

# FOOTWEAR RETAIL ANALYSIS

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**DESIGN AND IMPLEMENTATION OF A BI SOLUTION**

**A report written by**

**VICTOR ODOH**

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## Executive summary

Based on specific business questions, this report details every design and implementation process taken to create a BI solution for a footwear retail company. With the dashboard created, top management and store managers can examine data that has been properly visualised and generated from several data sets within the company to produce a precise image of where the company is currently at and to provide precise insights. Analyses from the dashboard revealed that Intangibles typically produce a negative annual profit (Loss) of -£1M for every £1M annual profit made by the Ladies Fashion Boots Market Group, cancelling out the gains. Since reaching a peak in 2015, Year Over Year sales growth has been steadily declining. The lowest Sales Growth rate was observed in 2021, falling by 41.4% from 2020. The 58.9% decline in sales from web transactions for the same year and the 87.5% decline in sales of Ladies Basic Boots between 2020 and 2021 account for the majority of the 41.4% decline in sales observed in 2021.

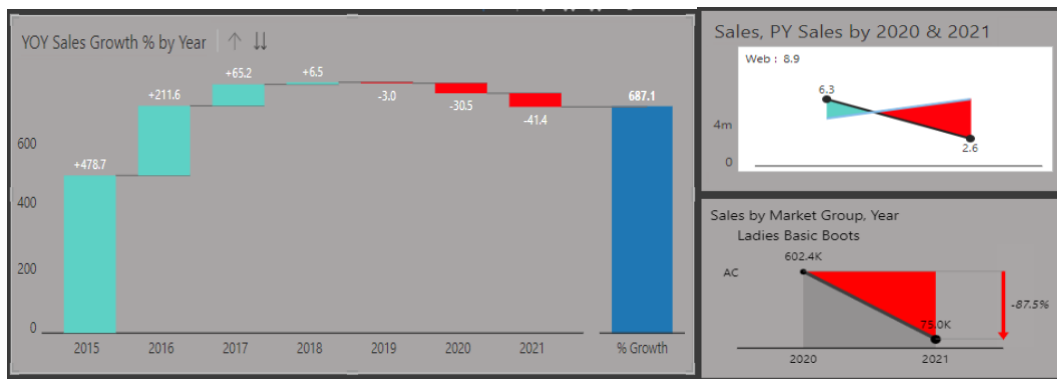


Figure 1.0: Some key visuals generated from the dashboard

More so, despite having the highest sales growth rate (478.7%), 2015 was the first and only year deficit (-£3.3m). This is due to the fact that the Cost of Goods (COGS) for that year (£6.8 million) was much higher than the yearly sales (£3.5 million).

By utilizing more online product-based marketing strategies, the sharp and ongoing decline in sales that began at the end of 2019 can be stopped. Market segments including "Ladies Sport Casual" and "Ladies Fashion Sandals" have had constant sales growth from the year 2020's beginning. More items from these groupings might be disseminated throughout all stores in an effort to boost overall business sales. The continually poor sales performance of intangible products, which is of significant concern, justifies a review and further inquiry. Better marketing tactics for intangibles such as digital assets, service contracts, etc. can reflect true profitability and reduce overall losses.

## 1.0 Introduction

This is a report on the design of a business intelligence (BI) solution that attempts to answer specific business issues using sales data from a footwear retail company and provide analysis that will give its executive management and store managers insights to help with decision-making and planning. For the purpose of this project, the company is assumed to be Deichmann SE, one of the largest footwear retailers in Europe. This report includes recommendations based on the analyses derived from the dashboard as well as a detailed explanation of all processes taken in the development of the BI solution and the dashboard visuals and metrics used.

### 1.1 Data Source

The data set that which was used for this project was retrieved from [https://livesacs-my.sharepoint.com/:x:/g/personal/a\\_occhipinti\\_tees\\_ac\\_uk/EZZMyeL2KzNFjMUElt31tYoB8y5QoBqDxEbN3-nQspF1Pw?e=FKk7ks](https://livesacs-my.sharepoint.com/:x:/g/personal/a_occhipinti_tees_ac_uk/EZZMyeL2KzNFjMUElt31tYoB8y5QoBqDxEbN3-nQspF1Pw?e=FKk7ks) via Teesside Universities Blackboard environment. The link opens up to a list of 23 data sets of which the “Footwear Retail Data Including Customer Data” was the 22<sup>nd</sup>. It is being hosted in the SharePoint account of the module leader, Dr. Annalisa Occhipinti.

#### 1.1.1 The Data Set

The data set consists of 6 tables and a “READMe” text file with short details about the tables. All 6 tables are in the Microsoft Excel .csv format with names and descriptions below:

- i. **Customer Table:** Contains customer data.

Column Name	Description
customer id	Unique ID of each customer
store number	Unique store ID of customers
gender	Customer gender: Male, female or unknown
marital status	Customer marital status
create source	Source of Customer transaction
dob	Customer’s Date of Birth (Empty column, no data)
create date	No data
loyalty opt in	Whether a customer registered for the loyalty programme
loyalty opt in date	Date they registered for the Loyalty programme
email opt in	Email linked to the loyalty registration.
email opt in date	Date of registration

Table 1.0: Customer Table Description

- ii. **Date table:** Contains various time/ date formats from year 2011 to 2031 for representation

as desired in a dashboard design.

<b>Column Name</b>	<b>Description</b>
id	Unique ID for date
date	Date in Date and time format
uk_date	Date in Day, Month and Year
description	Date in words
day_of_week	Day number in week
day_number_of_calendar_month	Day in the calendar month (normal / actual month)
day_number_in_calendar_year	Day in the year
day_number_of_trading_month	Number of trading month
day_number_of_trading_year	Day in trading month
calendar_year	Year
calendar_week_number	Week in calendar year
calendar_month_name	Calendar month in words
calendar_month_number	Number of actual month
calendar_quarter	Actual yearly quarter
trading_week_number	Number of trading week
Trading Month Name	Name of trading month
trading_month_number	Number of trading number
Trading Quarter	Trading yearly quarter
trading_season	Abbreviation of trading season
trading_season_description	Description of trading season
year_season	Abbreviation of season and year
year_season_description	Description of season and year
year_half	Yearly half and year
year_quarter	Yearly quarter and year
year_month	Number of month and year
year_week	Number of week and year
Trading Half	Yearly half of trading date
calendar_half	Yearly half
day_of_week_name	Name of days of the week
Trading Year	Year of trading
trading_date	Date of trading
trading_year_alt	Year of trading
Trading Month	Trading month abbreviated

Table 1.1: Date Table Description

iii. **Product table** : Contains product data.

Column Name	Description
Market Group Code	Unique code for each Market Group
Market Group Description	Name/ description of market group
Merch Group Code	Unique code for each Merch Group
Merch Group Description	Description of merch group
Gender	Product category in terms of customer gender, sundries, others.

Table 1.2: Product Table Description

iv. **Store Table** : Contains data on all the company's stores

Column Name	Description
Store name	Name of the store
Store number	Unique number or ID of each store
Region	Region the store is located (North / south)
Product type	The type of the product sold by store
Location type	The kind of store eg. High street, Retail Park etc.
Country	Country in which store is located
Store type	The type of store eg. Retail, Website, Concession etc.
Store name - short	Shortened name of each store

Table 1.3: Store Table Description

v. **Transaction Detail** Table : Details of all transactions at the item level

Column Name	Description
Transaction ID	Unique ID of each transaction
Transaction Line Number	Represents number of items tied to each transaction ID
Transaction Type	Type of transaction ( Either Sales or Return)
Sales Associate Number	ID number of Sales associate responsible for the transaction
Style Number	ID of the style
Market Group Code	Unique code for each Market Group
Colour Number	Colour ID of product
Size Number	Size Number of product
Quantity	Quantity of the item
Price	Selling price of the item / product
Cost	Cost price of product
Markdown Percentage	Percentage change between original price and any reduction in the original price
Coupon Code	Coupon code assigned to product

Table 1.4: Transaction Details Table Description

vi. **Transaction Header** Table : This contains the details of all sales at the transaction level

Column Name	Description
Transaction ID	Unique ID of each transaction
Transaction Source	Source of the transaction (Either via Web or Store)
Store Number	Unique number or ID of each store where transaction occurred.
Customer ID	Unique ID of Customer that performed the transaction
Sales Associate Number	Unique ID of Sales associate that handled the transaction
Transaction Date	Date of the transaction
Transaction Number	Number representing the n <sup>th</sup> transaction.
Till Number	Till number that handled / registered the transaction
Price	Transaction Value (Summation of the prices of all items / products of the transaction)
Transaction Lines	Represents number of items tied to each transaction ID

Table 1.5: Transaction Header Table Description

## 1.2 BI Requirements/ Questions

The BI solution addresses the following questions:

- How are sales distributed across stores, locations, and over time?
- What have been the sales trends? Have there been any steep changes in the yearly trends? If so, what was/were the contributing factor(s)?
- How are Market Groups performing in terms of sales volume and gross profit over time? What are the top and bottom performing Market Groups in terms of profit and how have they contributed to overall profit growth?
- How are stores performing in sales? Which are the top-performing and underperforming stores and how are the average sales across these stores influenced by product categories?
- Who are the most valuable Customers? What have been their individual contributions to overall company sales over time?



## 2.0 Visuals, Findings, and Discussion

The BI design consists of 7 pages, each with a number of visuals and metrics to help analyze the business questions. The pages are listed below:

- i. Home Page
- ii. Sales Trend Analysis
- iii. Store Performance
- iv. Inactive Stores
- v. Market Group Overview
- vi. Market Group Performance
- vii. Sales Distribution & Customer

### 2.1 Visuals and Metrics

The following subsections further explain the charts and metrics used on each page of the dashboard design. The Home page contains buttons that navigate to each of the pages.

#### 2.1.1 Sales Trend Analysis Visuals and metrics

The following business question is addressed on the Sales Trend Analysis page.

**Business Question:** What have been the sales trends? Have there been any steep changes in the yearly trends? If so, what was/were the contributing factor(s)?

##### Visuals / Metrics Used:

- i. Inforiver Vertical Waterfall Chart - YOY Sales Growth % by Year: This line chart is used to analyze the Year Over Year (YOY) sales growth metrics (In percentage).

The YOY growth metrics measure the change in annual sales between one year and the previous year. This rate gives the user an idea of how the company's sales are performing over time.

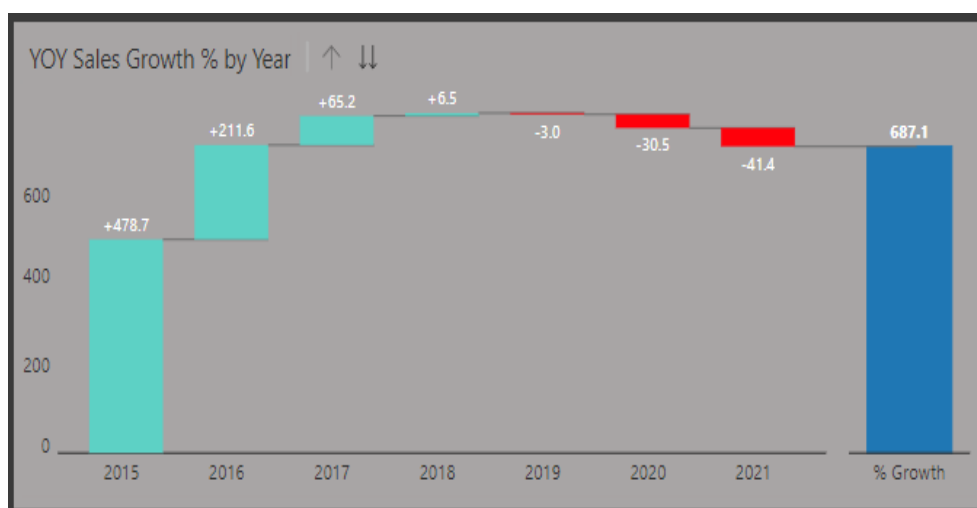


Figure 1.1: Waterfall Chart of YOY Sales Growth% by Year

- ii. Inforiver Line Chart – Sales, COGS, Profit by Year: This chart visualizes the yearly sales, yearly Cost of Goods (COGS), and yearly profit for comparison. It

was introduced to complement the Waterfall Chart of YOY Sales Growth by Year (Figure 1.0). Comparing both charts gives more insight into the Sales growth trends over the years.

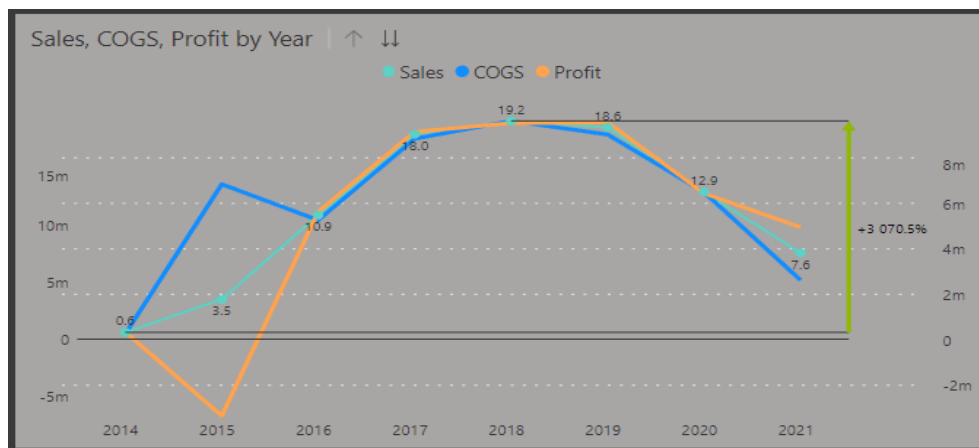


Figure 1.2: Line Chart of Sales, COGS & Profit by Year

Positioning the cursor over a data point on the chart reveals the sales, COGS and Profit corresponding to that point in time.

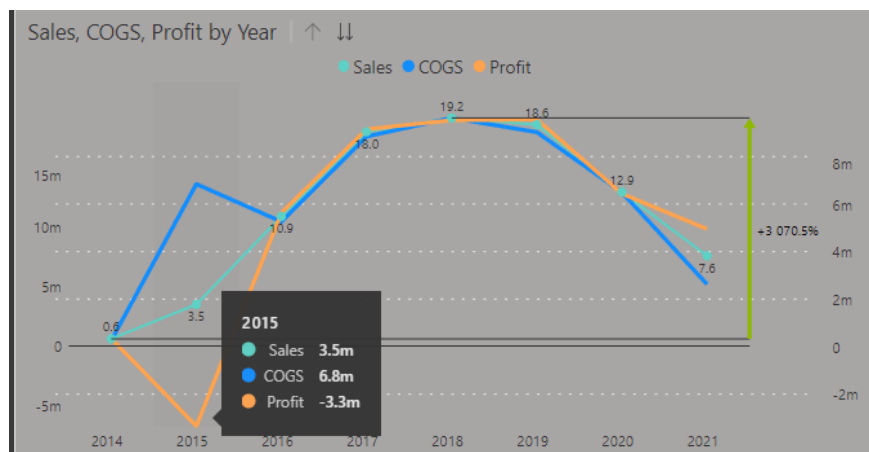


Figure 1.3: Sales, COGS, and Profit in 2015

- iii. Inforiver Integrated Variance Column Chart – Sales, PY Sales by 2015: It is known that the year 2015 recorded the highest sales growth rate. This chart gives an explanation for the steep increase in sales that occurred from 2014 to 2015. It shows the Sales, the Previous Year (PY) Sales, and the change in sales for two product categories, Ladies and Children. Comparing this with figure 1.2 shows that combined sales from both product categories amount to £2.7m which accounts for more than 70% of the 2015 annual sales of £3.5m.

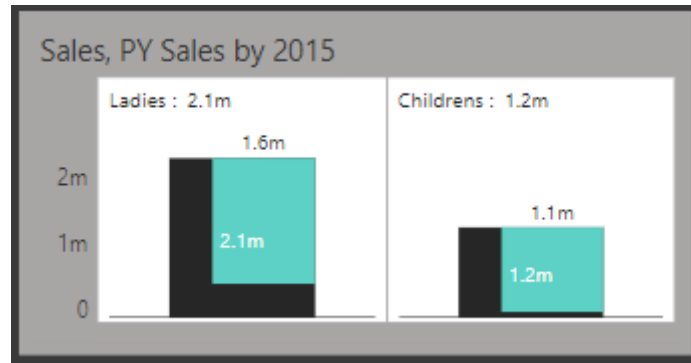


Figure 1.4: Sales, PY Sales by 2015, and product category (Ladies, Children)

- iv. Inforiver Line Chart – Sales, COGS, Profit by 2014 & 2015: This chart shows sales, COGS, and Profit in 2014 and 2015 for the Girls Senior shoes product category. It gives an explanation for the loss of £3.3m recorded in 2015.

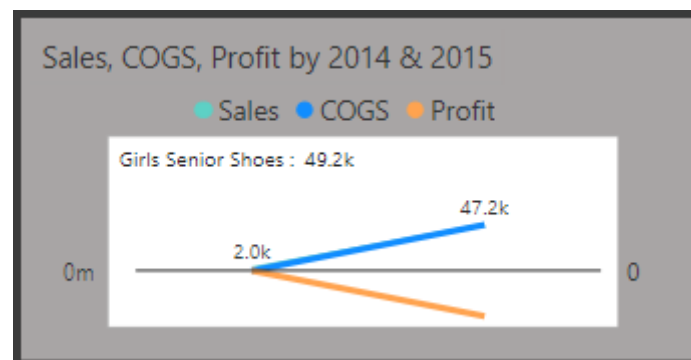


Figure 1.5: Sales, COGS, Profit by 2014 & 2014 and Girl Senior Shoes

- v. Inforiver Variance Line Chart – Sales, PY Sales by 2020 & 2021: These charts visualize the sales and PY sales for the web transaction source in the years 2020 and 2021. It gives an explanation for the least Sales growth rate of 41.4% recorded in 2021.

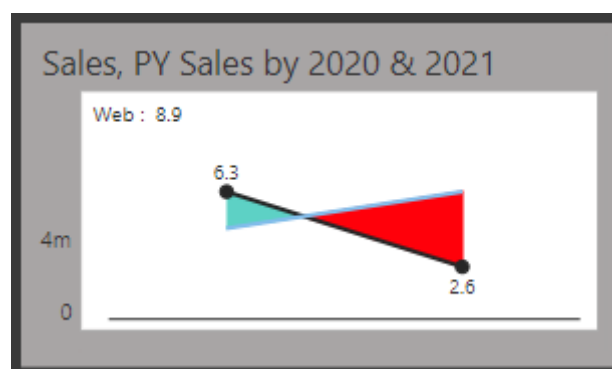


Figure 1.6: Sales, PY Sales by 2020 & 2021, and Web

- vi. Zebra BI Line Chart – Sales by Market Group & Year: This chart further explains the 41.4% decrease in sales in 2021. It shows the Sales in 2020 and 2021, and the sales change % for the “Ladies Basic boots” Market category.

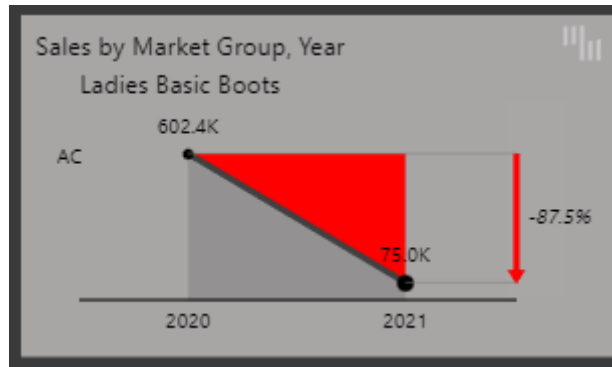


Figure 1.7: Sales by Ladies Basic Boots in 2020 and 2021

- vii. Power BI built-in Line Chart – Sales Growth Rate in two years coming: The forecasting feature was added to this line chart to give the user insight on sales growth trend in two years.

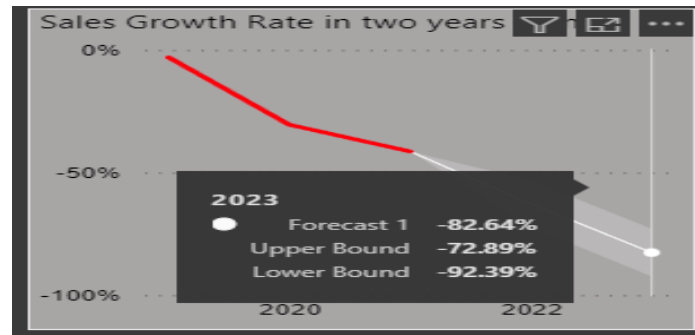


Figure 1.8: Line chart of Sales Growth rate in two years coming

- viii. Multi-card KPIs by TME AG: One of the interesting features of this card visual is that icons can be added to the card visual. These cards are used to visualize the following measures/metrics:

- CAGR % (Sales): The Compound Annual Sales Growth Rate in percentage is a measure of the annual sales growth over a period of time (between 2014 and 2021), with the effect of compounding taken into action. It signifies the rate at which the company grows in sales.
- Net Sales: The total net sales from 2014 to date
- Gross Sales: The total Sales minus returns from 2014 to date

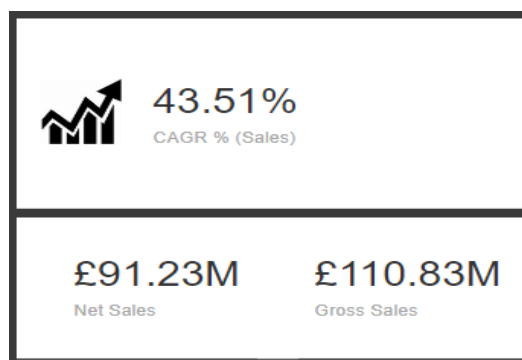


Figure 1.9: Sales Card visuals

## 2.1.2 Store Performance Visuals and Metrics

These visuals and metrics address the following business question:

**Business Question:** How are stores performing in sales? Which are the top-performing and underperforming stores and how are the average sales across these stores influenced by product categories?

### Visuals / Metrics Used:

- Zebra BI Tables Chart – Sales and PY Sales by Store name: This visualizes actual sales, PY sales, and Change in sales for each store in a table for comparison and analysis. Users can view the sales performance of each store at a glance. It is set to interact with the year slicer to provide analysis for each year.

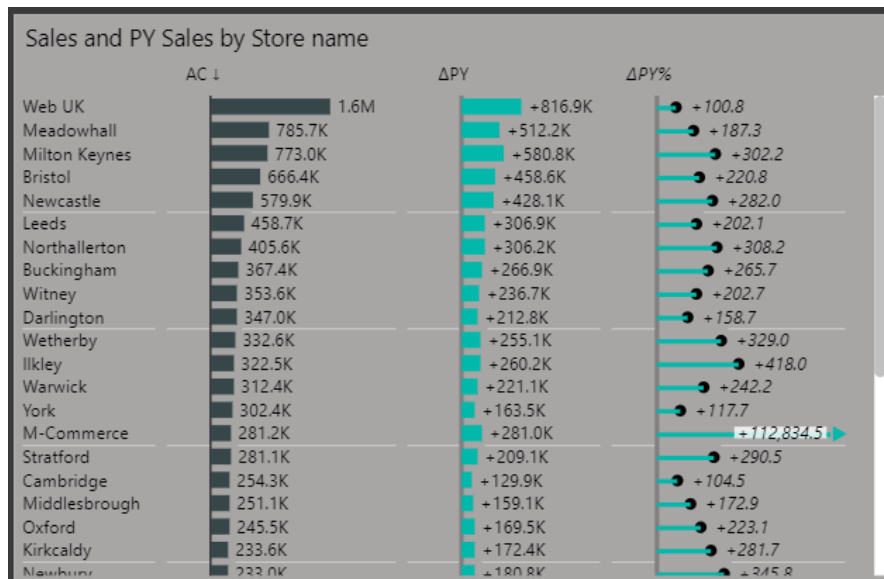


Figure 2.0: Sales and PY sales by Store name

- Key Influencers Visual: This was introduced in the design to analyze how product categories, stores and store types influence Sales. It is set to interact with other charts in the page hence analysis can be done for sales of individual stores when they are selected, and in the same manner for a selected year via the year selection slicer.

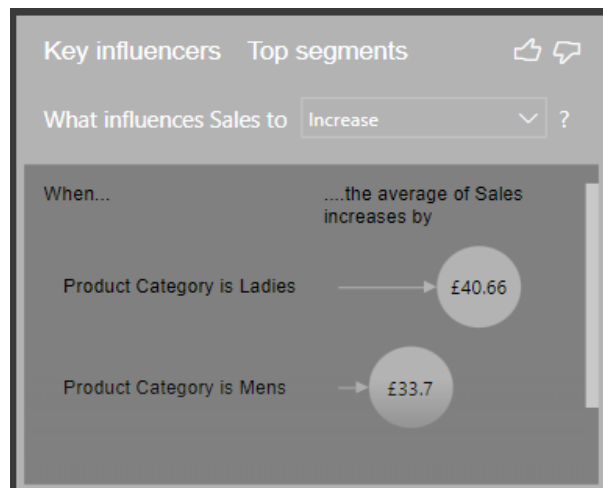


Figure 2.1: Key Influencer – Sales

- iii. Matrix visual: This was introduced in the design to provide visualizations for the average sales by each store over time with options to drill down to product categories on rows and to drill through year, quarter, month and day on column. It is formatted to highlight all stores that are performing below average sales.

Store name	January	February	March	April	May	June	July	August	September	October	November	December	Total
Bristol	£23.01	£26.21	£30.44	£29.26	£28.66	£24.99	£21.20	£26.15	£29.37	£34.98	£33.17	£27.13	£27.52
Buckingham	£26.77	£27.44	£30.00	£30.49	£29.53	£28.29	£25.22	£27.60	£28.94	£33.71	£33.20	£30.62	£28.94
Burford	£45.77	£44.92	£53.41	£45.81	£45.95	£43.10	£39.96	£43.75	£52.76	£56.04	£55.99	£53.80	£47.69
Call Centre	£21.79	£21.46	£21.34	£23.90	£22.55	£21.74	£17.79	£18.55	£22.04	£25.06	£21.93	£21.49	£21.53
Cambridge	£26.56	£28.88	£31.23	£30.86	£30.51	£26.73	£21.83	£27.39	£30.88	£37.51	£37.19	£30.64	£29.59
Cheltenham	£36.79	£38.56	£42.92	£42.81	£41.88	£37.92	£35.18	£38.12	£47.61	£48.61	£45.90	£41.99	£41.66
Chichester	£17.19	£35.58	£29.04	£33.37	£39.84	£36.46	£32.85	£32.73	£22.86	£37.09	£24.23	£23.21	£32.27
Darlington	£21.83	£23.52	£26.27	£26.00	£25.46	£22.69	£20.67	£25.06	£25.60	£30.15	£28.35	£25.73	£24.96
Total	£21.18	£23.42	£26.23	£27.39	£25.90	£23.24	£19.76	£25.02	£26.78	£32.22	£29.68	£25.81	£25.35

Figure 2.2: Matrix chart for average sales of store

- iv. Store Slicer and Advance card Visuals: This a group of Advance card visuals and a Store Selection Slicer. The metrics being visualized by the advance cards give the user insight on the performance of one or more selected stores.

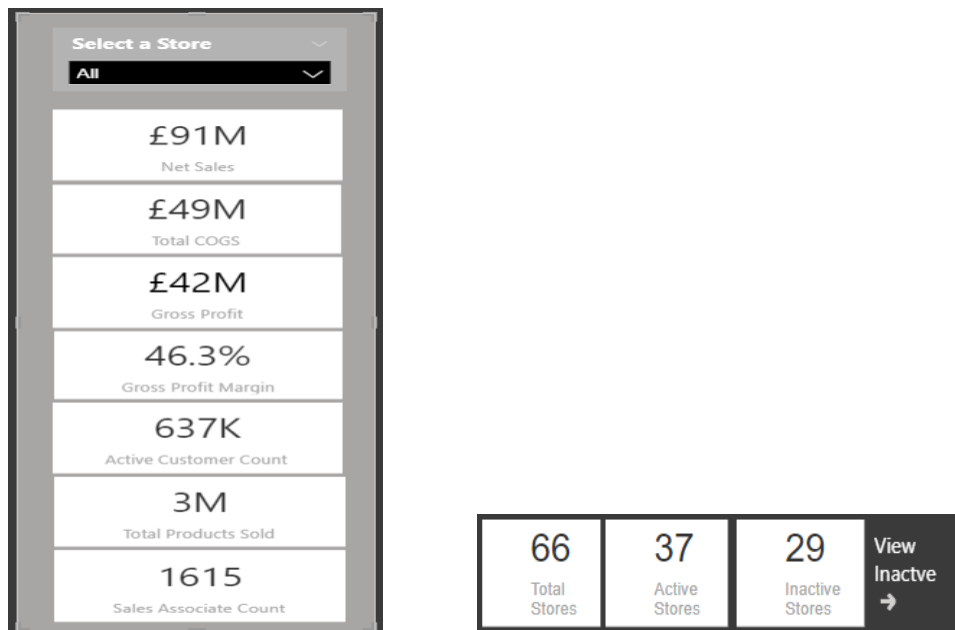


Figure 2.3: Advance Card Visuals and Store Selection Slicer.

The following new measures are visualized in the Store Performance Page:

- Total COGS: The Total Cost of Goods Sold hence, the total cost of products sold.
- Gross Profit: The Net Sales minus the COGS.
- Gross Profit Margin: This measures the financial health of a selected store or the company in general. It is the Gross profit expressed as a percentage of Net Sales.
- Active Customer Count: Number of customers that have made a purchase(s) between 2014 and 2021.
- Total Products Sold

- Sales Associate Count: Numbers of Sales associates
- Total Stores
- Active Stores: All active stores since 2014
- Inactive Stores: All Stores with no activity since 2014

A “View Inactive” button was created to navigate to a list of all inactive stores.

- Power BI built-in Table visual and Aster Plot 1.4.0 visual: In the “Inactive Stores” Page, all inactive stores are visualized using a table with “location type” and “store type” columns. The Aster plot chart shows the percentage of inactive stores by store type.

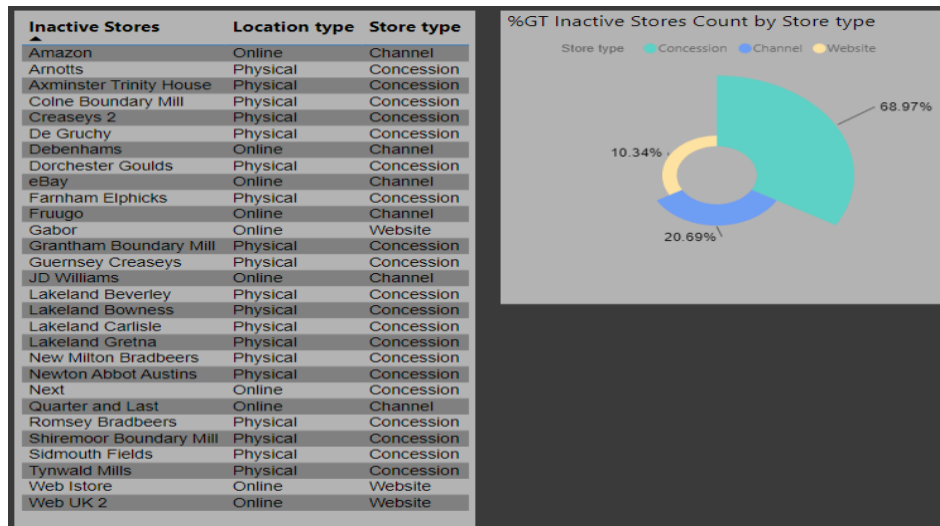


Figure 2.4: Inactive Stores

### 2.1.3 Market Group Overview / Performance Visuals and Metrics:

The following business question is addressed here.

**Business Question:** How are Market Groups performing in terms of sales volume and gross profit over time?. What are the top and bottom performing Market Groups in terms of profit and how have they contributed to overall profit growth.

#### Visuals / Metrics Used:

- Scroller Visual and Animated Bar Chart Race Visual: These Scroller visual is an animated chart which visualizes Market Group sales and profits with an animated effect that keeps them scrolling horizontally across the window. The Animated Bar Chart Race was introduced to visualize change in Sales trend of Market Groups over time. In figure 2.5 below, the Scroller visual is located at the top of the Animated Bar Chart Race visual.

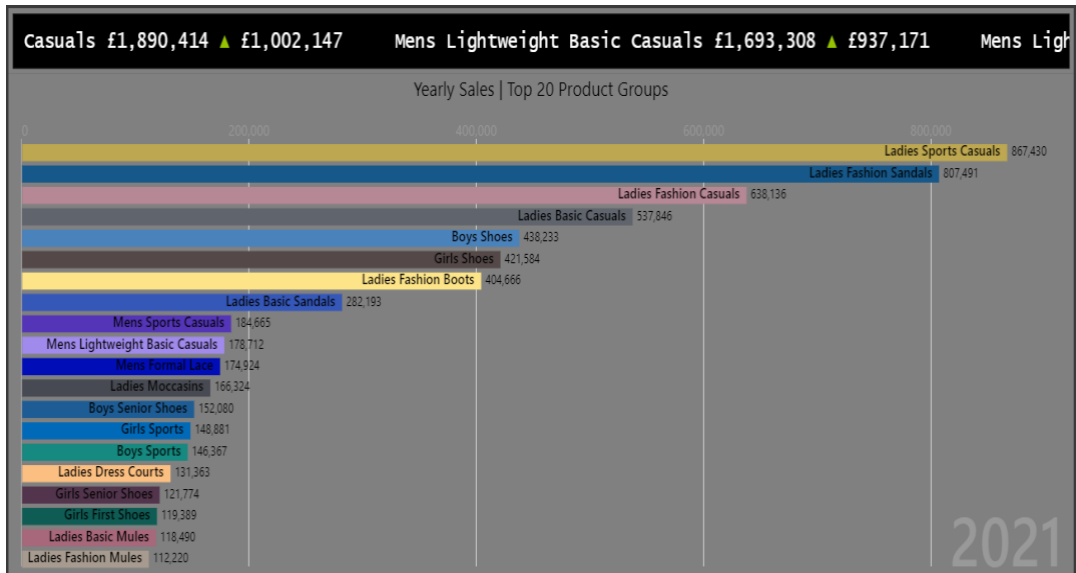


Figure 2.5: Scroller and Animated Bar Chart Race Visuals.

- ii. Funnel Chart: This is used to visualize the % of the grand total of the Return on Sales, contributed by each product category. Figure 2.6 below includes a card visual displacing the total amount of Returns on Sales.



Figure 2.6: Return on Sales by Product Category

- iii. Zebra BI Chart – Profit and PY Profit by Year: Found in the Market Group Performance Page. It also visualizes the percentage change in profit between a year and the previous. It is set to interact with the Profit by Top and Bottom 5 Market Groups and can be used to analyze the profit trends of each of the Top / Bottom 5 Market Groups. It also interacts with a Market Group Selection Slicer with which a user can select any Market Group to be analyzed.

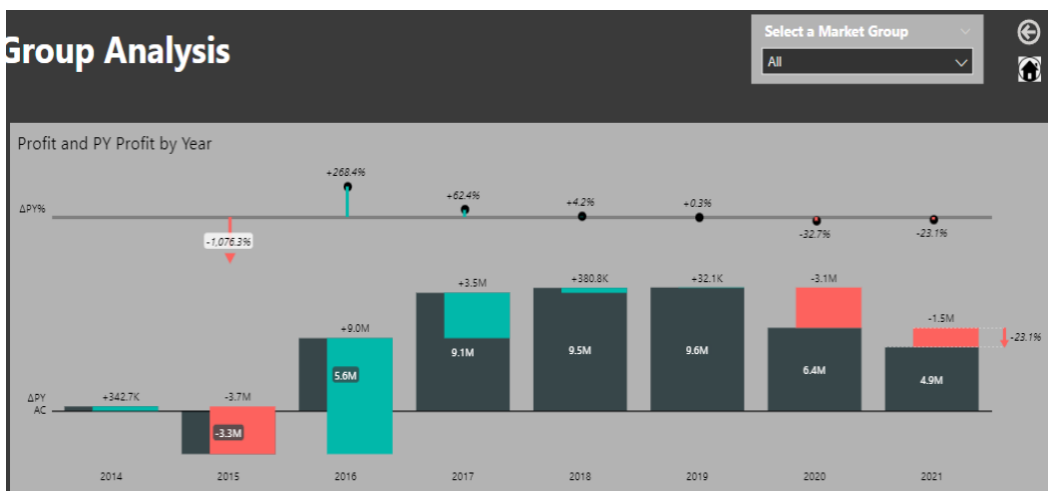


Figure 2.7: Profit and PY profit by Year with Market Group Selection Slicer



- iv. Inforiver Horizontal lollipop Charts: They are used to visualize the profit by the Top 5 and Bottom 5 Market Groups showing the % difference between the highest and lowest values.

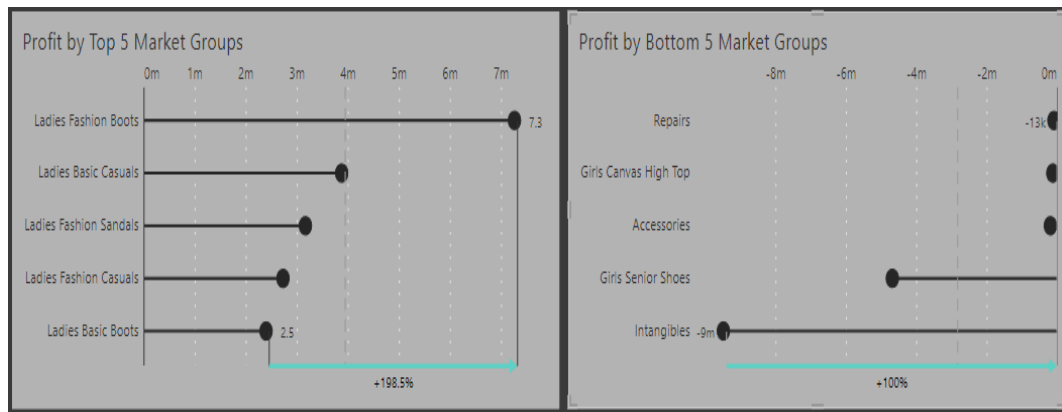


Figure 2.8: Profit by Top and Bottom 5 Market Groups

- v. Area Chart – Profit by Year and Best/Worst Performer: This is used with a trend line to analyze and compare at a glance, the yearly trends of profit by the Best performing and worst performing Market Groups (Intangibles and Ladies Fashion Boots).

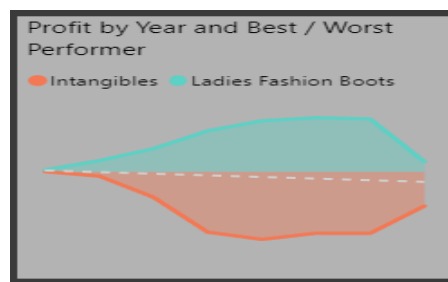


Figure 2.9: Profit by Year and Best/Worst Performer

The following new metrics were introduced:

- Avg. Revenue Per Market Group: The average of Market Group sales.
- Market Group Count: Number of Market Groups
- Return on Sales: Total amount of Sales returns
- Gross Sales, Gross Profit
- CAGR % (Profit): The Compound Annual Profit Growth Rate in percentage is a measure of the annual profit growth over a period of time (between 2014 and 2021), with the effect of compounding taken into action. It signifies the rate at which the company grows in profit.
- Profit by Top 5 Market Groups (MG)
- Profit by Bottom 5 MG
- Avg. Average Profit contributed by each of the Top 5 MG
- Avg. Profit by Bottom 5 MG: Profit contributed by each of the Bottom 5 MG

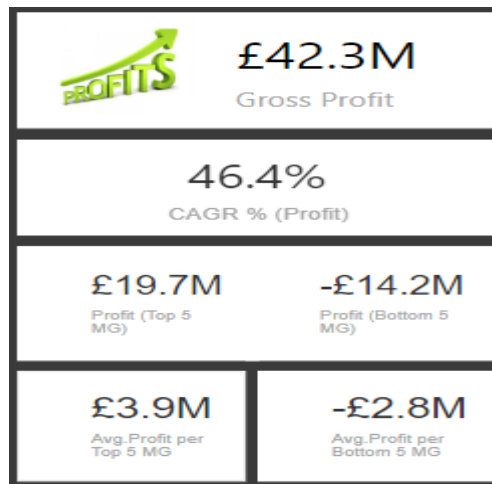


Figure 2.10: Card Visuals for Market Group Performance Measures

## 2.1.4 Sales Distribution and Customer Dashboard Visuals and Metrics

The following business questions are addressed here

### Business Questions:

- How are sales distributed across stores, locations, and over time?
- Who are the most valuable Customers? What have been their individual contributions to overall company sales over time?

### Visuals / Metrics Used:

- Decomposition Tree: This was introduced to visualize sales distribution across 4 dimensions (Date, Store Type, Store name and Market Group).

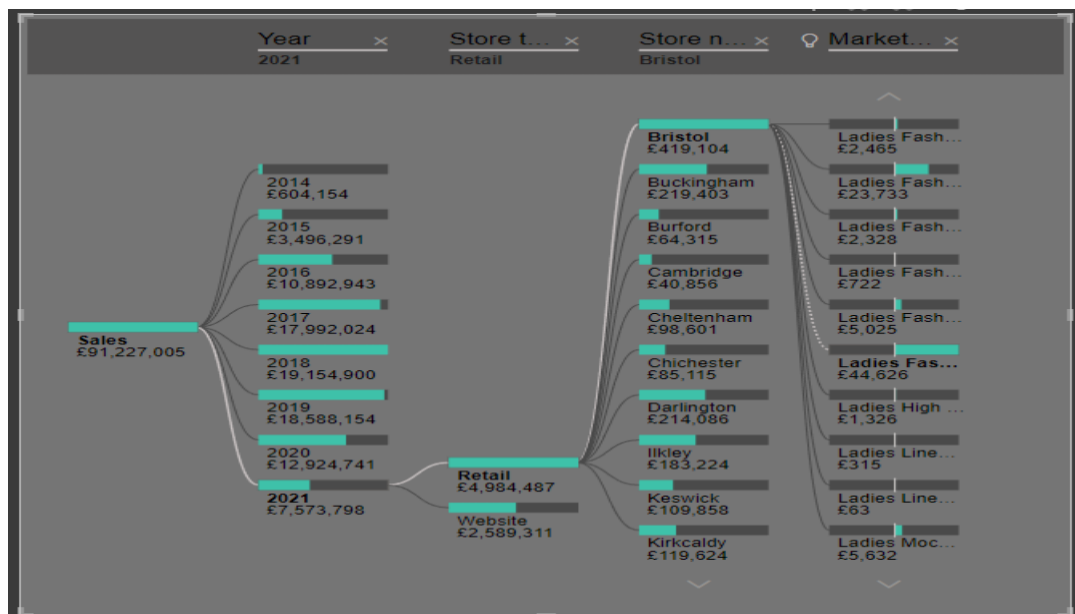


Figure 2.11: Sales Distribution Across 4 Dimensions

- Matrix and card Visuals: The matrix displays the top 3 customers represented by Customer ID. It includes Customer ID, Sales, and Items (number of products bought) columns. A user can drill down the rows to the Store type and Store

name where customers have made purchases.

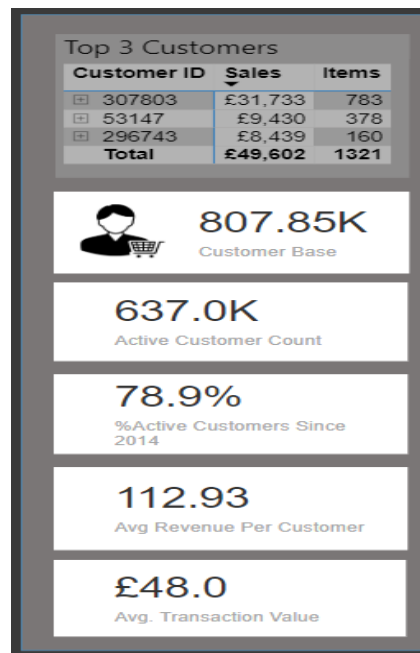


Figure 2.12: Top 3 Customers and Customer metrics

The metrics created for visualization on the page are as follows:

- Customer Base: Count of all customers in the Customer Table
  - Active Customer Count: All customers that made one or more purchases between 2014 and 2021
  - %Active Customers Since 2014
  - Avg. Revenue Per Customer
  - Avg. Transaction Value: The average amount spent on a transaction by a customer
- iii. Clustered Bar Chart and Line Chart: The clustered bar chart shows sales distribution by country. The line chart shows the trend in sales distribution by calendar half over time.

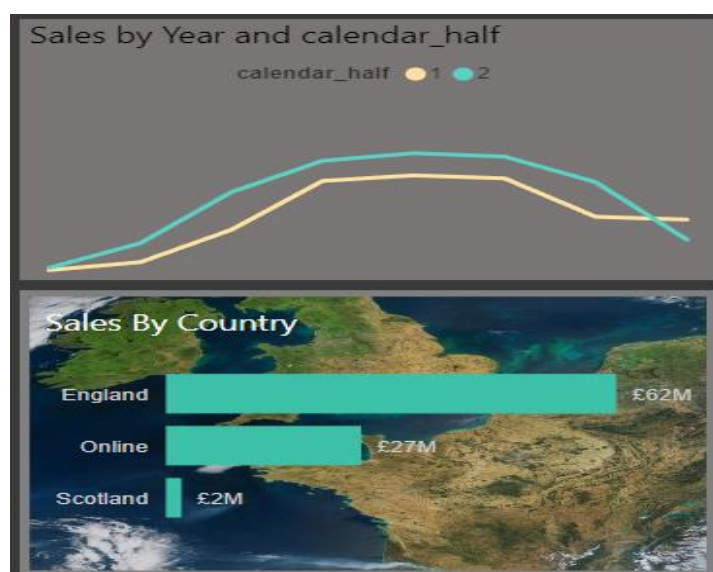


Figure 2.13: Sales Distribution by Calendar half, By Country

- iv. Aster Plot 1.4.0 – Sales By Store Type: Used to visualize the data in form of radical slices whose arcs represent each of the Store Types.

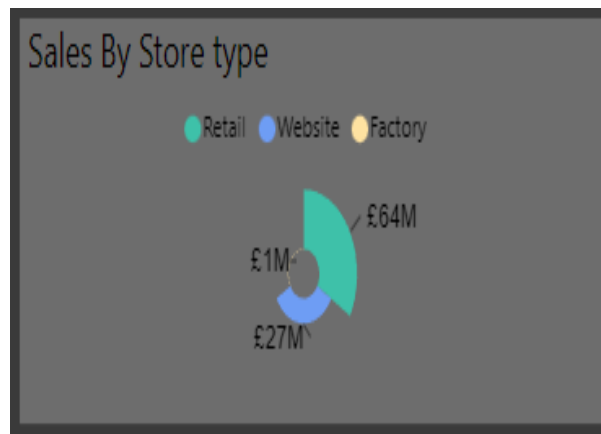


Figure 2.14: Aster Plot of Sales By Store Type

## 2.2 Key Findings

The following key findings are derived from analysis based on the BI visuals discussed in section 2.1 above.

- The highest YOY sales growth ever recorded was in 2015, a record 478.7% sales increase from the year 2014 to 2015 (figure 1.0).
- YOY Sales growth has been on a steady decline since its peak value in 2015 (figure 1.0).
- 2015 saw the first and only year loss (-£3.3m), despite having the highest sales growth rate (478.7%). This is because the Cost of Goods (COGS) (£6.8 million) was significantly greater than the yearly sales (£3.5 million) for that year. (figure 1.2).
- The high COGS and huge loss in 2015 can be attributed to the Market Group “Girl Senior Shoes” which recorded an annual sale of about £42, 200, annual COGS of £5.3M, and a consequent loss of £5.2M. The contributing COGS from this market group accounts for more than 70% of the total COGS (£6.8M) for 2015 (Figure 1.4)
- 2021 recorded the least Sales Growth rate, a 41.4% decline from 2020. ( figure 1.0).
- Most of the 41.4% decrease in sales recorded in 2021 can be attributed to the 58.9% fall in sales via web transactions for the same year (Figure 1.5) and also the 87.5% fall in sales of Ladies Basic Boots between 2020 and 2021 (figure 1.6).
- Ladies Fashion Boots had been the best-performing Market group and maintained a constantly increasing Sales growth from 2014 to the tail end of 2019. In early 2020, its sales suddenly began to experience a steady fall till the end of 2021. At about the same time when it began to fall, the Ladies Sport Casual and Ladies Fashion Sandals Market Groups began to experience a steady increase in sales till the end of 2021. At the end of 2021, both Market Groups

were positioned at the 1<sup>st</sup> and 2<sup>nd</sup> positions respectively, in annual sales (Figure 2.5)

- Web Uk has been the best-performing store in terms of sales with a total of £17.2M in sales while Web Till records £744 pounds in sales as the worst performer (figure 2.0)
- 29 stores of the company's 66 stores have been inactive since 2014. About 70% of these inactive stores are Concession Stores (Figure 2.3, 2.4)
- The "Intangibles" product category alone contributed to 50.47% of the Return on Sales (Figure 2.6).
- On average, for every £1M annual profit contributed by the Ladies Fashion Boots Market Group, Intangibles contributes a negative annual profit (Loss) of -£1M thereby canceling the profits out (Figure 2.9).
- Over time, more sales have been recorded in the second half of the year than in the first (Figure 2.13).

### **3.0 Conclusion and Recommendations**

Microsoft Power BI has established itself as a powerful business analytics and data visualisation tool that enables organisations of all sizes to close the information-decisions gap. It is impossible to overstate the importance of the practical knowledge acquired via the module course work and additional research for the successful design and implementation of this project.

Based on the Key findings from the analysis provided by the dashboard the following management actions are recommended:

- The rapid and continuous decrease in sales that started at the end of 2019 can be reversed by implementing more online product-based marketing techniques.
- Since the start of the year 2020, market groups including "Ladies Sport Casual" and "Ladies Fashion Sandals" have consistently increased sales. To increase overall company sales, more items from these groupings might be distributed across all stores.
- A review and further investigation are warranted due to the consistently subpar sales performance of Intangible goods, which is of grave concern. Better marketing strategies for digital assets, service contracts, etc. can reflect actual profitability and cut down on overall losses.

## A Appendix: BI Design

### A.1.0 Data Pre-processing / Cleaning

The data set consists of 6 tables. All tables are of the microsoft excel .csv file format. All steps taken to pre-process the data are detailed in the following subsections:

#### A.1.1 Loading the Data set into Power BI Desktop for Windows.

After launching the application and signing into my account, the first step was importing the data set into the Power BI Desktop app. The following steps were taken;

- i. **Get Data** button was clicked. It is located within the **Home tab** in ribbon at the top of the Power BI Desktop window. The Get Data dialogue window was launched.
- ii. Selected the *Text/CSV* file format, clicked the **Connect** button to launch the **open** window and then navigated to the location of the folder containing the data set. (*C:\Users\c2397722\Downloads\C2397722\_Odoh.Victor*)
- iii. Selected the *Transaction Detail* Table, clicked the **open** button and was taken to the **Load** window. Clicked the **Load** to import the table into Power BI Desktop.
- iv. Repeated i – iii to import the other tables.

#### A.1.2 Removing Errors

While Loading the *Customer* table, the load window displayed an error message. The following steps were taken to deal with the errors.

- i. Clicked the *View errors* link and was taken to the error window within the Power Query Editor Window. The errors were located in the *Create Source* column of the *Customer* Table. I navigated to same column but in the *Customer* Table in the Power Query Editor Window.
- ii. Right-clicked on the column header. Selecting the **Remove errors** option would also delete all corresponding rows of data in the table and I may lose a lot of data in the process. Being that I did not need the *Create Source* Column for my dashboard design, I selected the **Remove Column** option and the column was deleted from the table.
- iii. Clicked **Close & Apply** to apply the steps of removing the column

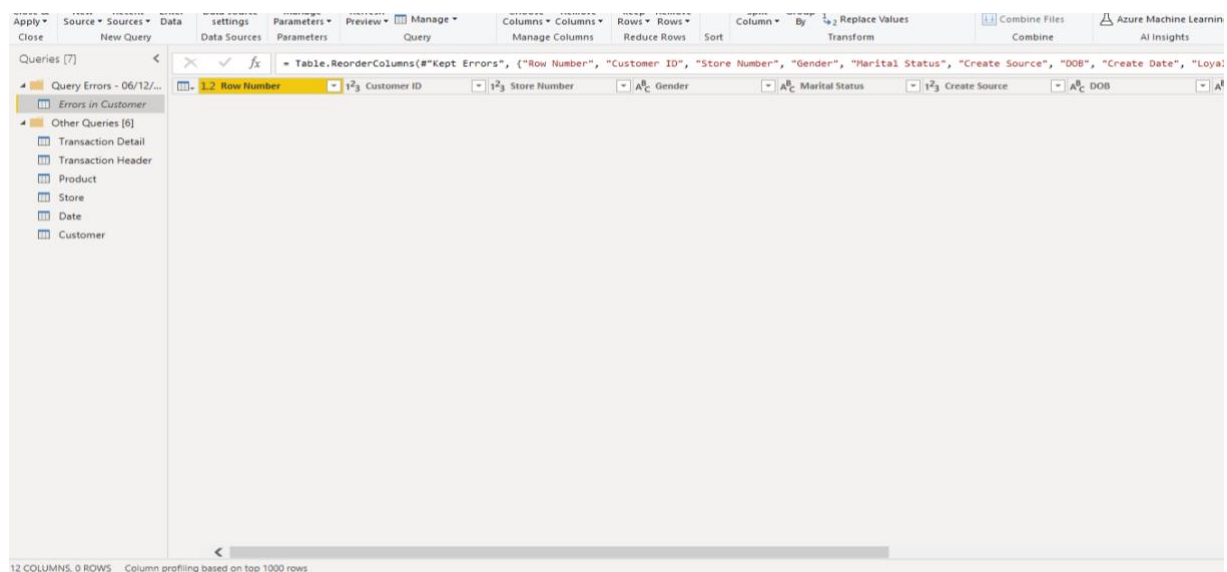


Figure A1.0: Errors removed

All imported tables appeared in the fields pane on the right of the power BI desktop window as shown in figure A1.1 below

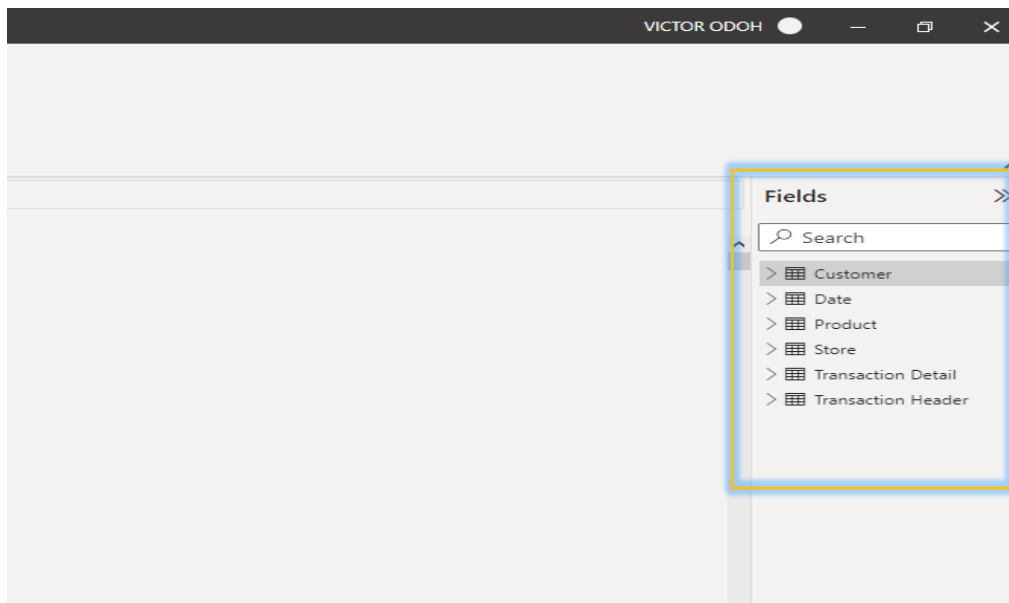


Figure A1.1 All Tables imported

### A.1.3 Removing Columns

Several columns were removed from the tables. The steps taken to remove a column are as follows:

- i. Clicked the **Transform Data** button located within the Home Tab in the Ribbon of the Power BI window in order to launch the **Power Query Editor** Window.
- ii. Right-clicked the column header of the column to be removed. To remove multiple columns at once, I pressed down CTRL while clicking on the column headers of all columns to be removed.
- iii. After highlighting these columns, I right-clicked on one of the selected column headers and clicked the **Remove Columns** to deleted all selected columns.

Using the steps detailed above, the following columns were removed from the following tables:

- Transaction Detail Table: Columns removed are;
  - i. *Transcation Line Number*
  - ii. *Style Number*
  - iii. *Colour Number*
  - iv. *Size Number*
  - v. *Markdown Percentage*
  - vi. *Coupon Code.*

Queries [9] fx = Table.RemoveColumns(#"Changed Type",{"Transaction Line Number", "Style Number", "Colour Number", "Size Number", "Markdown Percentage", "Coupon Code"})

	1 <sup>2</sup> Transaction ID	A <sup>B</sup> Transaction Type	1 <sup>2</sup> Sales Associate Number	1 <sup>2</sup> Market Group Code	1 <sup>2</sup> Quantity	1 <sup>2</sup> Price	1 <sup>2</sup> Cost
1	2733513	Sale		60101	1	0	0
2	3498469	Sale		60101	1	0	0
3	2733917	Sale		60101	1	0	0
4	2775861	Sale		60101	1	0	0
5	3194883	Sale		60101	1	0	0
6	3537798	Sale		60101	1	0	0
7	2769693	Sale		60101	1	0	0
8	2721437	Sale		60101	1	0	0
9	2721442	Sale		60101	1	0	0

Figure A1.2: Transaction Detail Columns left after removing unwanted columns

- Transaction Header Table: Columns removed are;

i. *Till Number*

- Product Table:

i. *Merch Group Code*

ii. *Merch Group Disription*

Queries [9] fx = Table.RemoveColumns(#"Changed Type",{"Merch Group Code", "Merch Group Description"})

	1 <sup>2</sup> Market Group Code	A <sup>B</sup> Market Group Description	1 <sup>2</sup> Gender Code	A <sup>B</sup> Gender
1	30105	Girls Senior Shoes	3	Childrens
2	30303	Girls Infant Canvas	3	Childrens
3	30503	Girls Sports	3	Childrens
4	30703	Girls Sandals	3	Childrens
5	30502	Girls Infant Sports	3	Childrens
6	30101	Girls Prewalkers	3	Childrens
7	31703	Unisex Sandals	3	Childrens
8	31502	Unisex Infant Sports	3	Childrens

Figure A1.3: Product table columns left after removing unwanted columns

- Store Table:

i. *Store name – short*

ii. *Product type*

Queries [9] fx = Table.ReplaceValue(#"Replaced Values in Location type","", "Online", Replacer.ReplaceValue, {"Region", "Country"})

	A <sup>B</sup> Store name	1 <sup>2</sup> Store number	A <sup>B</sup> Region	ABC 123 Location type	A <sup>B</sup> Country	A <sup>B</sup> Store type
1	Bristol	10	South	Physical	England	Retail
2	Buckingham	15	South	Physical	England	Retail
3	Burford	17	South	Physical	England	Retail
4	Cambridge	20	South	Physical	England	Retail
5	Cheltenham	25	South	Physical	England	Retail
6	Chichester	27	South	Physical	England	Retail
7	Darlington	30	North	Physical	England	Retail
8	Glasgow	35	North	Physical	Scotland	Retail

Figure A1.4: Store table columns left after removing unwanted columns

- Date Table: For this table, a lot of columns were deleted. I had selected the columns I needed and chose the **Remove other columns** option hence I was left with the following columns;

i. *id*

ii. *uk\_date*



iii. *calender\_half*

	id	uk_date	calendar_half
1	22358	09/12/2012	2
2	22359	10/12/2012	2
3	22360	11/12/2012	2
4	22361	12/12/2012	2
5	22362	13/12/2012	2
6	22363	14/12/2012	2
7	22364	15/12/2012	2
8	22722	08/12/2013	2
9	22723	09/12/2013	2

Figure A1.5: Date table columns left after removing unwanted columns

- Customer Table: Columns removed are;
  - i. *Create source*
  - ii. *DOB*
  - iii. *Create Date*
  - iv. *Loyalty opt in*
  - v. *Loyalty Opt in Date*
  - vi. *Email Opt in*
  - vii. *Email Opt in Date*
  - viii. *Gender* (Had too many unknowns, 527,679 out of 807,852 rows)
  - ix. *Marital Status* (had too many unknowns, 797,742 out of 807,852 rows)

	Customer ID	Store Number
1	343724	999
2	352402	999
3	440364	999
4	444677	999
5	479769	999
6	568534	999
7	570862	999
8	570981	999
9	590201	999

Figure A1.5: Customer table columns left after removing unwanted columns

#### A.1.4 Renaming Columns and Changing Data Type

To rename a column, I right-clicked on the column header and selected the **Rename** option. This highlighted the column name and then I typed in the desired name.

To change Column Data Type, I right-clicked on a column header and chose the **Change Type** , then further selected the desired Type.

The steps above were applied to change the following column names and Data Types of the following tables:

- *Transaction Detail* Table: The following columns were renamed;
  - Price* – Renamed as *Unit Price*
  - Cost* – *Unit Cost*

Transaction Type	Sales Associate Number	Market Group Code	Quantity	Unit Price	Unit Cost
2733513 Sale		0	60101	1	0
3498469 Sale		0	60101	1	0
2733917 Sale		0	60101	1	0
2775861 Sale		0	60101	1	0

Figure A1.6: Columns of Transaction Detail table renamed

- *Transaction Header* table:  
Changed the *Transaction Date* Column Type from the “Date/Time” Type to the “Date” Type

Transaction Source	Store Number	Customer ID	Sales Associate Number	Transaction Date
2847397 Web		305	2909	03/03/2017
2200386 Web		305	847	01/04/2015
1295070 Web		305	5697	28/03/2014
1296566 Web		305	5697	30/04/2014
2162588 Web		305	5697	28/03/2014

Figure A1.7: Transaction Date Column Type changed to “Date” type

- *Product* Table:  
The Following columns were renamed:
  - Gender* – renamed as *Product Category*
  - Gender Code* – renamed as *Category Code*
  - Market Group Description* – changed to *Market Group*
- *Date* Table:
  - uk\_date* – renamed as *calender\_date*

id	calender_date	calender_year
1	22358	09/12/2012
2	22359	10/12/2012
3	22360	11/12/2012
4	22361	12/12/2012
5	22362	13/12/2012
6	22363	14/12/2012
7	22364	15/12/2012
8	22722	08/12/2013

Figure A1.8: *uk\_date* column of *Date* Table renamed

- *Customer* table:  
Changed the Customer ID column data type from the “whole number” Data Type to the “Text” data type.

The screenshot shows the Power BI interface with a table named 'Customer'. The 'Customer ID' column is highlighted in yellow. Above the table, the formula bar contains the M language code: `= Table.TransformColumnTypes(#"Removed Columns",{{"Customer ID", type text}})`. The table data is as follows:

Customer ID	Store Number	Gender	Marital Status	Loy
343724		999	Unknown	Non Op
352402		999	Unknown	Non Op
440364		999	Unknown	Non Op
444677		999	Unknown	Non Op
479769		999	Unknown	Non Op

Figure A1.9: *Customer ID* column Data Type Changed to “Text” Type

### A.1.5 Replacing values and Dealing with blanks

Using M Language, some values and blanks were replaced with other values in the *Store* Table as follows;

- Within the *Location type* column, the following values were replaced;
  - “Shopping Centre” – replaced with “Physical”
  - “High Street” – replaced with “Physical”
  - “Retail Park” – replaced with “Physical”
- It was discovered that the Region and Country Columns contained blanks. After reviewing and comparing these columns with others within the *Store* table, it was logical to replace the blanks with “Online” as they corresponded to online store names.

The screenshot shows the Power BI interface with a table named 'Store'. The formula bar contains the M language code: `= Table.ReplaceValue(#"Replaced Values in Location type", " ", "Online", Replacer.ReplaceValue, {"Region", "Country"})`. The table data is as follows:

Store name	Store number	Region	Location type	Country	Store type
Sterling Mills	215	North	Physical	England	Factory
Stoke	220	North	Physical	England	Factory
Web UK	305	Online	Online	Online	Website
Web UK 2	306	Online	Online	Online	Website
Web Till	310	Online	Online	Online	Website
Web Istore	315	Online	Online	Online	Website
Web EU	320	Online	Online	Online	Website
Web ROW	325	Online	Online	Online	Website
Call Centre	330	Online	Online	Online	Website
M-Commerce	335	Online	Online	Online	Website
Debenhams	340	Online	Online	Online	Channel
Amazon	345	Online	Online	Online	Channel
eBay	350	Online	Online	Online	Channel
JD Williams	355	Online	Online	Online	Channel
Quarter and Last	360	Online	Online	Online	Channel
Gabor	365	Online	Online	Online	Website
Fruugo	396	Online	Online	Online	Channel
Arnotts	405	South	Physical	Ireland	Concession

Figure A1.10: Values replaced in *Store* table

More details of the use of M language in this pre-processing step are given in section A3.2

### A.1.6 Merging Tables

In an attempt to utilize a Star Schema Model for my BI design, I decided to merge some tables. It was observed that the *Transaction Detail* table contained the most data and was mostly related to the rest of the tables in the data set. Hence it was the best option that should be converted to a Fact table.

Before beginning the Merging process, the following were considered;

- The *Customer*, *Store*, and *Date* tables could be linked to the *Transaction header* table via the *Customer ID*, *Store Number*, and *Transaction Date* columns respectively.
- The *Transaction Header* table could be linked to the *Transaction detail* table via the *Transaction ID* columns of both tables.
- The *Transaction Detail* table could be linked to the *Product Table* via the *Market Group Code* Columns of both tables.

The goal was to look for a way to link all tables to the *Transaction Detail* table. Considering the points above, the best way was to merge the *Transaction Header* table to the *Transaction Detail* table and then expand into *Transaction Detail*, all the key columns that related to the other tables.

The following steps were taken to merge tables:

- In the right pane of the Power Query Editor and under the “Other Queries” section, I right-clicked the *Transaction Detail* Table and selected the **Duplicate** option. A duplicate table was created. I right-clicked the duplicate table and renamed it “Custom Fact”.
- With Custom Fact Table highlighted, I clicked on the **Merge Queries** button located in the Power Query Editor’s Home tab, and the **Merge** window was opened. The *Custom Fact* table was already selected as it appeared in the Merge window.
- In the lower pane of the window, I selected the *Transaction Header* Table and matched both tables by pressing down CTRL while clicking on the *Transaction ID* Columns of both tables after which I clicked the **Ok** button. A *Merged Queries* step was updated in the Applied Steps section on the left pane and a “Transaction Header” column was created as a pivot table to expand its columns based on selection, into the *Custom Fact* Table.
- On the column header, I clicked the icon at the right and a dialogue window was opened. I clicked on the “Select All Columns” to untick all columns and then proceeded to tick only the columns (*Customer ID*, *Store Number*, and *Transaction Date*) that needed to be expanded into the *Custom fact* table, unticked the “Use original Column name as prefix” box and then clicked **Ok**.
- The required columns were expanded into the *Custom Fact* table. To complete the Merging process
- Clicked **Close & Apply** to apply the steps

Unit Cost	Transaction Source	Store Number	Customer ID	Transaction Date
0	Web	305	748618	29/12/2016
94	Web	305	748618	29/12/2016
0	Web	305	2909	03/03/2017
0	Web	335	748641	11/12/2017
20	Web	335	748641	11/12/2017
0	Web	305	847	01/04/2015
0	Web	305	748670	01/01/2017
14	Web	305	748670	01/01/2017
0	Web	305	5697	28/03/2014
0	Web	305	748670	22/01/2017
36	Web	305	748670	22/01/2017

Figure A1.11: Columns expanded into the *Custom Table*

### A.1.7 Filtering rows

While randomly testing the model with some visualizations, I noticed that despite the absence of blanks in my datasets after the thorough cleanup process, some charts still produced blanks. This usually occurs when there are data on the many side of a relation that are not represented on the one side of the relationship. I noticed that the issue occurred with charts involving the *Product* and *Store* tables. This implied that there were unique *store numbers* and *market group codes* which existed in the *Custom fact* table but do not exist in the *Store* and *Product* tables respectively.

A simple comparison of the related columns to the Custom Fact table using the **table** visual was able to filter out the values in the Custom fact table that were missing in the other tables.

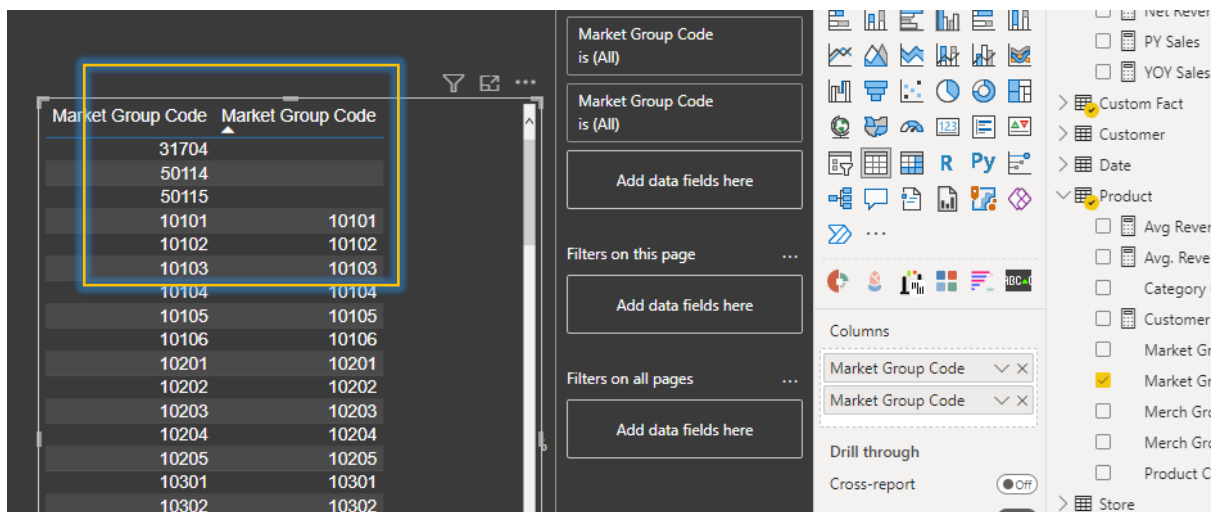


Figure A1.12 Filtering missing values using table visual

These values were filtered out of the *Custom Fact* table in the Power Query Editor window by the following steps;

- i. Clicked the **drop-down** arrow button at the right on the column header of the concerned columns.
- ii. Unticked the corresponding values in the drop-down list and clicking **OK**
- iii. Clicked **Close & Apply** to apply the steps

The Values were small in number and hence could be conveniently filtered out in this manner.

### A.2.0 BI Data Modelling via Star Schema – Facts and Dimensions

Based on the Business questions outlined in subsection 1.2 of this report, a Star Schema model was adopted. This was created in the **Model View**.

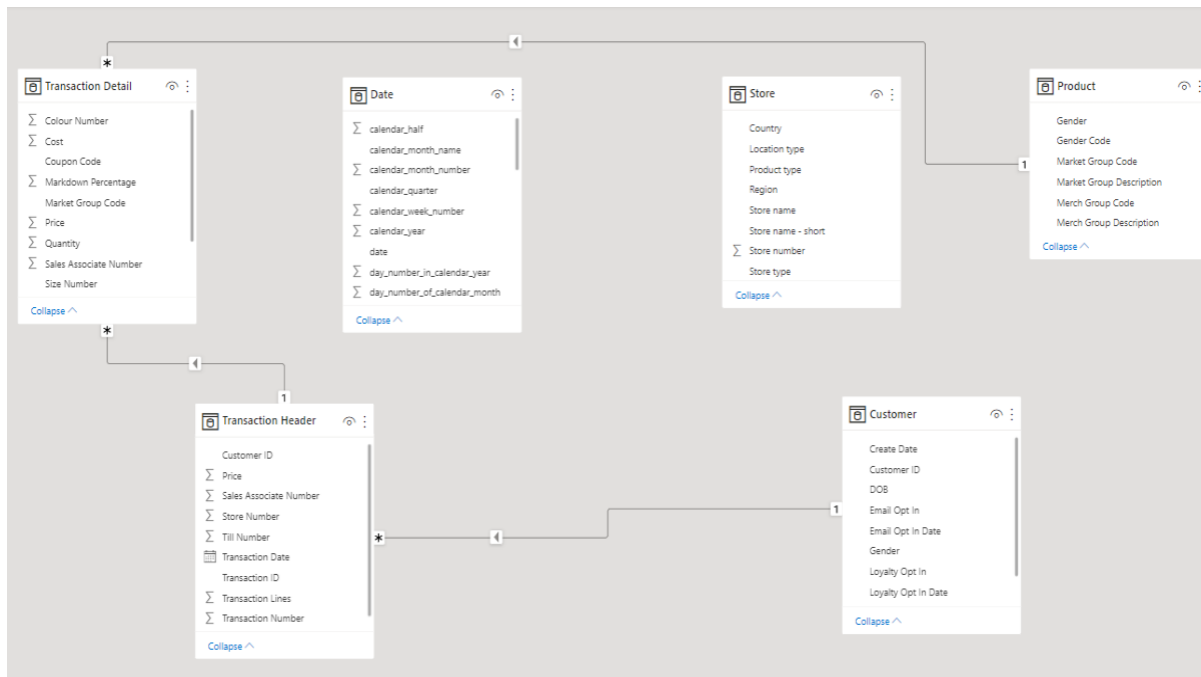


Figure A1.13: Before the Star Schema Model was created

After creating the *Custom Fact* Table and applying all Data pre-processing steps, the following steps were taken to create the Star Schema Model;

- i. On the main Power BI Desktop video, the **Model View** button was clicked to navigate to the Model view. This button is located at the right pane of the window and below the **Data View** Button. In the Model view, all tables including the *Custom Fact* table were displayed, with some connected to others through a relationship link.  
**Note:** It was observed that the Transaction Detail and Transaction Header tables were connected to each other and also connected to the *Custom Fact* Table. Since all relevant columns had been included in the *Custom Fact* Table, the *Transaction Detail* and *Transaction Header* tables were no longer needed for my Model. I decided to disable the loading of these tables to eliminate them from the **Model View**. To do this, the Power Query Editor was launched. I right-clicked the concerned table names and unticked the **Enable Load** option for both tables then clicked **Close & Apply** and got back to the **Model View**. Now, the *Transaction Detail* and *Transaction Header* tables were no longer present.
- ii. Unlinked all autocreated relationships between the tables by right-clicking on each connector and clicking **Delete**
- iii. To create a relationship between *Custom Fact* Table and the *Product* Table, the **Manage Relationships** button was clicked. It is located at the top and under the Home Tab. It opened the **Manage Relationships** window.
- iv. On the window, the **New** button was clicked and this opened the **Create Relationship** Window to select the tables and create a relationship between them/.
- v. The *Custom Fact* table was selected first followed by the *Product* table.
- vi. The **Cardinality** was set as “Many to one (\*:1)” and the **Cross Filter Direction** was set at “Single”. The “Make this relationship active” box was ticked.
- vii. Clicked the Ok button to create the relationship.
- viii. Repeated iii – vii above to create relationships between the *Custom Fact* table and the others
- ix. Dragged each table in order to rearrange their positions.

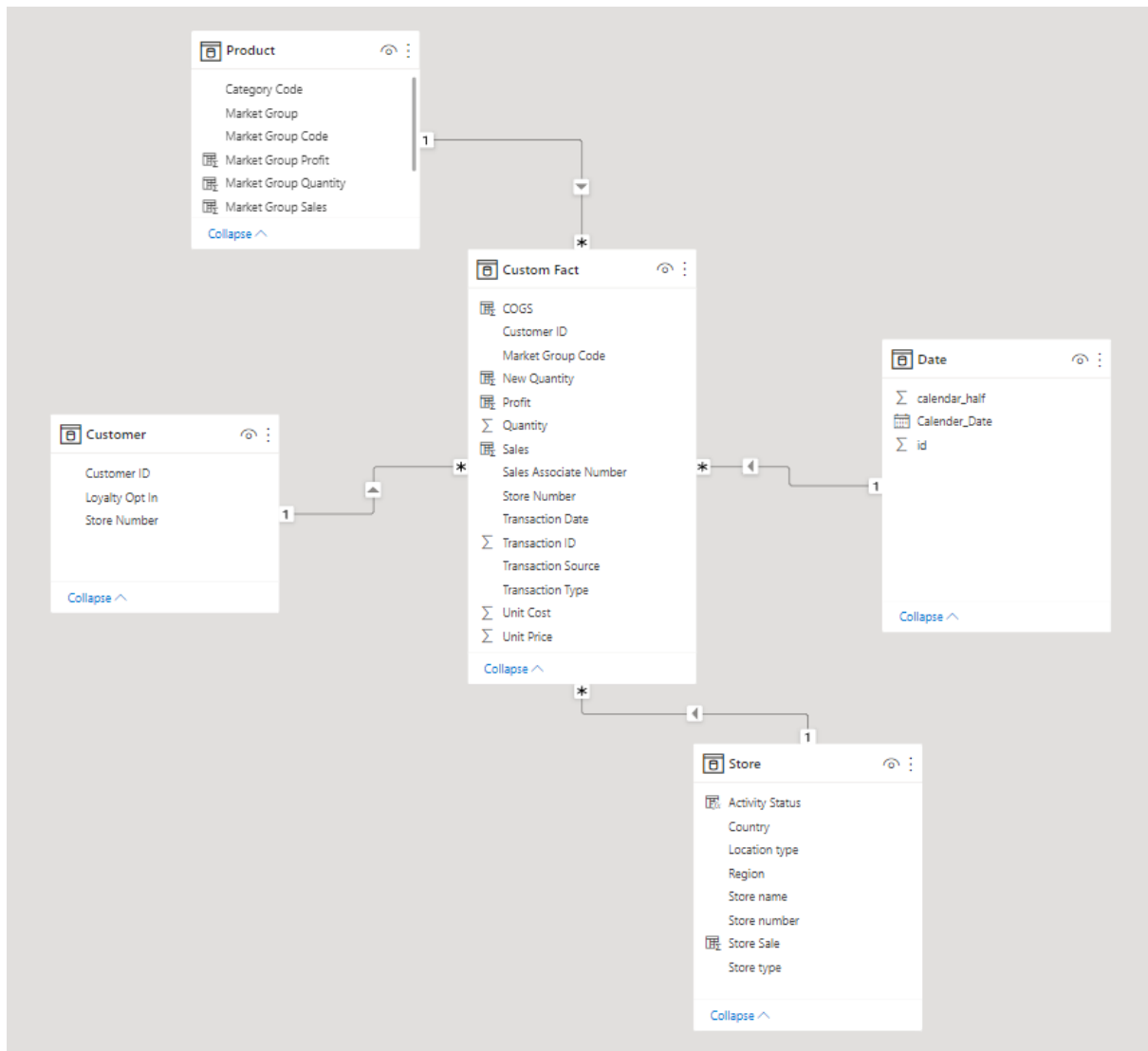


Figure A1.14: The Star Schema Model

### A.3.0 Use of DAX and M Language

#### A.3.1 DAX measures

DAX measures used for the BI design had been explained in Section 2.0 of this report. The DAX measures and their DAX formulas are listed below:

- i. %Active Customers since 2014

%Active Customers Since 2014 = `DIVIDE(`  
`DISTINCTCOUNT('Custom Fact'[Customer ID]), [Customer Base]``)`

- ii. Active Customer Count

Active Customer Count = `DISTINCTCOUNT('Custom Fact'[Customer ID])`

- iii. Active Stores

Active Stores = `[Total Stores] - [Inactive Stores]`

iv. Avg. Revenue Per Customer

Avg Revenue Per Customer = `SUM('Custom Fact'[Sales])/DISTINCTCOUNT(Customer[Customer ID])`

v. Avg. Revenue Per Market Group

Avg. Revenue Per Market Group = `SUM('Custom Fact'[Sales]) / DISTINCTCOUNT('Custom Fact'[Market Group Code])`

vi. Avg. Transaction Value

Avg. Transaction Value = `SUM('Custom Fact'[Sales]) / DISTINCTCOUNT('Custom Fact'[Transaction ID])`

vii. Avg. Profit per Bottom 5 MG (Market Group)

Avg.Profit per Bottom 5 MG =  
`Var PBottom5 = CALCULATE(  
SUM('Custom Fact'[Profit]),  
FILTER('Product', 'Product'[Profit Rank] > 147))  
Return  
DIVIDE(PBottom5, 5)`

viii. Avg. Profit per Top 5 MG

Avg.Profit per Top 5 MG =  
`Var PTop5 = CALCULATE(  
SUM('Custom Fact'[Profit]),  
FILTER('Product', 'Product'[Profit Rank] < 6))  
Return  
DIVIDE(PTop5, 5)`

ix. CAGR % (Profit)

CAGR % (Profit) =  
`Var CYProfit =  
CALCULATE(  
SUM('Custom Fact'[Profit]),YEAR('Custom Fact'[Transaction Date]) = YEAR(MAX('Custom Fact'[Transaction Date]  
)))  
Var First_Year_Profit =  
CALCULATE(  
SUM('Custom Fact'[Profit]),YEAR('Custom Fact'[Transaction Date]) = YEAR(MIN('Custom Fact'[Transaction Date]  
)))  
Var Compound_Annual_Growth_Rate =  
(  
POWER(  
DIVIDE(CYProfit, First_Year_Profit),DIVIDE(1, DATEDIFF(FIRSTDATE('Custom Fact'[Transaction Date]),LASTDATE('Custom Fact'[Transaction Date]),YEAR))  
)  
) - 1  
RETURN`



Compound\_Annual\_Growth\_Rate

x. CAGR % (Sales)

CAGR % (Sales) =

Var CYSales =

CALCULATE(  
SUM('Custom Fact'[Sales]),YEAR('Custom Fact'[Transaction Date]) = YEAR(MAX('Custom Fact'[Transaction Date])  
)))

Var First\_Year\_Sales =

CALCULATE(  
SUM('Custom Fact'[Sales]),YEAR('Custom Fact'[Transaction Date]) = YEAR(MIN('Custom Fact'[Transaction Date])  
)))

Var Compound\_Annual\_Growth\_Rate =

(  
POWER(  
DIVIDE(CYSales, First\_Year\_Sales),DIVIDE(1, DATEDIFF(FIRSTDATE('Custom Fact'[Transaction Date]),LASTDATE('Custom Fact'[Transaction Date]),YEAR))  
)  
) - 1

RETURN

Compound\_Annual\_Growth\_Rate

xi. Customer Base

Customer Base = DISTINCTCOUNT(Customer[Customer ID])

xii. Gross Profit

Gross Profit = SUM('Custom Fact'[Profit])

xiii. Gross Profit Margin

Gross Profit Margin = [Gross Profit]/ABS([Net Sales])

xiv. Gross Sales

Gross Sales = CALCULATE(  
SUM('Custom Fact'[Sales]),  
FILTER('Custom Fact', 'Custom Fact'[Transaction Type]="Sale"))

xv. Inactive Stores

Inactive Stores = CALCULATE(  
COUNT(Store[Activity Status]),Store[Activity Status] = "Inactive")

xvi. Market Group Count

Market Group Count = DISTINCTCOUNT('Custom Fact'[Market Group Code])

xvii. Net Sales

Net Sales = `SUM('Custom Fact'[Sales])`

xviii. Profit (Bottom 5 MG)

Profit (Bottom 5 MG) = `CALCULATE(  
SUM('Custom Fact'[Profit]),  
FILTER('Product', 'Product'[Profit Rank] > 147))`

xix. Profit (Top 5 MG)

Profit (Top 5 MG) = `CALCULATE(  
SUM('Custom Fact'[Profit]),  
FILTER('Product', 'Product'[Profit Rank] < 6))`

xx. PY Profit

PY Profit = `CALCULATE([Gross Profit], DATEADD('Date'[Calender_Date],-1,YEAR))`

xxi. PY Sales

PY Sales = `CALCULATE([Net Sales], DATEADD('Date'[Calender_Date],-1,YEAR))`

xxii. Return on Sales

Return on Sales = `CALCULATE(  
SUM('Custom Fact'[Sales]),  
FILTER('Custom Fact', 'Custom Fact'[Transaction Type]="Return"))`

xxiii. Sales Associate Count

Sales Associate Count = `DISTINCTCOUNT('Custom Fact'[Sales Associate Number])`

xxiv. Total COGS

Total COGS = `SUM('Custom Fact'[COGS])`

xxv. Total Products Sold

Total Products Sold = `SUM('Custom Fact'[New Quantity])`

xxvi. Total Stores

Total Stores = `DISTINCTCOUNT(Store[Store number])`

xxvii. YOY Profit Growth %

YOY Profit Growth % =  
`VAR PYProfit =  
CALCULATE([Gross Profit], DATEADD('Date'[Calender_Date],-1,YEAR))  
RETURN  
DIVIDE((([Gross Profit]-PYProfit), PYProfit)`

## xxviii. YOY Sales Growth %

```
YOY Sales Growth % =  
VAR PYSales =  
    CALCULATE([Net Sales], DATEADD('Date'[Calender_Date],-1,YEAR))  
RETURN  
    DIVIDE((([Net Sales]-PYSales), PYSales)
```

### A.3.2 Calculated Columns Using DAX

A number of calculated columns were created in some tables to further enhance analytics for the dashboard. For each table, the calculated columns are explained below:

- **Custom Fact Table Calculated Columns:**

- i. **New Quantity** Column: This represents the quantity of products bought. It was created because after reviewing the initial *Quantity* column, I noticed that it recorded “-1” for some “Sale” Transaction Type. Only a “Return” Transaction Type was meant to have a negative *Quantity*. The DAX formula is given below:

```
New Quantity = IF('Custom Fact'[Transaction Type] = "Sale",ABS('Custom Fact'[Quantity]),  
IF(AND('Custom Fact'[Transaction Type] = "Return",'Custom Fact'[Quantity] > 0), -1 * 'Custom  
Fact'[Quantity],  
'Custom Fact'[Quantity]))
```

- ii. **COGS** Column: This is an acronym for “Cost of Goods Sold” and represents the cost of the product sold. It is the unit cost multiplied by the New Quantity. The DAX formula is given below:

```
COGS = ABS('Custom Fact'[New Quantity]) * 'Custom Fact'[Unit Cost]
```

- iii. **Sales** Column: The *unit price* multiplied by *New Quantity*

```
Sales = ABS('Custom Fact'[New Quantity]) * 'Custom Fact'[Unit Price]
```

- iv. **Profit** Column: Sales minus Cost

```
Profit = 'Custom Fact'[Sales] - 'Custom Fact'[COGS]
```

- **Product Table Calculated Columns:**

- i. **Market Group Quantity** Column: Total Quantity of each Market Group / products that was sold.

```
Market Group Quantity = CALCULATE(  
    SUM('Custom Fact'[New Quantity]),  
    FILTER('Custom Fact', 'Custom Fact'[Market Group Code] = 'Product' [Market Group Code]))
```

- ii. **Market Group Sales** Column: Total sales / revenue generated by each Market Group

```
Market Group Sales = CALCULATE(  
    SUM('Custom Fact'[Sales]),  
    FILTER('Custom Fact', 'Custom Fact'[Market Group Code] = 'Product' [Market Group Code]))
```

iii. *Sales Rank* Column: Ranking of Market Group by their Sales

Sales Rank = `RANKX('Product',  
'Product'[Market Group Sales])`

iv. *Market Group Profit* Column: Total profit generated by each Market Group

Market Group Profit = `CALCULATE(  
SUM('Custom Fact'[Profit]),  
FILTER('Custom Fact', 'Custom Fact'[Market Group Code] = 'Product' [Market Group Code]))`

v. *Profit Rank* Column: Ranking of Market Groups by their total profits

Profit Rank = `RANKX('Product',  
'Product'[Market Group Profit])`

- **Store Table Calculated Columns:**

i. *Store Sale* Column: Total sales / revenue generated by each store

Store Sale = `CALCULATE(SUM('Custom Fact'[Sales]),  
FILTER('Custom Fact', 'Custom Fact'[Store Number] = Store[Store number]))`

ii. *Activity Status* Column: To show if a store has registered any sale since the first transaction date from the data given (Since 2014).

Activity Status = `IF(ISBLANK(Store[Store Sale]),"Inactive","Active")`

### A.3.3 Use of M Language

M language was used in the *Store* table to delete some values, replace some values and fill empty rows with some specified values. The M language formula is given below:

```
let
Source = Csv.Document(File.Contents("C:\Users\c2397722\Downloads\C2397722_Odoh.Victor\Footwear Retail Data Including Customer Data\Store.csv"),[Delimiter=",", Columns=8, Encoding=1252, QuoteStyle=QuoteStyle.None]),

#"Promoted Headers" = Table.PromoteHeaders(Source, [PromoteAllScalars=true]),

#"Changed Type" = Table.TransformColumnTypes(#"Promoted Headers",{{"Store name", type text}, {"Store number", Int64.Type}, {"Region", type text}, {"Product type", type text}, {"Location type", type text}, {"Country", type text}, {"Store type", type text}, {"Store name - short", type text}}),

#"Columns Deleted" = Table.RemoveColumns(#"Changed Type",{ "Store name - short", "Product type" }),

#"ToBeReplaced" = [{"High Street" = "Physical", "Shopping Centre" = "Physical", "Retail Park" = "Physical"}],

#"Replaced Values in Location type" = Table.TransformColumns(#"Columns Deleted",{{"Location type",each Record.FieldOrDefault(#"ToBeReplaced",_)}}),

#"Replaced empty rows" = Table.ReplaceValue(#"Replaced Values in Location type","", "Online",Replacer.ReplaceValue,{"Region", "Country"})

in

#"Replaced empty rows"
```

## A.4.0 The Dashboard

The dashboard consists of 7 pages. A combination of Power BI built-in visuals and visuals imported from AppSource were used across all pages. The Power BI “Innovate Theme” was applied to the entire dashboard. Each page, excluding the **Home page**, has a **back button** and **Home button** located at the top left. The **back button** returns a user back to the last viewed page while the **Home button** takes the user to the **Home page**. The pages, along with their visuals, are listed below in the order in which they are arranged:

1. **Home Page:** This is the first page of the dashboard and contains buttons that navigate to the other pages of the dashboard.

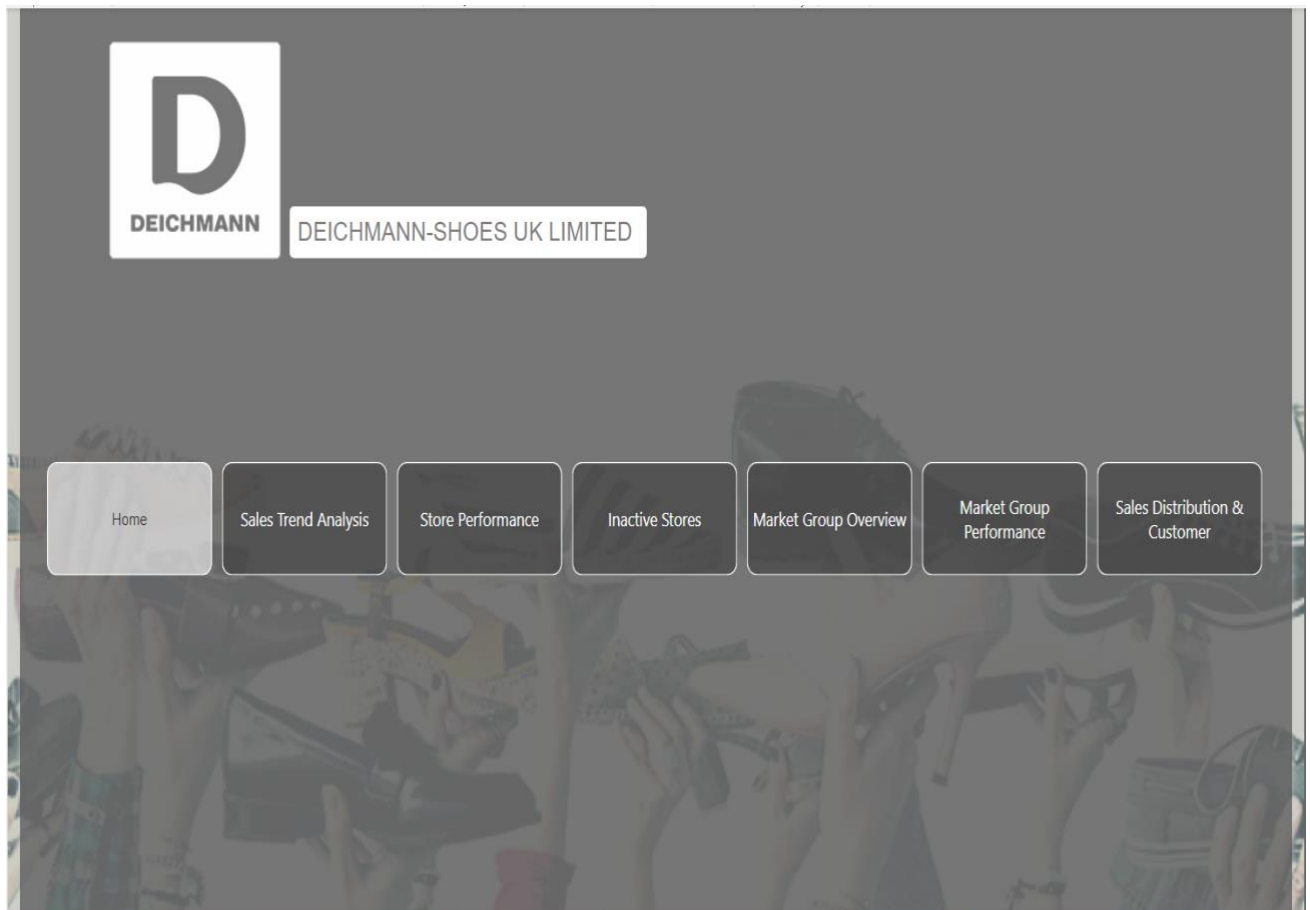


Figure A1.15: The Home Page

2. **Sales Trend Analysis Page:** The following visuals are contained on this page:
  - i. Inforiver Vertical Waterfall Chart - YOY Sales Growth % by Year
  - ii. Inforiver Line Chart – Sales, COGS, Profit by Year
  - iii. Inforiver Integrated Variance Column Chart – Sales, PY Sales by 2015
  - iv. Inforiver Line Chart – Sales, COGS, Profit by 2014 & 2015
  - v. Inforiver Variance Line Chart – Sales, PY Sales by 2020 & 2021
  - vi. Zebra BI Line Chart – Sales by Market Group & Year
  - vii. Power BI built-in Line Chart – Sales Growth Rate in two years coming
  - viii. Multi-card KPIs by TME AG – For;
    - CAGR % (Sales)
    - Net Sales
    - Gross Sales

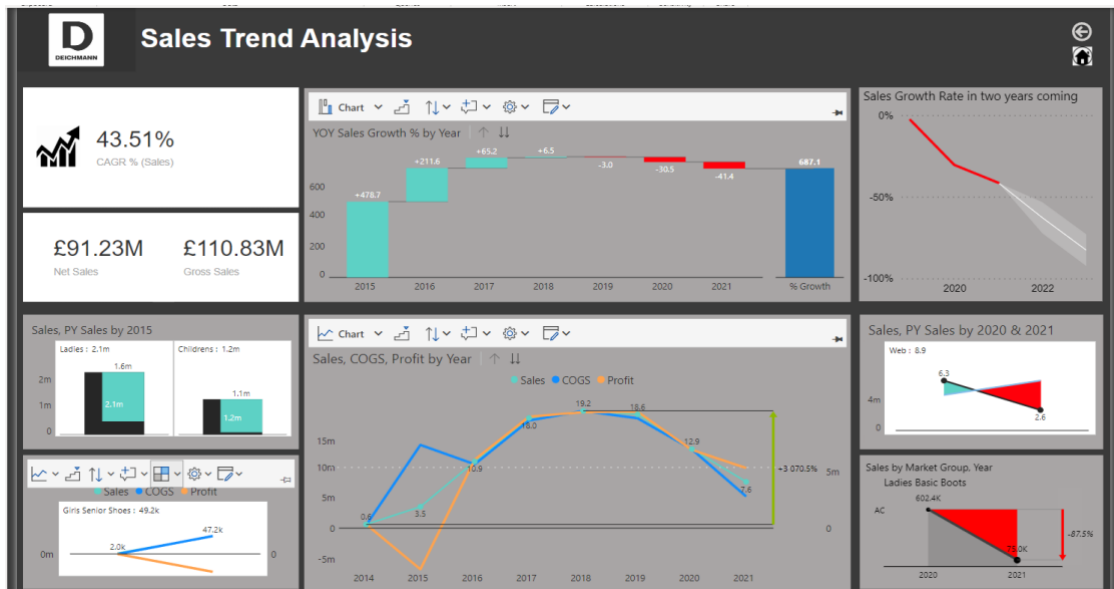


Figure A1.16: The Sales trend Analysis Page

- 3. Store Performance Page:** The following visuals are contained on this page:
- Zebra BI Tables Chart – Sales and PY Sales by Store name
  - Key Influencers Visual – By Product categories, stores, and Store Types
  - Matrix visual – Average sales by each store over time.
  - Store and Year Selection Slicers
  - Advance Card visuals – For;
    - Net Sales
    - Total COGS
    - Gross Profit
    - Gross Profit Margin
    - Active Customer Count
    - Total Products Sold
    - Sales Associates Count
    - Total Stores
    - Active Stores
    - Inactive Stores

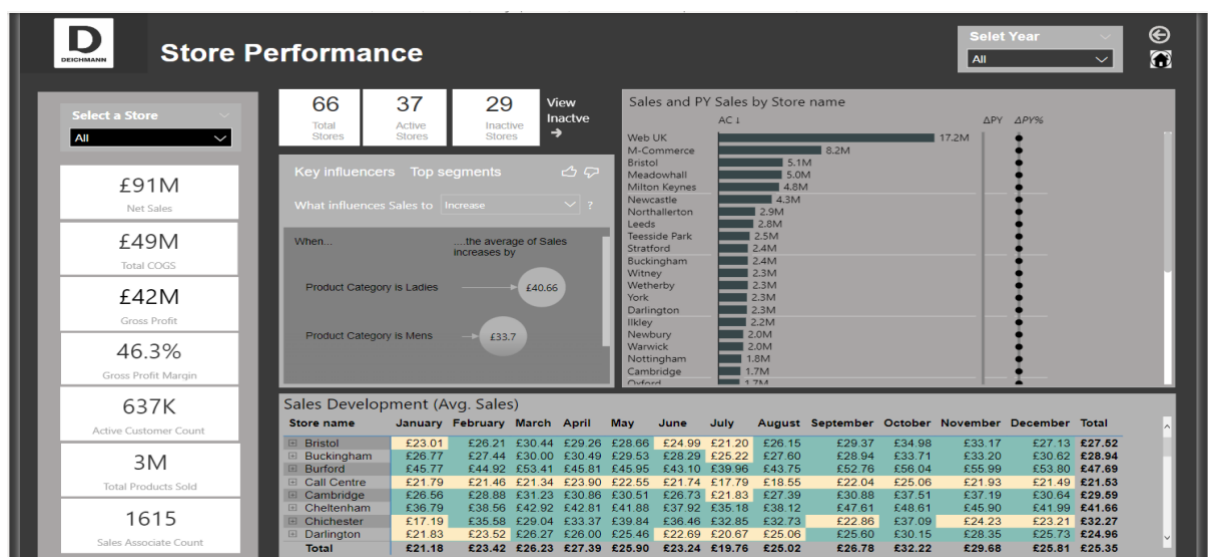


Figure A1.17: The Store Performance Page

4. **Inactive Stores Page:** This is an extension of the Store Performance page. The following visuals are contained on this page:
- Table – Cols; Inactive Stores, Location Type, Store Type
  - Aster Plot 1.4.0 visual – Inactive users by Store type



Figure A1.18: The Inactive Stores Page

5. **Market Group Overview Page:** The following visuals are contained on this page:
- Multi-Card KPIs visuals – For;
    - Avg. Revenue Per Market Group
    - Market Group Count
    - Net Sales
    - Gross Sales
    - Return on Sales
  - Funnel chart – Return on Sales by Product Category
  - Scroller Visual – Market Group Sales & Profit
  - Animated Bar Chart Race – Sales by Top 20 Market Groups

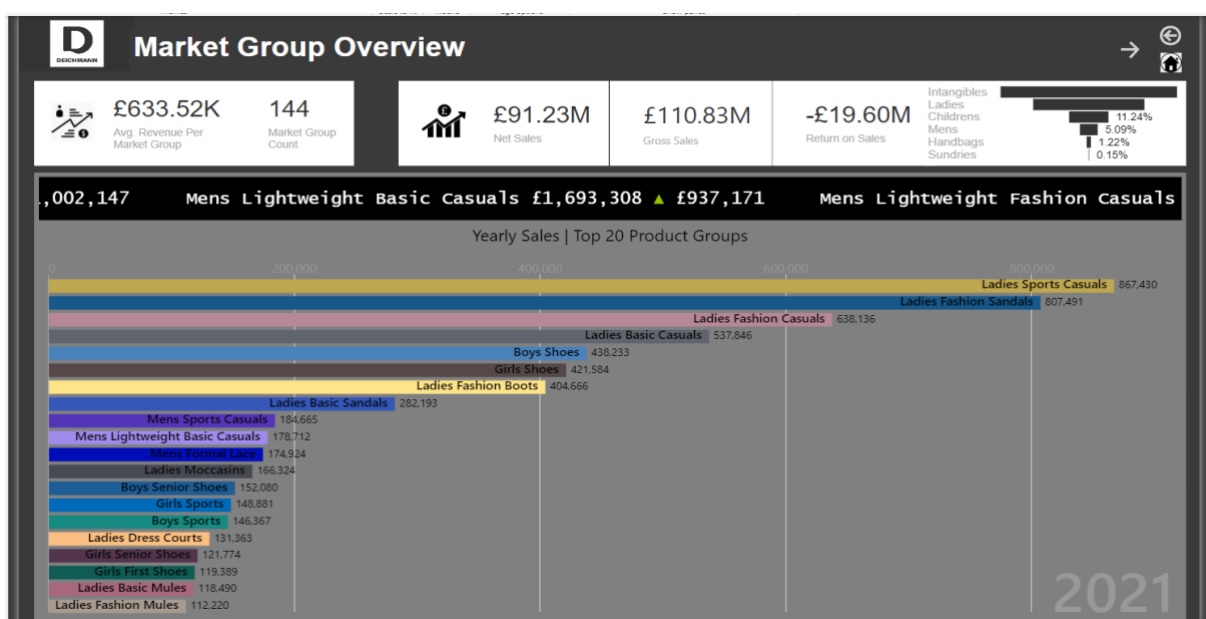


Figure A1.19: The Market Group Overview Page

**6. Market Group Performance Page:** This is the sixth page of the dashboard. The following visuals are contained on this page:

- i. Market Group Selection Slicer
- ii. Zebra BI Chart – Profit and PY Profit by Year
- iii. Inforiver Horizontal lollipop Charts – Profit by Top 5 Market Groups
- iv. Inforiver Horizontal lollipop Charts – Profit by Bottom 5 Market Groups
- v. Area Chart – Profit by Year and Best / Worst Performer
- vi. Multi-Card KPIs visuals – For;
  - Gross Profit
  - CAGR % (Profit)
  - Profit (Top 5 MG)
  - Profit (Bottom 5 MG)
  - Avg. Profit Per Top 5 MG
  - Avg. Profit by Bottom 5 MG

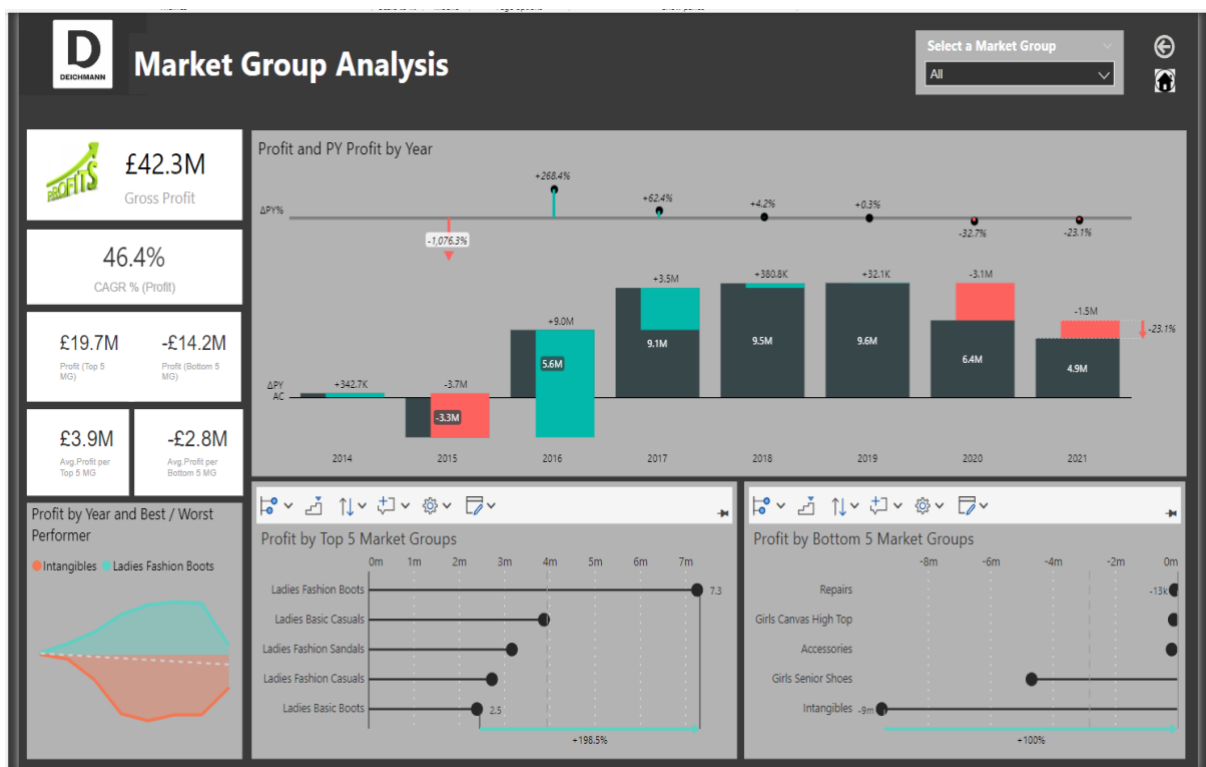


Figure A1.20: The Market Group Analysis Page

**7. Sales Distribution and Customer Page:** This is the seventh and last page of the dashboard. The following visuals are contained on this page:

- i. Aster Plot 1.4.0 – Sales By Store Type
- ii. Line Chart – Sales By Year and Calendar Half
- iii. Clustered Bar Chart – Sales By Country
- iv. Decomposition Tree – Date, Store Type, Store Name, Market Group
- v. Matrix Visual – Columns; Customer ID, Sales, Items
- vii. Multi-Card KPIs visuals – For;
  - Customer Base
  - Active Customer Count
  - %Active Customer Since 2014
  - Avg. Revenue Per Customer
  - Avg. Transaction Value



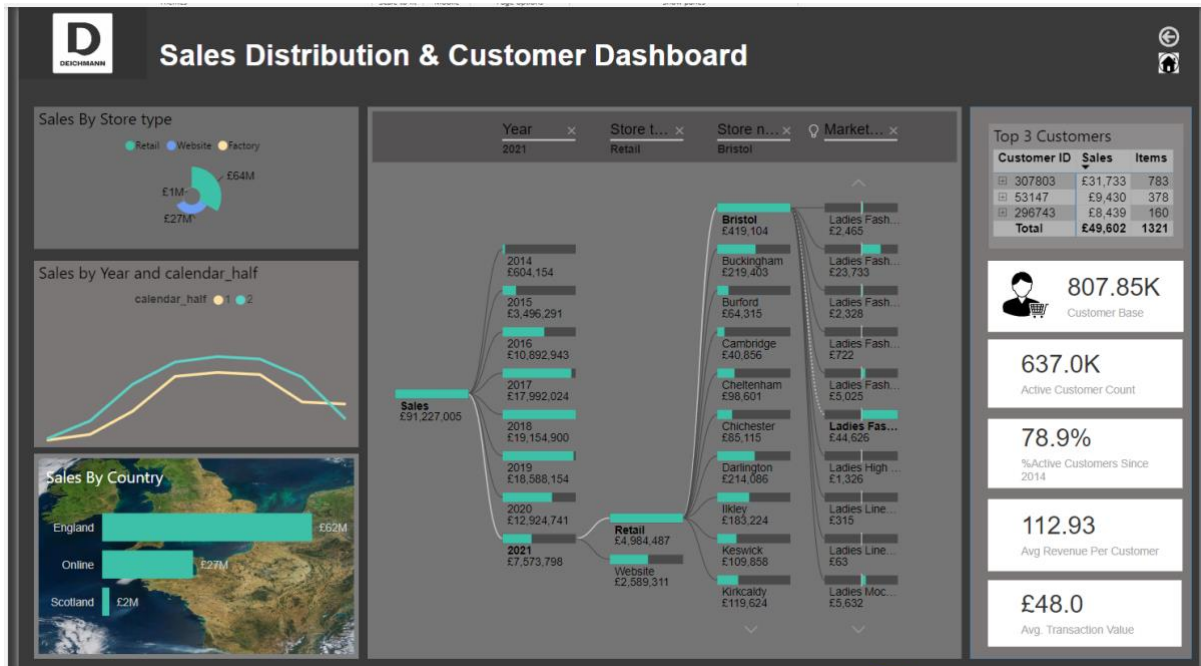


Figure A1.21: The Sales Distribution & Customer Page

### A.5.0 Self-assessment

Use the table below to **self-assess** your work. This will help reflect on your work. You must keep this table in your report.

Report Section	Description	Grade your work from 1 to 4 (1-poor, 2-sufficient, 3- good, 4-excellent)
Report Structure	The report is well-written, and it contains all the relevant sections	4
Data Pre-processing and Data Modelling	Many pre-processing steps have been applied. The data model is well-structured	4
Dax and M language	Both DAX and M Language have been extensively used in the report	4
Dashboard Design	The dashboard contains a variety of charts, including advanced ones.	3
Average		Add below the average of the four cells above:  <b>3.75</b>

## References

Aspin, A. (2018). Pro Power BI Desktop. Apress. <https://doi.org/10.1007/978-1-4842-3210-1>

Ferrari, A., & Russo, M. (2016). Introducing Microsoft Power BI. Microsoft Press.

*(Compound Annual Growth Rate (CAGR) Formula and Calculation, n.d.)*

Investopedia (n.d.). Compound Annual Growth Rate (CAGR) Formula and Calculation. Retrieved December 11, 2022, from <https://www.investopedia.com/terms/c/cagr.asp>