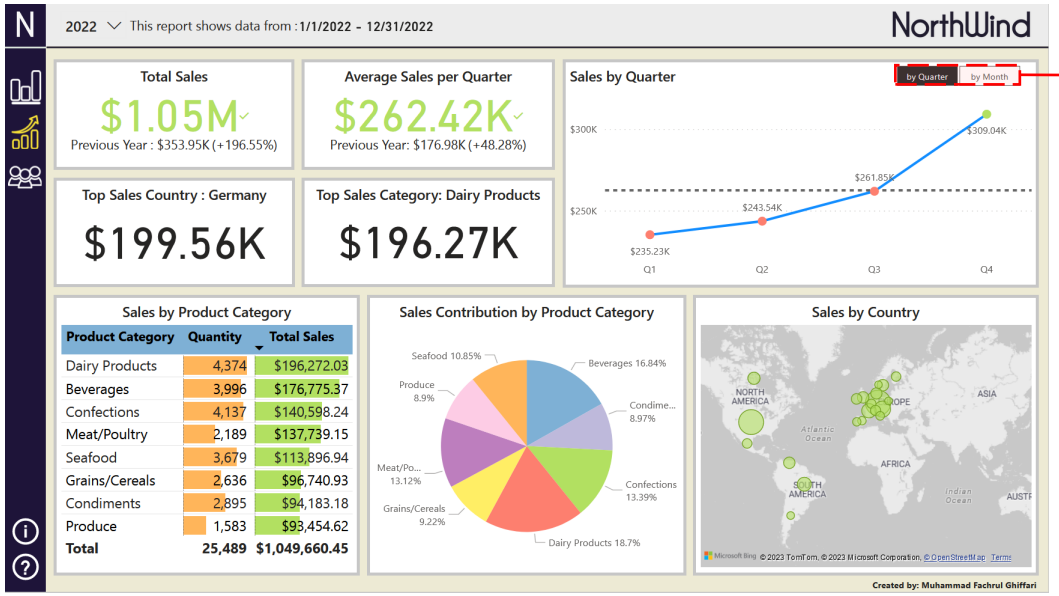
Displays **sales in each country.** This metric **can be used as a filter to analyze sales in each country in more detail.**
If the user selects a country in this metric, the metrics "Total Sales", "Average Sales per Quarter/Month", "Top Sales Category", "Sales by Quarter/Month", "Sales by Product Category", and " Sales Contribution by Product Category" will be filtered according to the selected country.

Sales by Product Category

This table **displays product categories, sales quantities, and total sales**. The rows in this table **can be sorted by either sales quantity or total sales**.
This table **can be used as a filter to analyze sales in more detail for each product category**. If the user selects a specific product category in this table, the metrics "Total Sales", "Average Sales per Quarter/Month", "Top Sales Country", "Sales by Quarter/Month", and "Sales by Country" will be filtered according to the selected product category.

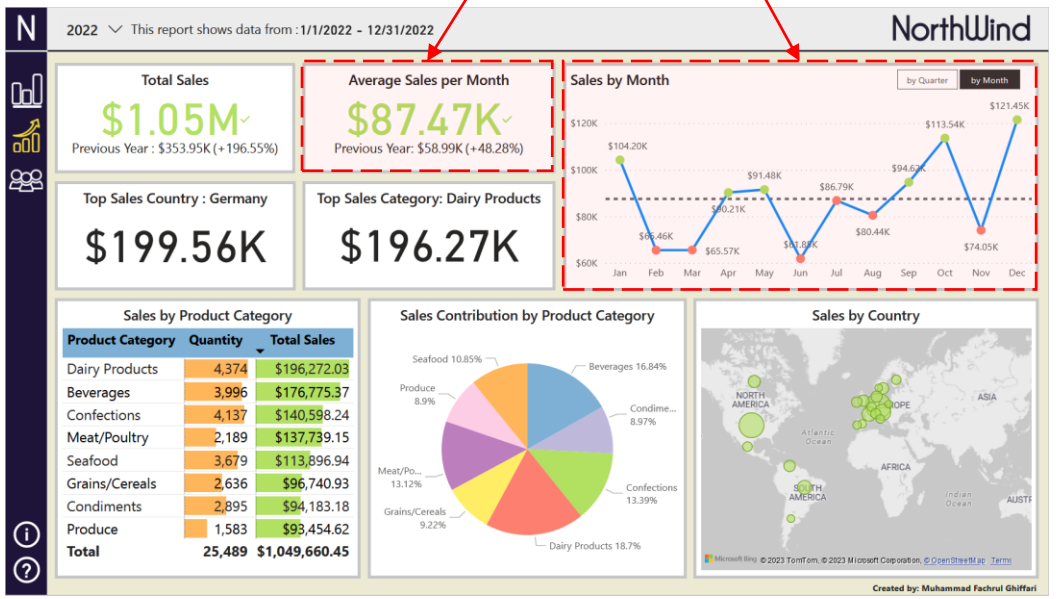
Sales Contribution by Product Category

This pie chart displays **the percentage contribution of each product category to the sales**.
This metric **can be used as a filter to analyze sales in more detail for each product category**. If the user selects a specific product category in this pie chart, the metrics "Total Sales", "Average Sales per Quarter/Month", "Top Sales Country", "Sales by Quarter/Month", and "Sales by Country" will be filtered according to the selected product category.



X-Axis Slicer

User can select time unit on this slicer, which will be used on the X-axis in **Sales by Quarter/Month,** and change value in **Average Sales per Quarter/Month**



Sales Dashboard Slicer

Total Customers Since Inception

Total number of customers counted since the establishment of the company

Total Customers in the Selected Years/Quarter/Month

This metric is also displayed on the main dashboard.

New Customers

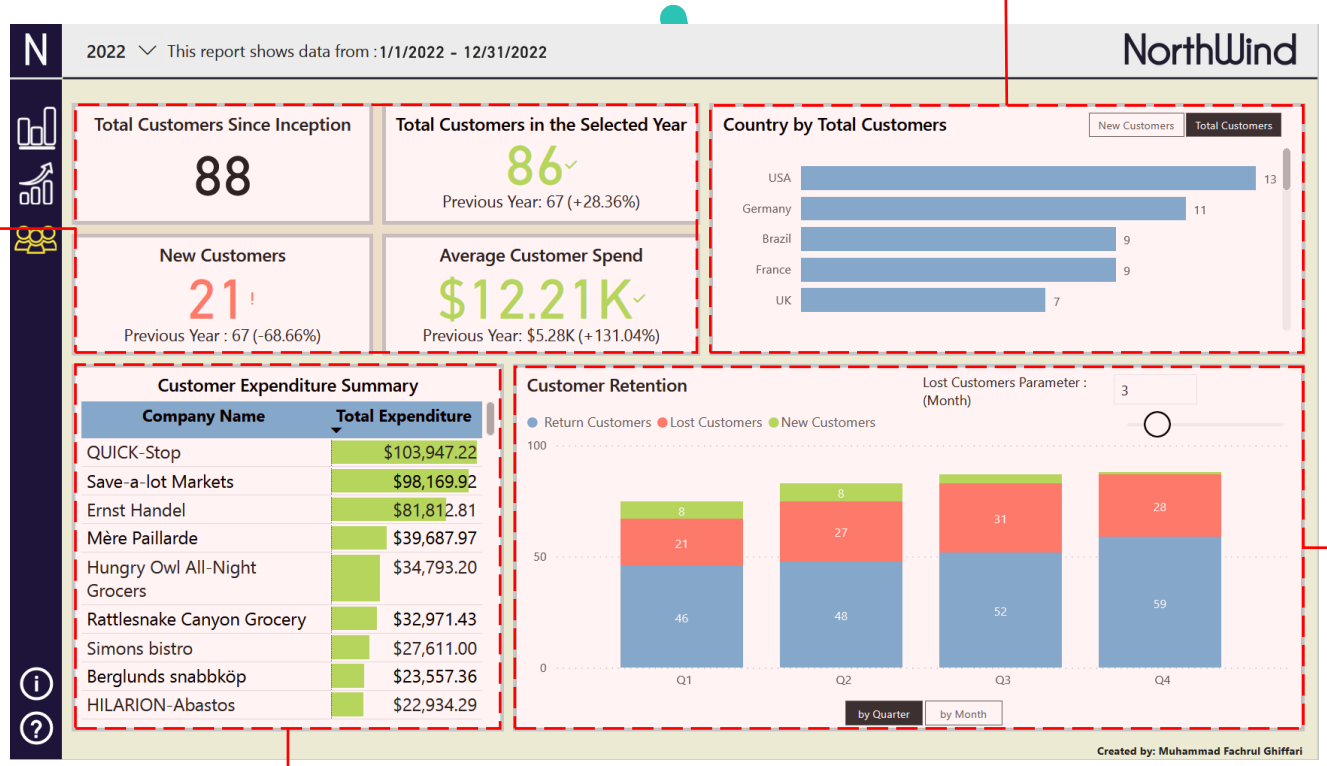
This metric is also displayed on the main dashboard.

Average Customer Spend

Displays the **average expenditure of customers**. This metric can display average customer spend for a specific quarter/month by filtering it from the "Customer Retention" chart.

Country by New Customers/Total Customers

This bar chart displays countries based on New Customers/Total Customers (selectable through the slicer in the top right section). It displays the top 5 countries, and user can scroll down to see more countries. This bar chart can be used as a filter for the metrics such as "Total Customers in the Selected Year/Quarter/Month", "New Customers" (Card), "Average Customer Spend", and the "Customer Expenditure Summary" table.



Customer Retention

Displays **new customers, return customers, and lost customers for each month/quarter**. New customers are displayed in green, return customers in blue, and lost customers in red.

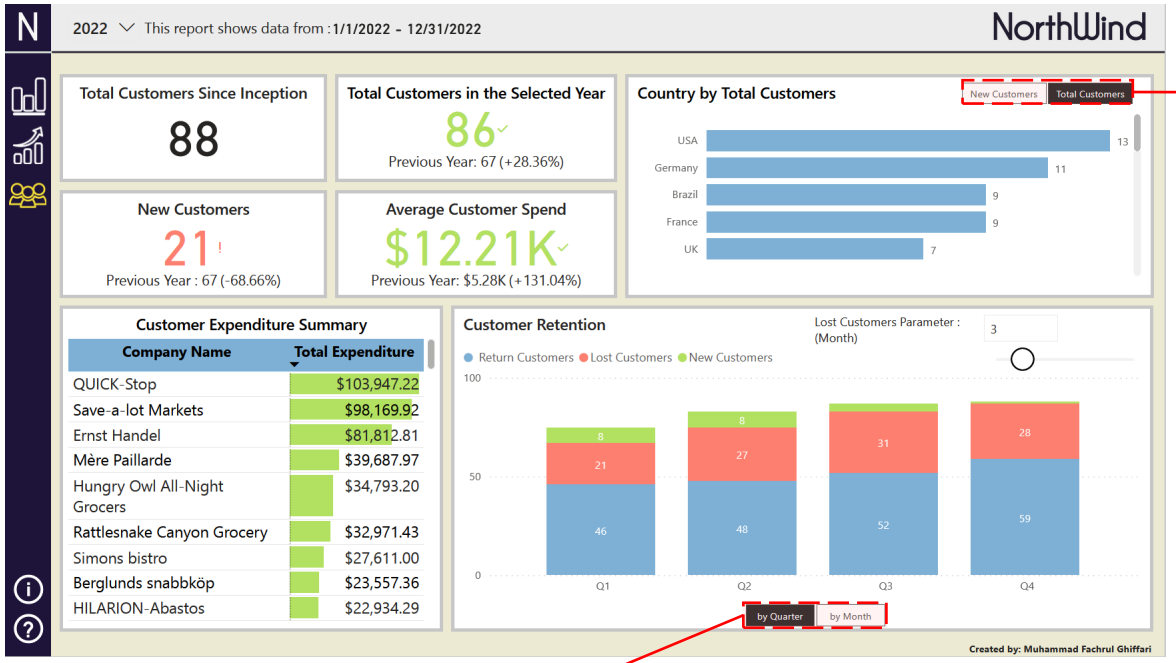
Lost Customers are customers who do not make transactions for x months, the x parameter can be determined by the user (will be explained on the next slide).

This chart can be used as a filter for the AOV, Total Customers, and New Customers metrics.

Customer Expenditure Summary

This table displays the **expenses of each customer**. This table can display all customers or only new customers (selected in the "New Customers/Total Customers" slicer). The table can also be filtered using the chart "Country by New Customers/Total Customers" to display customers from the selected country.

Customers Dashboard Metrics

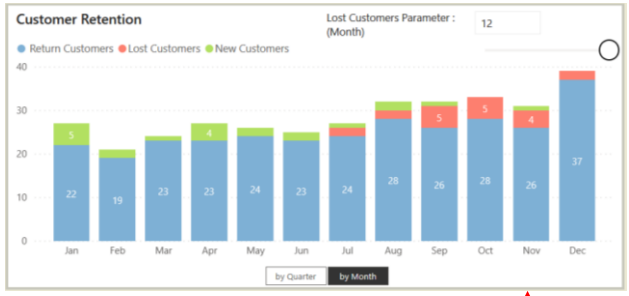


New Customers/Total Customers Slicer

User can **select which metric to display** on the "Country by New Customers/Total Customers" bar chart and "Customer Expediture Summary" table through this slicer.

Customers Expenditure Summary (New Customers)

Company Name	Total Expenditure
Folies gourmandes	$19,844.98
Great Lakes Food Market	$14,569.67
Gourmet Lanchonetes	$13,622.81
LINO-Delicateses	$12,518.63
Maison Dewey	$9,010.05
Alfreds Futterkiste	$3,440.30
Let's Stop N Shop	$2,888.90
The Cracker Box	$2,757.73
Total	**$93,469.21**



X-Axis Slicer

User can select time unit on this slicer, which will be used on the X-axis in **Customer Retention** graph.

Lost Customer Parameter

As explained in the previous slide, the Customer Retention graph includes Lost Customers. Lost Customers are customers who have not made any transactions for x months. The **parameter x can be determined through this slicer.**

Customers Dashboard Slicer

3

Data Pre-Processing

Change the year and UnitPrice in Nortwhind Database

We changed the date columns in the "Orders" table and the UnitPrice columns in the "Order Details" and "Products" tables. We changed the years from 1996-1998 to 2021-2023, and we adjusted the UnitPrice based on the CPI from July 1996 to July 2021 (Source: Bureau of Labor Statistics). In real-world cases this is of course not allowed, we did it in this project to make our portfolio more interesting. We use SSMS to do this process.

```
UPDATE Orders
SET OrderDate = DATEADD(YEAR, 25, OrderDate),
    RequiredDate = DATEADD(YEAR, 25, RequiredDate),
    ShippedDate = DATEADD(YEAR, 25, ShippedDate);

UPDATE [Order Details]
SET UnitPrice = ROUND(UnitPrice + (UnitPrice * 0.701), 2);

UPDATE Products
SET UnitPrice = ROUND(UnitPrice + (UnitPrice * 0.701), 2);
```

Change data using SQL with SSMS

Load data to PostgreSQL on cloud

SQLServer_to_PostgreSQL.py > ...

```python
# Define a function to extract data from SQL Server
def extract():
    try:
        # Connect to SQL Server
        src_conn = pyodbc.connect(f'DRIVER={driver};SERVER={server_sqlserver}\SQLEXPRESS;DATABASE={db_src};UID={uid_src};PWD={pwd_src}')
        src_cursor = src_conn.cursor()
        # Execute query to select all table in Northwind Database on SQL Server except sysdiagrams
        src_cursor.execute("select  t.name as table_name"
                " from sys.tables t where t.name NOT IN ('sysdiagrams')")
        src_tables = src_cursor.fetchall()
        # Rename "Order Details" table to "[Order Details]" to avoid error while reading data
        src_tables[7][0] = src_tables[7][0] = '[Order Details]'

        # Iteration to load each table to PostgreSQL
        for tbl in src_tables:
        # Query and load save data to dataframe
            df = pd.read_sql_query(f'select * FROM {tbl[0]}', src_conn)
            # Call load function
            load(df, tbl[0])
    except Exception as e:
        print("Data extract error: " + str(e))
    finally:
        # Close connection from SQL Server
        src_conn.close()

# Define a function to load data to PostgreSQL
def load(df, tbl):
    try:
        rows_imported = 0
        # You can use the code below to connect by filling in the target database variable
        ## engine = create_engine(f'postgresql://{user_postgresql}:{pass_postgresql}@{server_postgresql}:5432/{database_postgresql}')
        engine = create_engine(f'[redacted]')
        print(f'importing rows {rows_imported} to {rows_imported + len(df)}... for table {tbl}')
        # Rename '[Order Details]' table to 'Order Details'
        if tbl == '[Order Details]':
            df.to_sql(f'Order Details', engine, if_exists='replace', index=False)
            rows_imported += len(df)
            print("Data imported successful")
        else:
            df.to_sql(f'{tbl}', engine, if_exists='replace', index=False)
            rows_imported += len(df)
            print("Data imported successful")
    except Exception as e:
        print("Data load error: " + str(e))
    # Use this code below if your PostgreSQL has connection limits
""" finally:
        engine.dispose() """

try:
    # Call extract function
    extract()
except Exception as e:
    print("Error while extracting data: " + str(e))
```

Python code to extract data from SQL Server to PostgreSQL

If the database is stored on a single PC, the dashboard will heavily rely on that PC to refresh its data. Therefore, we decided to use the cloud as the database solution. The cloud allows us to refresh data from anywhere and at any time without depending on a single PC. We are using PostgreSQL database as the server.

We use Python to extract data from SQL Server and load it into PostgreSQL.

Change data type and explore data in PostgreSQL

```
ALTER TABLE "Categories"
    ALTER COLUMN "CategoryID" TYPE smallint,
    ALTER COLUMN "CategoryName" TYPE text,
    ALTER COLUMN "Description" TYPE text,
    ALTER COLUMN "Picture" TYPE text,

    ALTER COLUMN "CategoryID" SET NOT NULL,
    ALTER COLUMN "CategoryName" SET NOT NULL;

ALTER TABLE "CustomerCustomerDemo"
    ALTER COLUMN "CustomerID" TYPE char(5),
    ALTER COLUMN "CustomerTypeID" TYPE char(10),

    ALTER COLUMN "CustomerID" SET NOT NULL,
    ALTER COLUMN "CustomerTypeID" SET NOT NULL;

ALTER TABLE "CustomerDemographics"
    ALTER COLUMN "CustomerTypeID" TYPE char(10),
    ALTER COLUMN "CustomerDesc" TYPE text,

    ALTER COLUMN "CustomerTypeID" SET NOT NULL;

ALTER TABLE "Customers"
    ALTER COLUMN "CustomerID" TYPE char(5),
    ALTER COLUMN "CompanyName" TYPE text,
    ALTER COLUMN "ContactName" TYPE text,
    ALTER COLUMN "ContactTitle" TYPE text,
    ALTER COLUMN "Address" TYPE text,
    ALTER COLUMN "City" TYPE text,
    ALTER COLUMN "Region" TYPE text,
    ALTER COLUMN "PostalCode" TYPE text,
    ALTER COLUMN "Country" TYPE text,
    ALTER COLUMN "Phone" TYPE text,
    ALTER COLUMN "Fax" TYPE text,

    ALTER COLUMN "CustomerID" SET NOT NULL,
    ALTER COLUMN "CompanyName" SET NOT NULL;

ALTER TABLE "EmployeeTerritories"
    ALTER COLUMN "EmployeeID" TYPE smallint,
    ALTER COLUMN "TerritoryID" TYPE text,

    ALTER COLUMN "EmployeeID" SET NOT NULL,
    ALTER COLUMN "TerritoryID" SET NOT NULL;

ALTER TABLE "Employees"
    ALTER COLUMN "EmployeeID" TYPE smallint,
    ALTER COLUMN "LastName" TYPE text,
    ALTER COLUMN "FirstName" TYPE text,
    ALTER COLUMN "Title" TYPE text,
    ALTER COLUMN "TitleOfCourtesy" TYPE text,
    ALTER COLUMN "BirthDate" TYPE date,
    ALTER COLUMN "HireDate" TYPE date,
    ALTER COLUMN "Address" TYPE text,
```

Query to change data type and set not-null

After the data is loaded into PostgreSQL, the data has a different data type from its origin. So we perform data type conversion using pgAdmin 4.

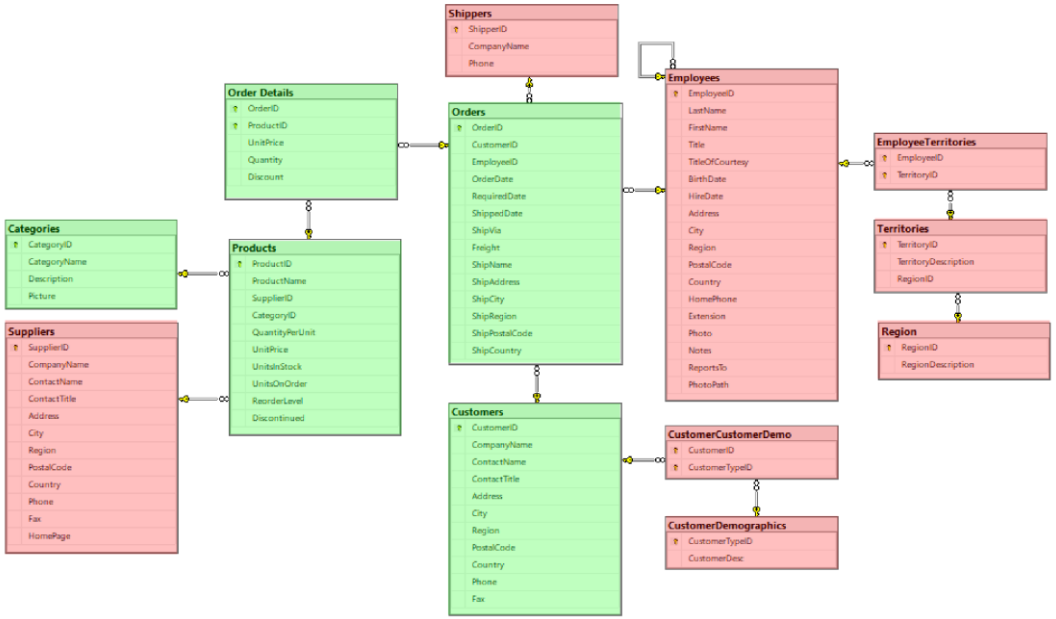
After this process, the data is further explored to determine which tables will be used in Power BI to create the dashboard.

Connect PowerBI to PostgreSQL

Only a few tables are used to create this dashboard

After the data was explored through SSMS and the tables to be used were determined, **PowerBI then connected to the Northwind Database existing on PostgreSQL**. We use the cloud as the server. If there are any changes or additions to the data in the database, the data on the dashboard would be updated when refreshed.

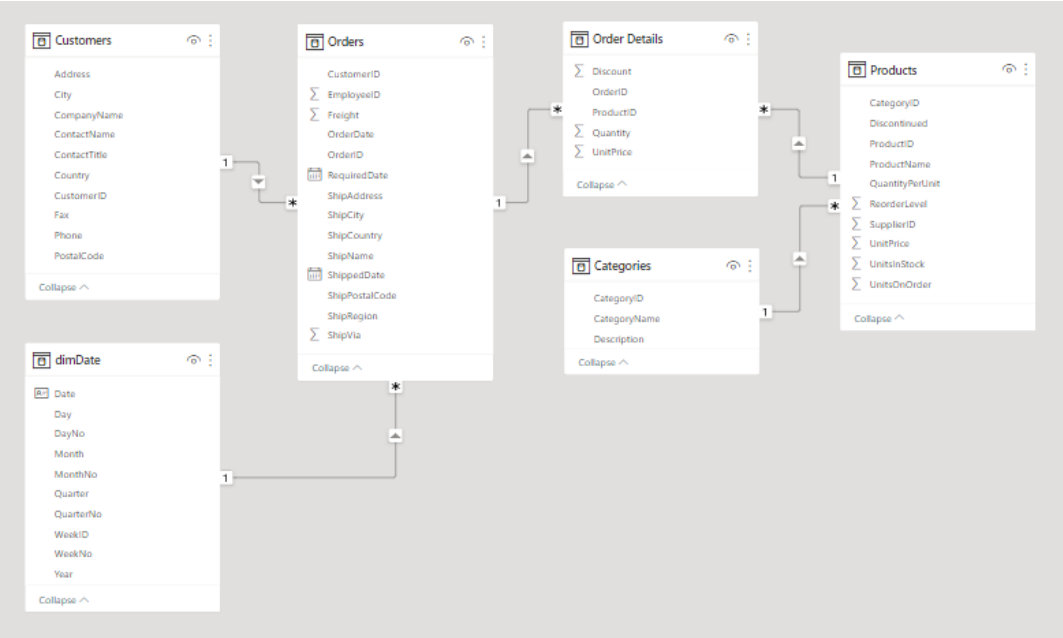
Then, we pulled the previously specified tables, which were Orders, Order Details, Customers, Categories, and Products, into PowerBI. These tables are needed to create the Customers and Sales Dashboard. In this process, column selection is not performed because it is assumed that important metrics can be found from those columns later on.



Green table is table that used in the dashboard

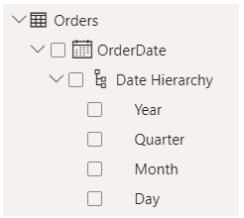
PowerBI's date table is not flexible to use

We created a date table named dimDate

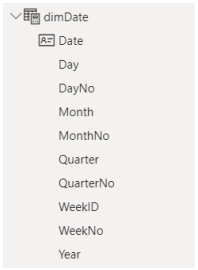


Data schema in powerBI

PowerBI date table



dimDate



Power BI provides a date table for each date column. But unfortunately it is not flexible to use. For example: when we create a breakdown by month, we cannot use abbreviations such as Jan, Feb but instead we have to use January, February which of course takes up a lot of space. Another example is that we cannot create a breakdown by week with the date table provided by PowerBI. So **we decided to create a new date table.**

The date table we created is **called "dimDate"**. dimDate has a primary key from the OrderDate column in the Orders table. **With this date table, we have the flexibility to create and display various metrics.**

4

Metrics Highlight

Main Dashboard

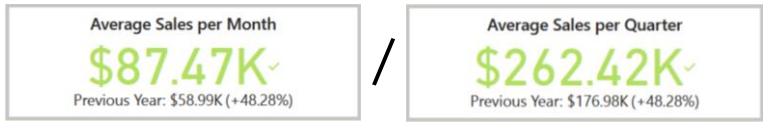
- **Total Sales**

Total Sales is the **sum of sales from all orders**. With sales itself, it is calculated using the following formula:

Sales = UnitPrice x Quantity – (UnitPrice x Quantity x Discount) [From Order Details Table]

This metric aims to allow user to know how sales were in that year and how it compares to last year. Of course, by knowing this, leaders can conclude whether the sales are better or not.

- **Average Sales per Month/Quarter**



Average Sales per Month/Quarter is the total sales divided by the number of months/number of quarters.

Average Sales per Month/Quarter = Total Sales / Numbers of months or quarters (Depending on which is selected in the slicer)

The "Total Sales" metric will compare the sales in the selected year with the previous year, no matter if the selected year has not yet reached the end of the year. As a result, the difference between the two may provide less relevant information to measure sales performance for that year. **To measure sales performance in an unfinished year, the "Average Sales per Quarter/Month" metric will be very helpful.**

Main Dashboard

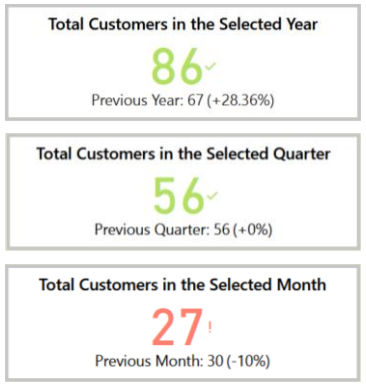
- **Average Order Value (AOV)**

It is calculated by dividing Total Sales by the Number of Orders. The Number of Orders is calculated by counting the number of data in the OrderID column in the Orders table.

AOV = Total Sales / Number of Orders

Knowing the value of **AOV can provide valuable insights into marketing strategies**. For example, companies can evaluate marketing performance, and if AOV increases after a specific marketing campaign, it can be confirmed that the marketing campaign was successful. Conversely, if the AOV is low, then a more effective marketing strategy is needed.

- **Total Customers in the Selected Year/Quarter/Month**

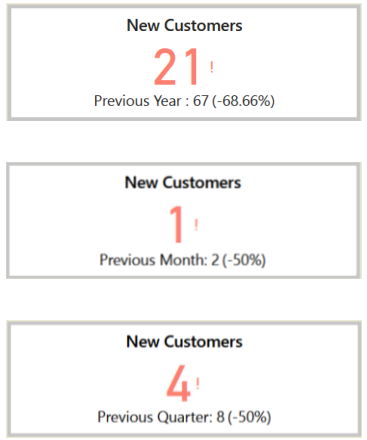


Calculate the number of distinct or unique values in the CustomerID column of the Orders table.

The metric of total customers in the selected period provides information about customer growth from period to period. **This metric helps evaluate whether the company has been successful in attracting new customers and retaining existing ones**. Strong customer growth is a positive indication of business health and the success of marketing strategies.

Main Dashboard

- **New Customers**



There are 3 variables that we create for this metric: Past Customers, Current Customers, and New Customers. To find out New Customers, we need both Past Customers and Current Customers. Past Customers refer to the customers who made transactions before the selected period, while Current Customers are the customers who made transactions in the selected period. Therefore, New Customers are the Current Customers who are not part of the Past Customers. After that, we can calculate the number of members in the New Customers variable.

New Costumers = Current Customers \ Past Customers

This metric is very important because it can illustrate how strong the company is growing. If the number of new customers meets the target or even exceeds it, it can be concluded that the company is on the right track. Conversely, if the number of new customers fails to reach the target, it can be an indication that the ongoing/past marketing strategies are ineffective.

In this dashboard, we set the target as the number of new customers in the previous period.

Note : The symbol "\" is the symbol for the complement intersection, which means taking the elements from the left set that are not members of the right set.

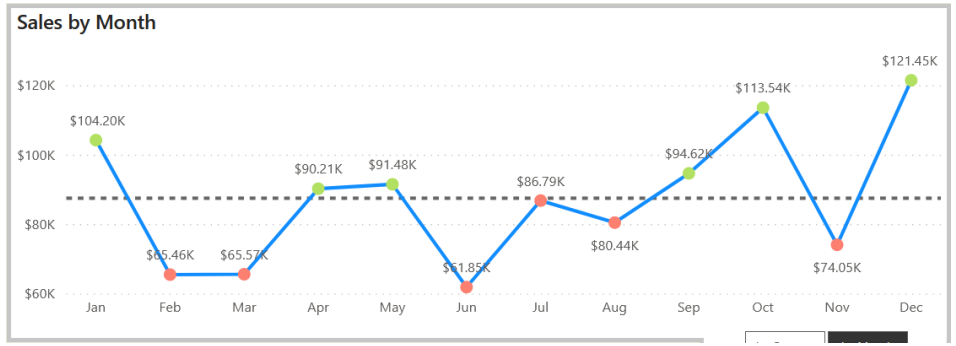
Main Dashboard

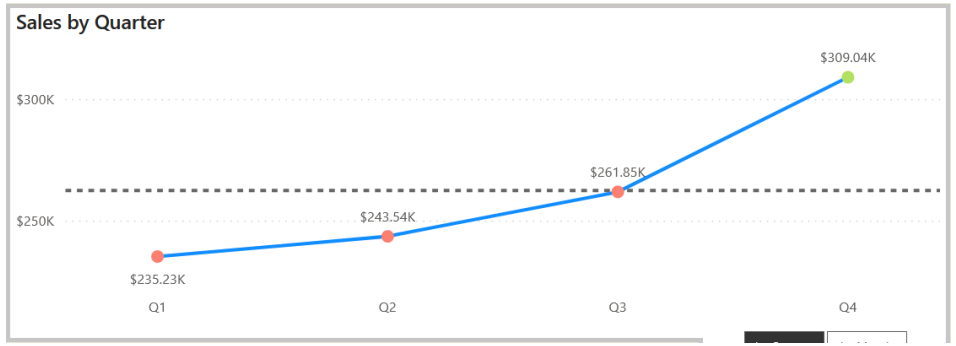
- **Sales by Month/Quarter**

This metric provides a breakdown of sales on a monthly or quarterly basis (depending on the selected time object on the slicer) visualized with a line chart. In this metric, there is a dashed line representing the target. A data point will be colored red if it falls below the target line, while it will be colored green if it is above the target line.

With this metric, company leaders can monitor monthly/quarterly sales performance and identify trends and patterns in sales. The target line will help evaluate the company's performance in achieving monthly/quarterly sales targets.

The target represented by the dashed line can be adjusted according to the company's preference. In this dashboard, we use the average sales as the target.





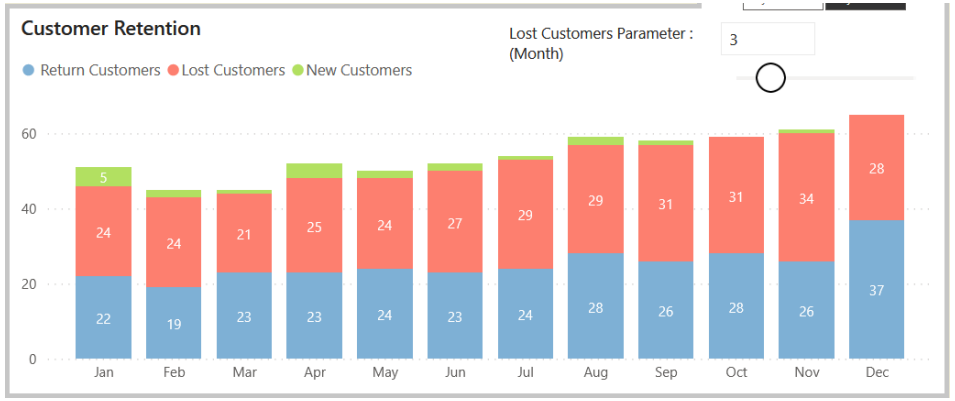
Main Dashboard

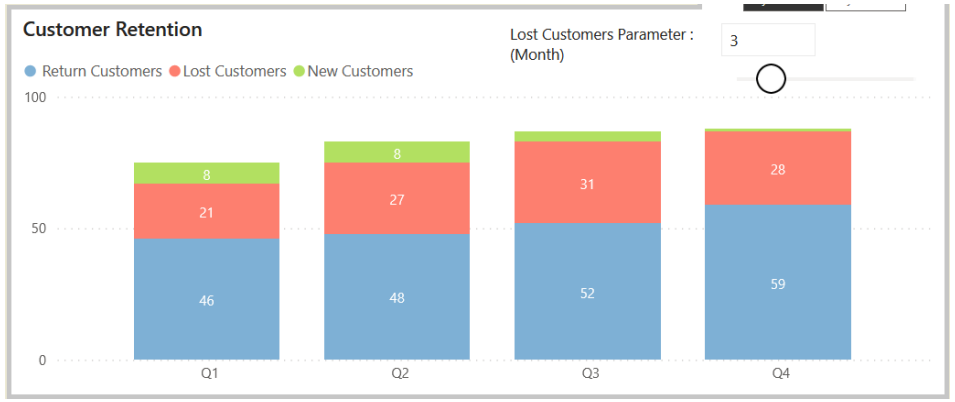
- **Customer Retention (1)**

This metric is equally important as the previous metric. This metric provides a breakdown of lost customers, new customers, and returning customers each month/quarter.

Knowing the number of lost customers, new customers, and return customers will help company leaders evaluate the level of customer churn and take necessary actions to improve customer retention. It also aids in measuring the effectiveness of marketing strategies and customer acquisition efforts. Additionally, it provides insights into the extent to which the company has been successful in retaining customers. This information will help company leaders to make strategic decisions.

The presence of customers is crucial for a company. The company must retain existing customers and attract new customers to strengthen its growth.





Main Dashboard

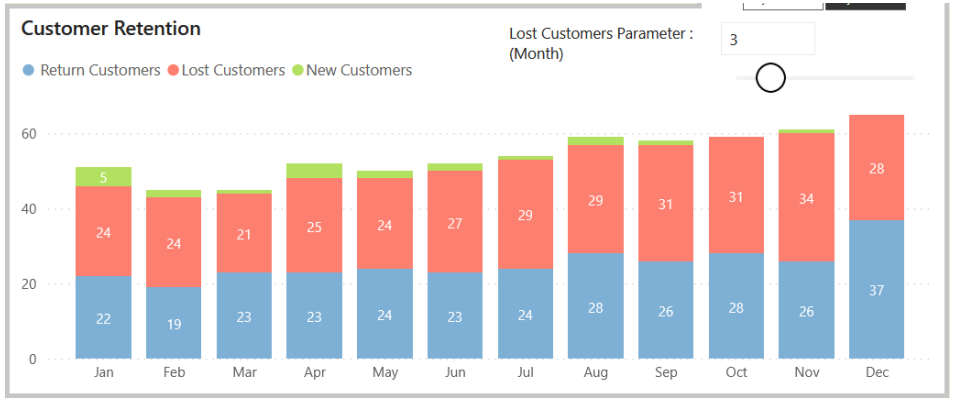
- **Customer Retention : New Customers**

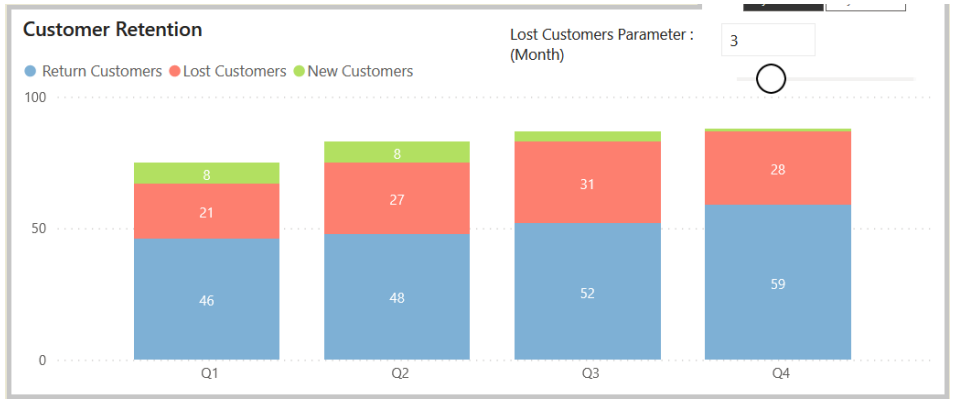
New Customers on this bar chart has the same logic as the "New Customers" metric on page 28, which is identifying New Customers through Past Customers and Current Customers. However, in this chart, the time unit is in month/quarter.

New Costumers = Current Customers \ Past Customers

Past Customers are the customers who made transactions before that month/quarter, Current Customers are the customers who made transactions in that month/quarter, and New Customers are the subset of Current Customers who are not Past Customers.

Note : The symbol "\" is the symbol for the complement intersection, which means taking the elements from the left set that are not members of the right set.





Main Dashboard

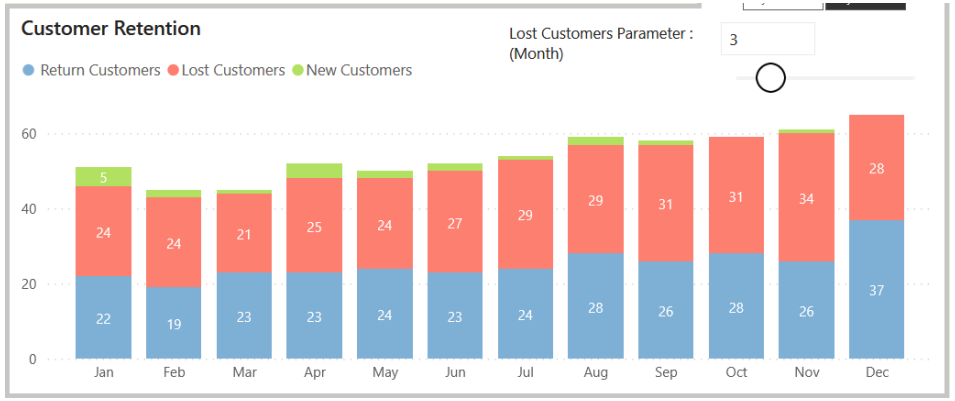
- **Customer Retention : Return Customers**

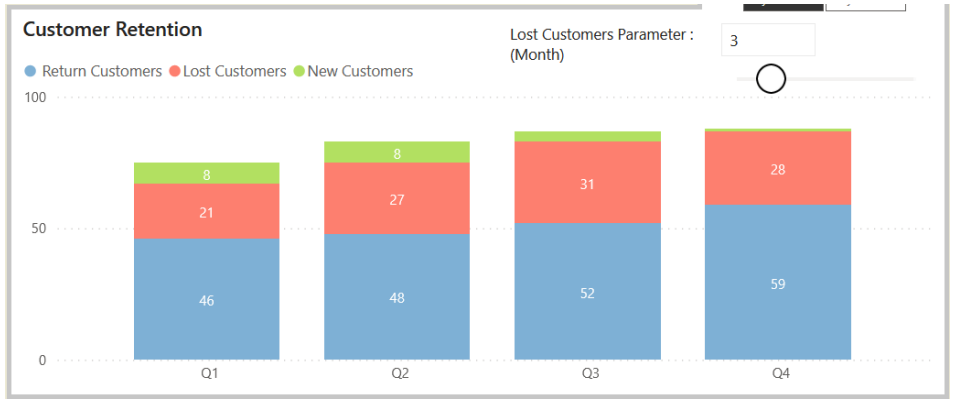
Similar to New Customers, to determine Return Customers, we need the variables Past Customers and Current Customers.

Return Customers = Current Customers ∩ Past Customers

Past Customers are the customers who made transactions before that month/quarter, Current Customers are the customers who made transactions in that month/quarter, and Return Customers are Current Customers who are also Past Customers.

Note : The symbol "∩ " is the symbol that indicates a new set that consists of elements that are common to both sets





Main Dashboard

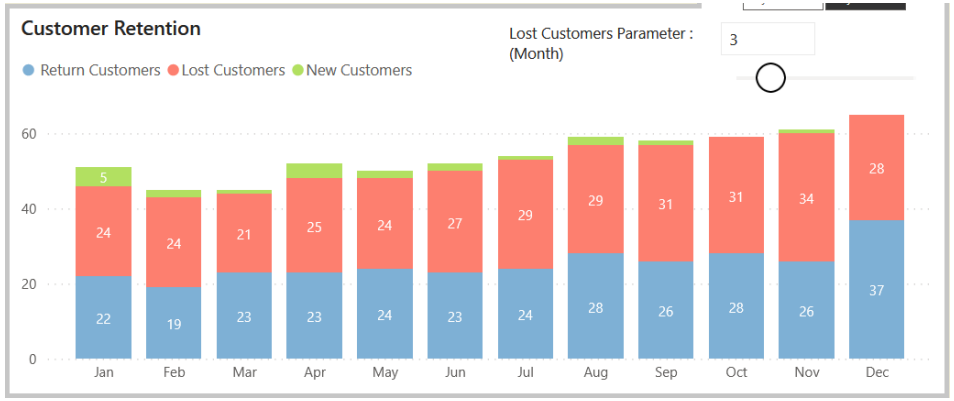
- **Customer Retention : Lost Customers**

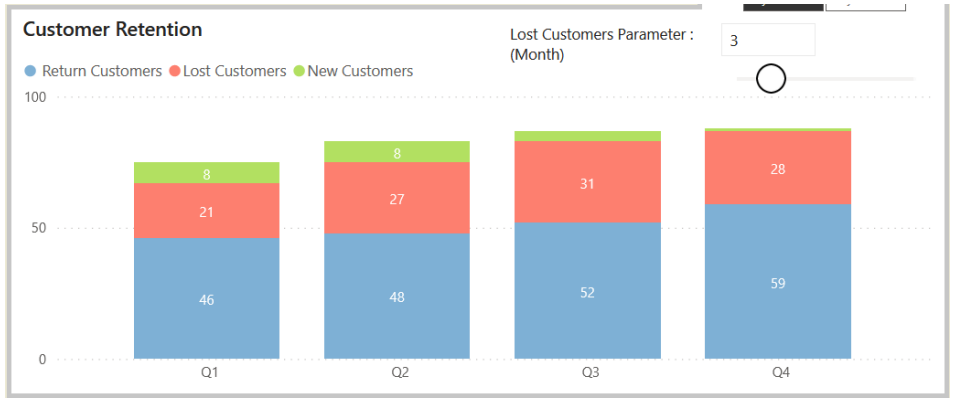
To find out the number of Lost Customers per month, we first create a variable called "*_Customers,*" which contains the Customers table and two columns that we have created, namely *"PurchasesUntilPeriod"* and *"PurchasesXmonthBefore"*.

The "PurchasesUntilPeriod" column contains the total expenditure of each customer from the beginning of the company until a specific month. On the other hand, the "PurchasesXmonthBefore" column contains the total expenditure of each customer from the beginning of the company until X months before the specific month. The value of X is determined through a provided slicer, ranging from 1 to 12 months.

If "PurchasesUntilPeriod" > "PurchasesXmonthBefore", it means that the customer has placed an order again in the last X months. However, if "PurchasesUntilPeriod" = "PurchasesXmonthBefore, it indicates that the customer has not placed an order in the last X months, and they are considered as lost customers.

Because the _Customers variable includes all customers, whether they have placed an order or not. Customers who have never placed an order will also be counted as lost customers. Therefore, Lost Customers are customers with "PurchasesUntilPeriod" > 0 and "PurchasesUntilPeriod" = "PurchasesXmonthBefore".



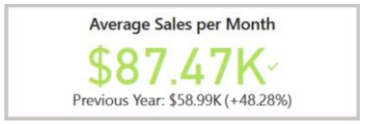


Sales Dashboard

- **Metrics that also displayed in Main Dashboard**

1. Total Sales

2. Average Sales per Month/Quarter



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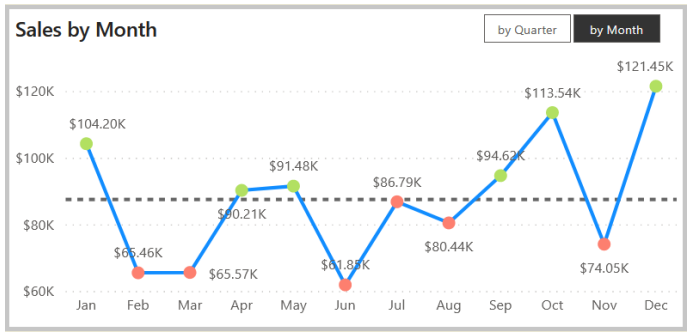
3. Sales by Month/Quarter



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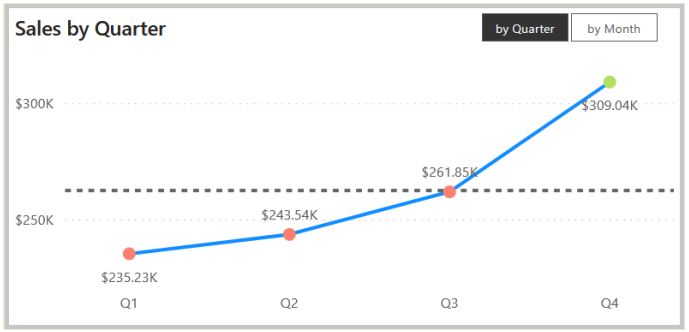
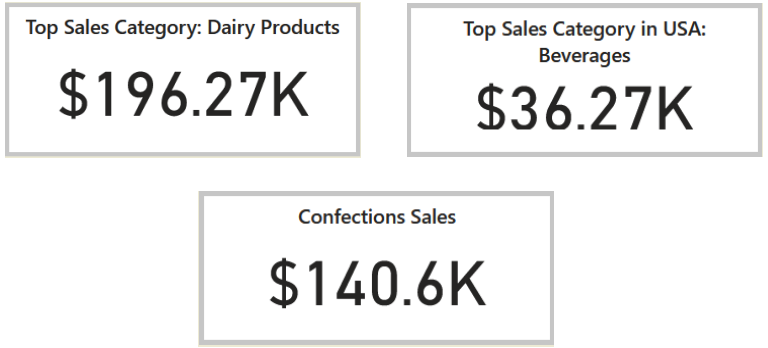


Sales Dashboard

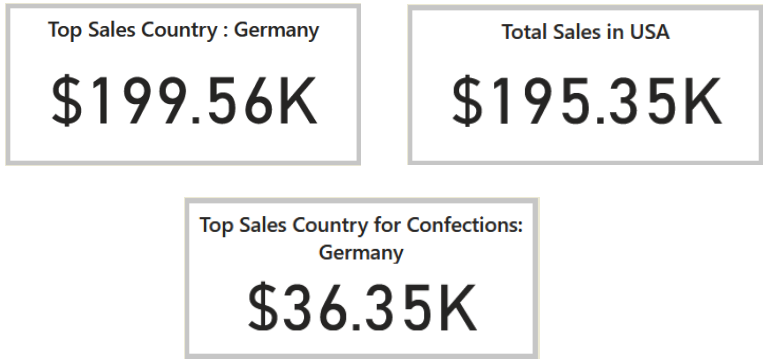
- **Top Sales Category**



This metric displays the category of products with the highest sales along with the corresponding sales figures. By looking at this metric, **user can immediately identify which product category contributes the most to sales.**

This metric will also display the Top Sales Category in a country by filtering it from the "Sales by Country" map, and will display sales in a particular product category if filtered through the "Sales by Product Category" table or on the "Sales Contribution by Product Category" bar chart.

- **Top Sales Country**



This metric displays which country has the highest sales along with the corresponding sales figures. By looking at this metric, **user can immediately identify which country contributes the most to sales**. This metric will also display the Top Sales Country for a product category by filtering it through the "Sales by Product Category" table or the "Sales Contribution by Product Category" bar chart, and will display sales in a country if selected through the "Sales by Country" map.

Knowing the region/country with the highest sales is crucial for a business. The benefit is that the company can determine marketing focus in that country to achieve bigger targets, optimize product distribution, make better investment decisions in that country, and more.

Sales Dashboard

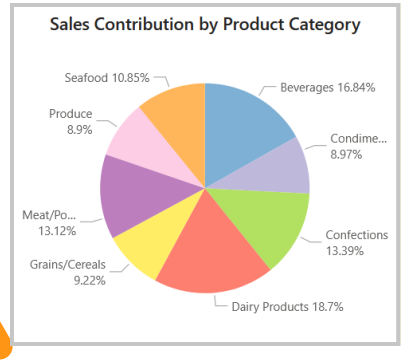
- **Sales by Product Category**

Sales by Product Category

Product Category	Quantity	Total Sales
Dairy Products	4,374	$196,272.03
Beverages	3,996	$176,775.37
Confections	4,137	$140,598.24
Meat/Poultry	2,189	$137,739.15
Seafood	3,679	$113,896.94
Grains/Cereals	2,636	$96,740.93
Condiments	2,895	$94,183.18
Produce	1,583	$93,454.62
Total	**25,489**	**$1,049,660.45**

This table displays product categories, the quantity sold, and sales figures. User can directly see the sales for each product category. **This table will help user to view sales for each product category, providing insights into which product category are performing well and which ones are not.**
The table can also examine sales by category within a specific region by selecting the region in the "Sales by Country" metric. This will be highly useful in understanding sales trends in a particular country. To analyze each category further, this table can be used as a filter for the “Average Sales per Month”, “Top Sales Country”, "Sales by Country“, "Sales by Month/Quarter" metrics.

- **Sales Contribution by Product Category**



This metric displays the proportion of each product category in sales, visualized with a pie chart. The pie chart reaffirms the "Sales by Product Category" table, but with a focus on the contribution of each product category in percentage terms. With this metric, **company leaders will find it easier to see the proportion of sales for each product category compared to the "Sales by Product Category" table.**
Just like the "Sales by Product Category" table, this pie chart can be used as a filter for the " “Average Sales per Month”, “Top Sales Country”, "Sales by Country“, "Sales by Month/Quarter" metrics.

Sales Dashboard

- **Sales by Country**

This metric displays sales based on countries, visualized with a map and green-colored bubbles representing the sales. The larger the bubble, the higher the sales in that country.

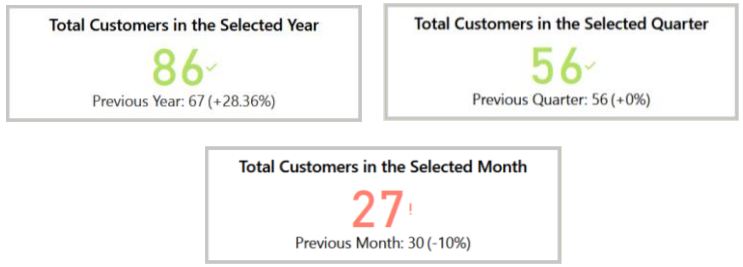
This metric is intended to provide insights to company leaders regarding sales in those countries**. It helps them plan marketing strategies for specific countries, expand their business in countries with higher sales, and more.**

The map can also serve as a filter for the "Sales by Product Category" table, to determine the sales figures and quantities for each product category in a specific country. Additionally, it can be used as a filter for the “Sales Contribution by Product Category" pie chart, “Total Sales”, “Average Sales per Quarter/Month”, “Sales by Quarter/Month”, “Top Sales Category” to get more information about the selected country.

Customers Dashboard

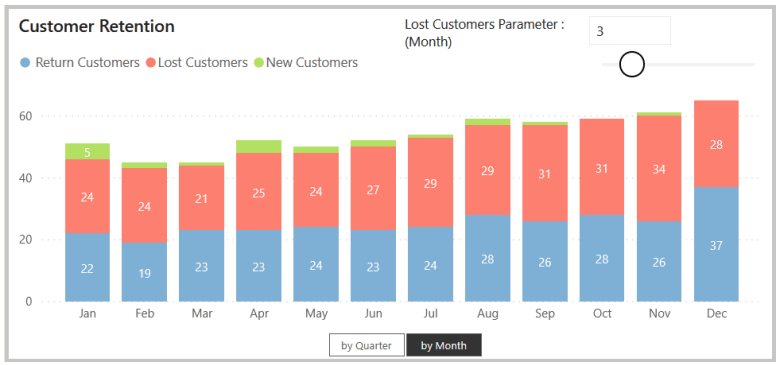
- **Metrics that also displayed in Main Dashboard**

1. Total Customers in the Selected Year/Quarter/Month



2. New Customers

3. Sales by Month/Quarter



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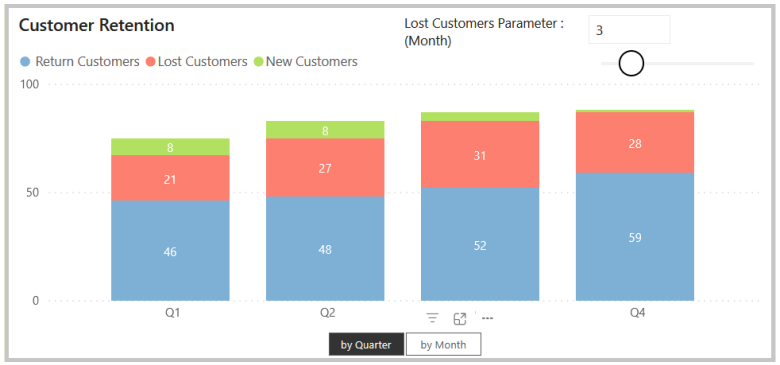
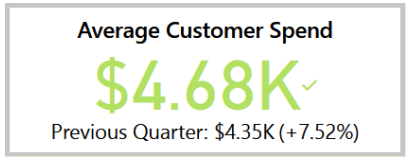


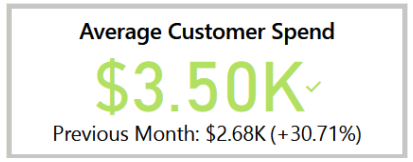
Customers Dashboard

- **Total Customers Since Inception**

This metric displays the number of customers from the inception of the company until a specific time. **with this metric, company leaders can understand the growth of the company over time.**

- **Average Customer Spend**





Average Customer Spend displays the average expenditure of each customer during selected period. Knowing this will **help company leaders measure sales performance, evaluate marketing strategies, and assist in making better business decisions.**

Customers Dashboard

- **Country by New Customers/Total Customers**

There are 2 metrics that can be displayed in this bar chart, "**Country by New Customers**" and "**Country by Total Customers**". Users can choose which metric to display on the slicer located in the top right corner of the bar chart.

This bar chart will provide information about the number of new customers and total customers in each country. Both pieces of **information will help** allocate marketing budgets to countries with potential for **acquiring new customers**, **determine whether to focus on acquiring** new customers **or increasing retention rates** in a particular country, **and evaluate marketing strategies**.

Customers Dashboard

- **Customer Expenditure Summary**

Customer Expenditure Summary

Company Name	Total Expenditure
QUICK-Stop	$103,947.22
Save-a-lot Markets	$98,169.92
Ernst Handel	$81,812.81
Mère Paillarde	$39,687.97
Hungry Owl All-Night Grocers	$34,793.20
Rattlesnake Canyon Grocery	$32,971.43
Simons bistro	$27,611.00
Berglunds snabbköp	$23,557.36
HILARION-Abastos	$22,934.29

Customers Expenditure Summary (New Customers)

Company Name	Total Expenditure
Folies gourmandes	$19,844.98
Great Lakes Food Market	$14,569.67
Gourmet Lanchonetes	$13,622.81
LINO-Delicateses	$12,518.63
Maison Dewey	$9,010.05
Alfreds Futterkiste	$3,440.30
Let's Stop N Shop	$2,888.90
The Cracker Box	$2,757.73
Total	**$93,469.21**

This table displays the amount spent by each customer. **This information will help company leaders measure the level of customer satisfaction**. Customers who spend more tend to be more satisfied with the company's products or services, allowing the company to take specific approaches to retain or increase sales from these customers. The company can also determine other marketing strategies or improve services to increase spending from other customers.

Summary and Development Plan

5

Conclusions

The Sales and Customers dashboard displays various metrics, each serving different functions that will help executives to view data without having to query it manually from the database. This will make it easier for executives and optimize their time efficiency.

The Main Dashboard presents a summary of the Sales and Customers reports, making it even easier for executives to get an overview of both without having to look at the sales and customers reports first.

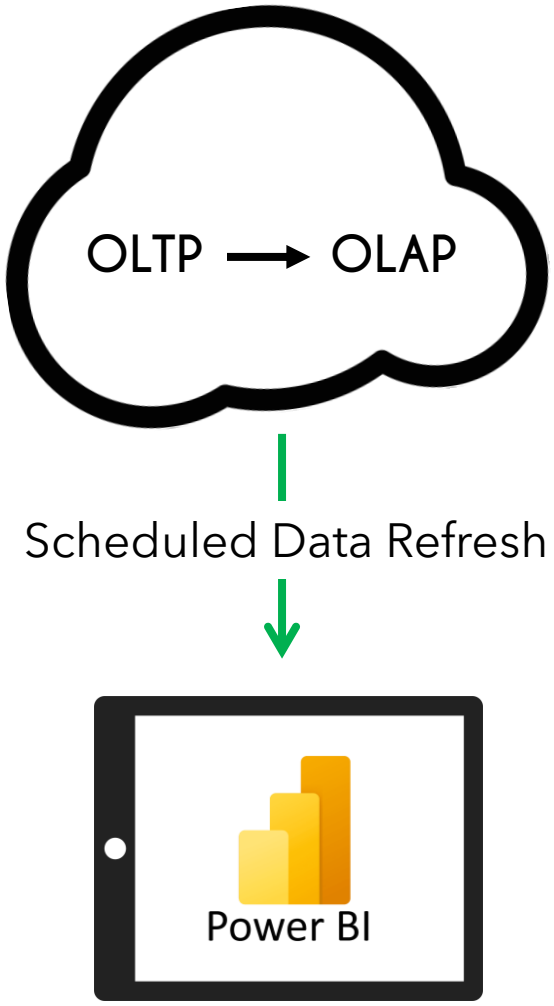
In general, this dashboard will facilitate executives in evaluating the company's performance and aid in decision-making. However, there are still many aspects that can be further developed in this dashboard, which will be explained in the next slide.

Future dashboard development

In this dashboard there are some weaknesses and some things that can be developed. Often this dashboard feels a little slow when transitioning from one page to another, this is because it still uses the OLTP database as the data source. In addition, DAX performance also affects this dashboard.

In the future, we will create a data pipeline to transform the Northwind database from OLTP to OLAP. Data pre-processing and storage will be done using the cloud, so that data can be used anytime by any device and refreshing data on the dashboard can be done automatically. We will modify the time objects in the database to 2021-2023, and adjust the unit prices based on the inflation rate from that period to the current year. This is intended to make the database appear up-to-date and more appealing for use.

Besides that, we will evaluate the DAX's performance and look deeper into the data to explore more important things that can be displayed in the dashboard.



Thank you

It would be my honor to receive your suggestions and criticisms.

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