E-Commerce Data Analysis Report

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2025-05-27

I. Introduction

This independent project aims to clean, process, and analyze e-commerce data to identify correlations and uncover potential trends through data visualization. It also serves to demonstrate my skills in data analysis, visualization, and reporting.

II. Data Cleaning and Considerations

In this report, e-commerce data is analyzed to derive business insights supported by data. The dataset is loaded into BigQuery, inspected, and cleaned prior to analysis. SQL queries are used to retrieve and aggregate relevant information, and R along with Tableau are used for data visualization.

Data Cleaning Steps

- **Missing Values**: Entries with missing values in critical fields (e.g., product description) were removed. Entries without customer IDs were retained, as they represented a significant portion of the dataset and likely corresponded to guest users.
- **Duplicates**: Duplicate entries were removed to ensure data quality.
- **Filtering**: Transactions with negative quantities were excluded.

```
# SELECT DISTINCT *
# FROM `[Project_Name].E_Commerce_Data.Retail_Data`
# WHERE
# Description IS NOT NULL
# AND CustomerID IS NOT NULL
# AND Quantity > 0
```

III. Analysis Results

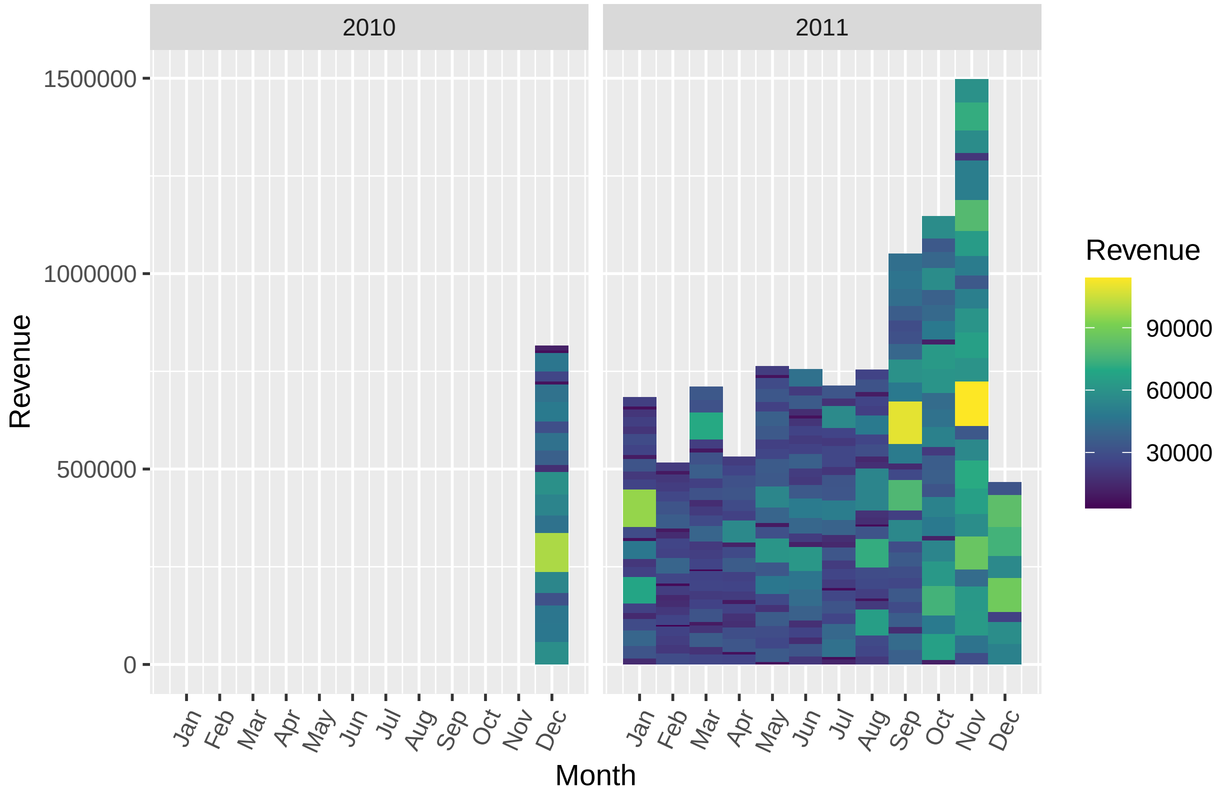
1. Monthly Revenue Trends

The analysis begins with a monthly revenue breakdown to identify potential trends. Data from December 2010 to December 2011 was used to calculate monthly revenue.

From the plotted results, it is evident that revenue peaks between **September and November 2011**, during which revenue nearly doubles. This indicates that the platform could benefit from targeted sales campaigns or special offers during this period to further boost revenue.

```
ecd1 <- read.csv("C:\\Users\\mixal\\OneDrive\\ϒ     \\e_commerce_datasets\\DAILY_REVENUE_PER_MONTH.csv"
ecd1_clean <- ecd1 %>%
  filter(!is.na(month) & !is.na(Day) & !is.na(Revenue))
ggplot(data = ecd1_clean) +
  geom_col(mapping = aes(x = month, y = Revenue, fill = Revenue), width = 1) +
  facet_wrap(~year) +
  labs(
    x = "Month",
    y = "Revenue",
    title = "Figure 1: Revenue Generated Per Month"
  ) +
  scale_x_continuous(breaks = 1:12, labels = month.abb[1:12]) +
  theme(axis.text.x = element_text(angle = 65, hjust = 1)) +
  scale_fill_viridis_c()
```

Figure 1: Revenue Generated Per Month

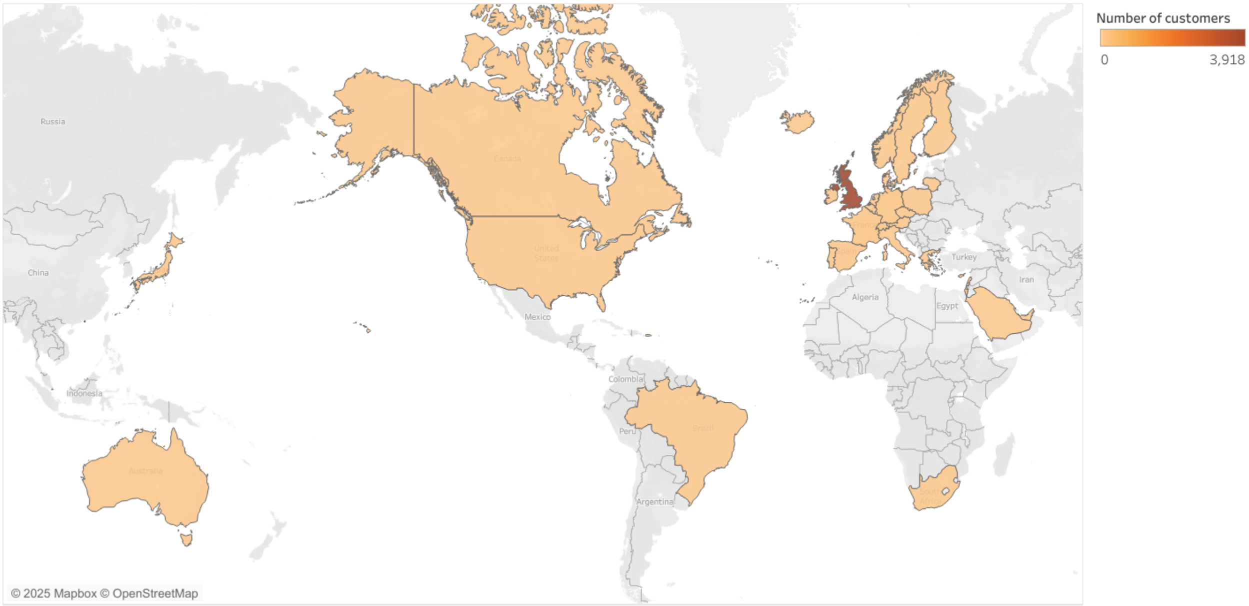


2. Customer Distribution by Country

The country of origin for customers was examined. Great Britain has the highest number of customers, significantly surpassing other countries. This suggests that marketing efforts could be concentrated in this region to retain and further engage this dominant customer base.

```
# SELECT
# Country,
# COUNT(DISTINCT(CustomerID)) AS Number_of_customers
# FROM [Project_Name].E_Commerce_Data.Cleaned_All_Customer_ID_Retail_Data
# GROUP BY Country
# ORDER BY Number_of_customers DESC
```

Customer_Number_per_country



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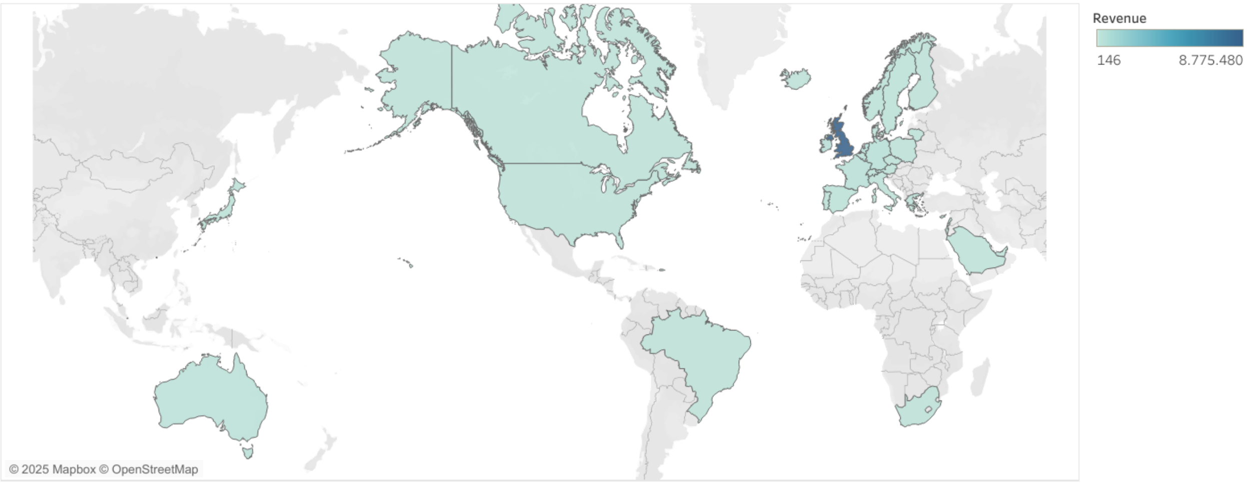
3. Revenue by Country

To verify whether customer distribution aligns with financial performance, revenue per country was also analyzed. The results confirm that **Great Britain contributes the majority of the platform's revenue**, aligning with its high customer count.

```
# SELECT
# Country,
# SUM(Quantity * UnitPrice) AS Revenue
# FROM [Project_Name].E_Commerce_Data.Cleaned_All_Customer_ID_Retail_Data
# GROUP BY Country
# ORDER BY Revenue DESC
```

Revenue_Per_Country



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4. Hourly Revenue Trends

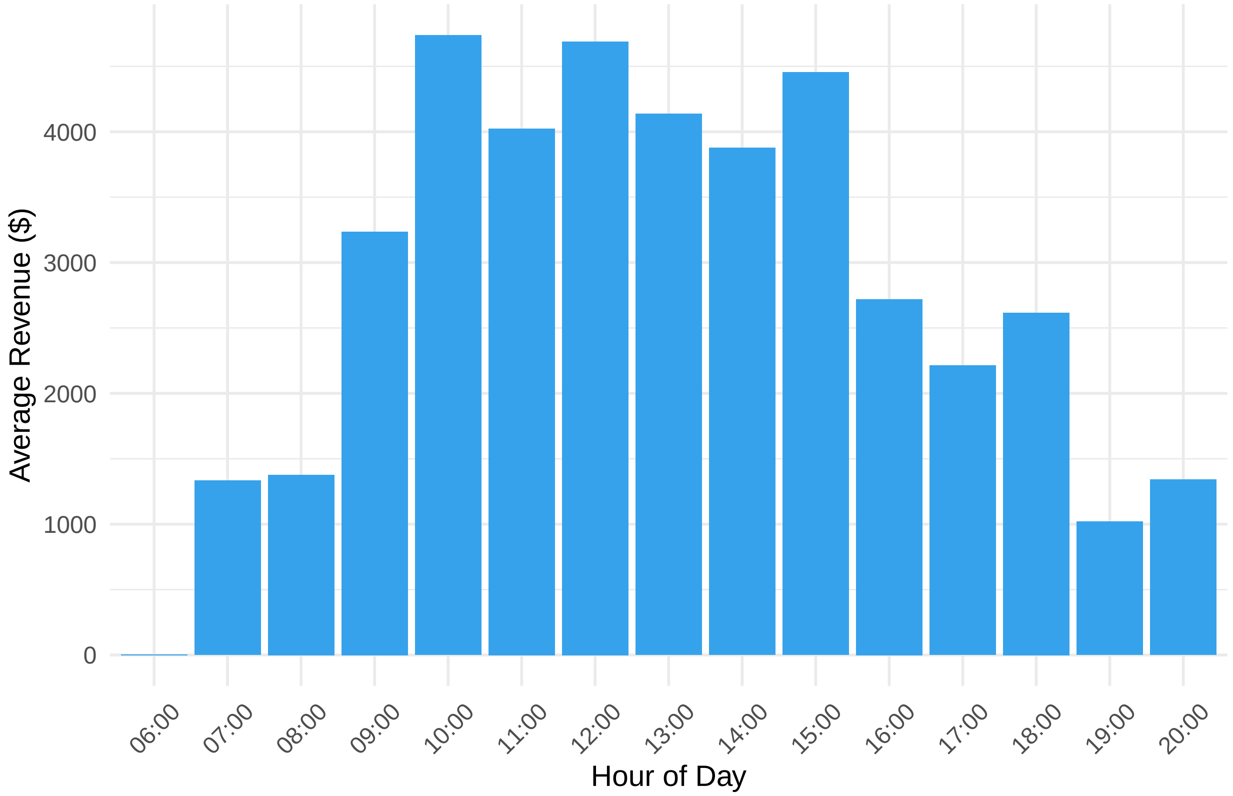
Hourly trends were then explored to uncover patterns in revenue generation throughout the day. The data revealed that the time window from **10:00 to 15:00** consistently exhibits the highest average revenue.

These findings suggest that the platform could benefit from sending automated notifications, targeted emails, or launching special offers during peak hours to increase sales further and attract more customer engagement.

```r
ecd4 <- read.csv("C:\\Users\\mixal\\OneDrive\\ϒ      \\e_commerce_datasets\\REVENUE_PER_HOUR.csv", na.st
ecd4_clean <- ecd4 %>%
  filter(!is.na(month) & !is.na(Day) & !is.na(Revenue))
data <- ecd4_clean %>%
  mutate(hour_of_day = as.numeric(Hour))
avg_revenue <- data %>%
  group_by(hour_of_day) %>%
  summarise(avg_revenue = mean(Revenue, na.rm = TRUE)) %>%
  ungroup()

ggplot(avg_revenue, aes(x = sprintf("%02d:00", hour_of_day), y = avg_revenue)) +
  geom_bar(stat = "identity", fill = "#36A2EB") +
  labs(
    title = "Figure 4: Average Revenue by Hour of Day (Dec 2010 - Dec 2011)",
    x = "Hour of Day",
    y = "Average Revenue ($)"
  ) +
  theme_minimal() +
  theme(
    plot.title = element_text(hjust = 0.5),
    axis.text.x = element_text(angle = 45, vjust = 0.5)
  )
```

Figure 4: Average Revenue by Hour of Day (Dec 2010 − Dec 2011)



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5. Top Products by Revenue

A breakdown of revenue by product revealed the **top-selling items**. These products could be promoted more prominently or bundled into special offers to maximize their sales potential.

```
# SELECT
# StockCode,
# SUM(Quantity * UnitPrice) AS Revenue
# FROM [Project_Name].E_Commerce_Data.Cleaned_All_Customer_ID_Retail_Data
# GROUP BY StockCode
# ORDER BY Revenue DESC
```

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6. Top Customers by Revenue

The dataset also revealed which customers generated the most revenue. Identifying these high-value customers can support the development of loyalty programs, exclusive deals, or personalized outreach strategies to encourage continued spending.

```
# SELECT
# CustomerID,
# SUM(Quantity * UnitPrice) AS Revenue
# FROM [Project_Name].E_Commerce_Data.Cleaned_All_Customer_ID_Retail_Data
# GROUP BY CustomerID
# ORDER BY Revenue DESC
```

IV. Conclusions

In this project, the e-commerce dataset was cleaned, processed, and analyzed using BigQuery, R, and Tableau. The analysis revealed the following key insights:

- **Revenue Trends**: Revenue peaks between **September and November**, indicating seasonal sales opportunities.
- **Hourly Trends**: The most profitable time of day is between **10:00 and 15:00**.
- **Geographic Insights**: Over 80% of both customers and total revenue originate from **Great Britain**.
- **Customer and Product Insights**: A subset of top customers and products generates a significant portion of the revenue.

These findings provide a solid foundation for implementing data-driven marketing, customer segmentation, and targeted advertising strategies.