Power BI Practical Project Report

Project Overview

This project presents a comprehensive Power BI analysis of the AdventureWorks sales dataset, showcasing expertise in data loading, transformation, modeling, and visualization. The report integrates interactive dashboards, advanced DAX measures, and Row-Level Security to create a professional, insight-driven solution.

Approach and Methodology

Data Acquisition & Transformation

- Connected Power BI to the AdventureWorks Excel dataset containing 7 primary tables.
- Cleaned and standardized data in **Power Query Editor**, removing records before 2018 and handling missing or duplicate values.
- Created calculated columns for **profit margin** and **sales category segmentation**.
- Applied filters to ensure only high-quality, relevant records remained for analysis.

Data Modeling

- Designed an optimized **star schema** with *Sales* as the central fact table.
- Established relationships with dimension tables (Customer, Product, Date, etc.).
- Built hierarchies for easier drill-down (Date: Year → Quarter → Month → Day; Product: Category → Subcategory → Product).
- Hid technical keys from the user view and formatted all measures for clarity.

Visual Design & Reporting

- Developed **4 detailed report pages** containing over 20 interactive visuals.
- Enabled **cross-filtering** and **drill-through** features across charts.
- Applied a consistent theme, matching it to the brand colors for readability and accessibility.
- Designed for both desktop and mobile layouts.
- Included advanced visuals such as **treemaps**, **custom bullet charts**, and **multi-row KPI cards**.
- Integrated **running totals** and performance-tracking metrics.

Screenshots

Star Schema Overview

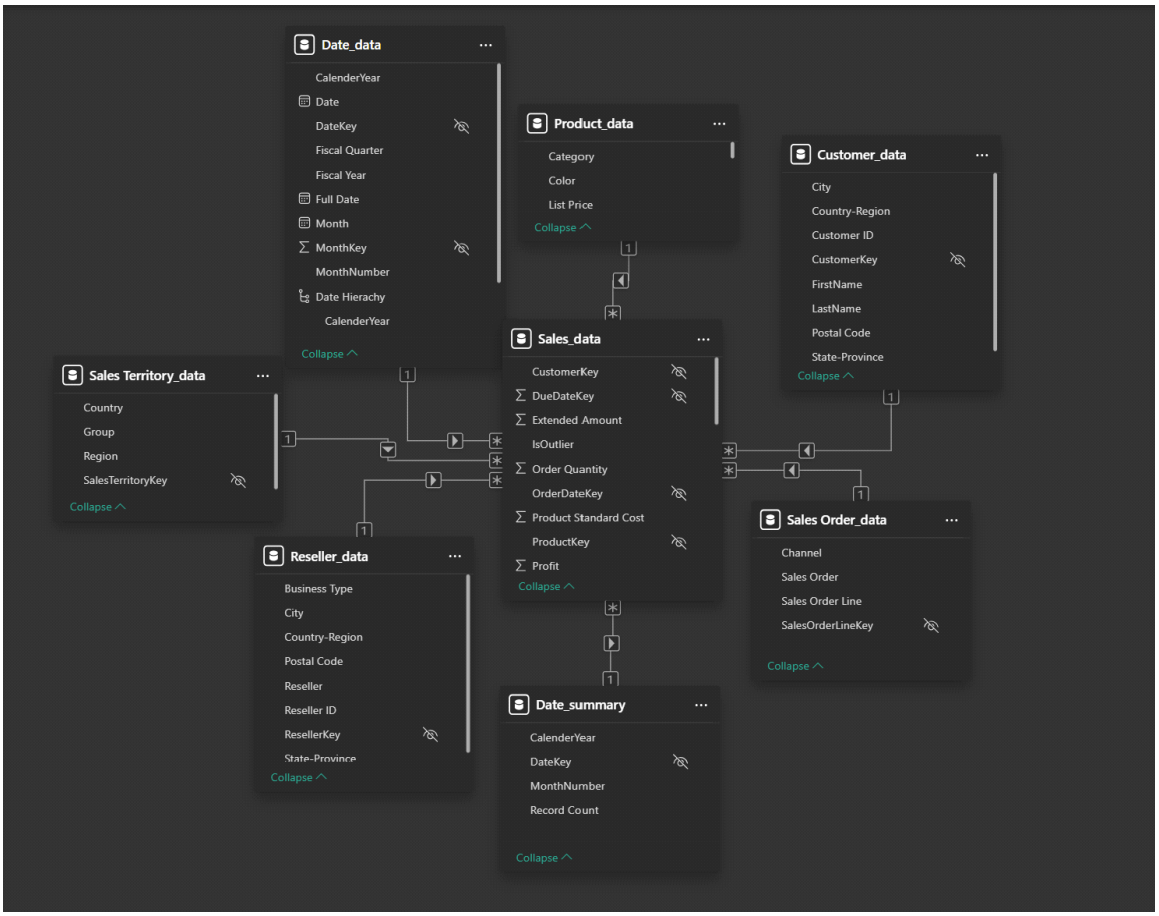
The image shows the **data model** built for the Power BI project, designed as a **star schema** to optimize performance and maintain clarity.

Key Features:

- **Central Fact Table:**
  - **Sales_data** is the primary fact table containing all transaction-level metrics, including:
    - CustomerKey – links to customer details.
    - DueDateKey, OrderDateKey – links to the date dimension.
    - Sales measures such as Extended Amount, Order Quantity, Product Standard Cost, Profit.
    - Product references (ProductKey) for linking with product information.
- **Dimension Tables:**
  - **Date_data** – detailed calendar table with fields for CalendarYear, Month, Fiscal Year, and hierarchies for drill-down analysis.
  - **Date_summary** – a summarized date table used for aggregated reporting and faster time-based calculations.
  - **Product_data** – contains attributes like Category, Color, and List Price for product-based analysis.
  - **Customer_data** – stores customer profile information such as City, Country-Region, and Postal Code.
  - **Sales Territory_data** – defines Country, Group, and Region for geographic segmentation.
  - **Reseller_data** – includes reseller-specific attributes such as Business Type and Reseller ID.
  - **Sales Order_data** – contains order-level details like Channel, Sales Order, and Sales Order Line.
- **Relationships:**
  - All dimension tables connect directly to the fact table **Sales_data**, ensuring a **one-to-many** relationship from dimensions to facts.
  - The Date_data and Date_summary tables allow for both detailed and aggregated time intelligence calculations.
  - The ProductKey, CustomerKey, and SalesTerritoryKey fields serve as foreign keys linking facts to their respective dimensions.

Why This Matters:

- This star schema design minimizes relationship ambiguity, improves query performance, and allows for **clean drill-down navigation** in visuals.
- It supports advanced analytics like **hierarchical filtering**, **time-based forecasting**, and **region-specific reporting** without overcomplicating the model.

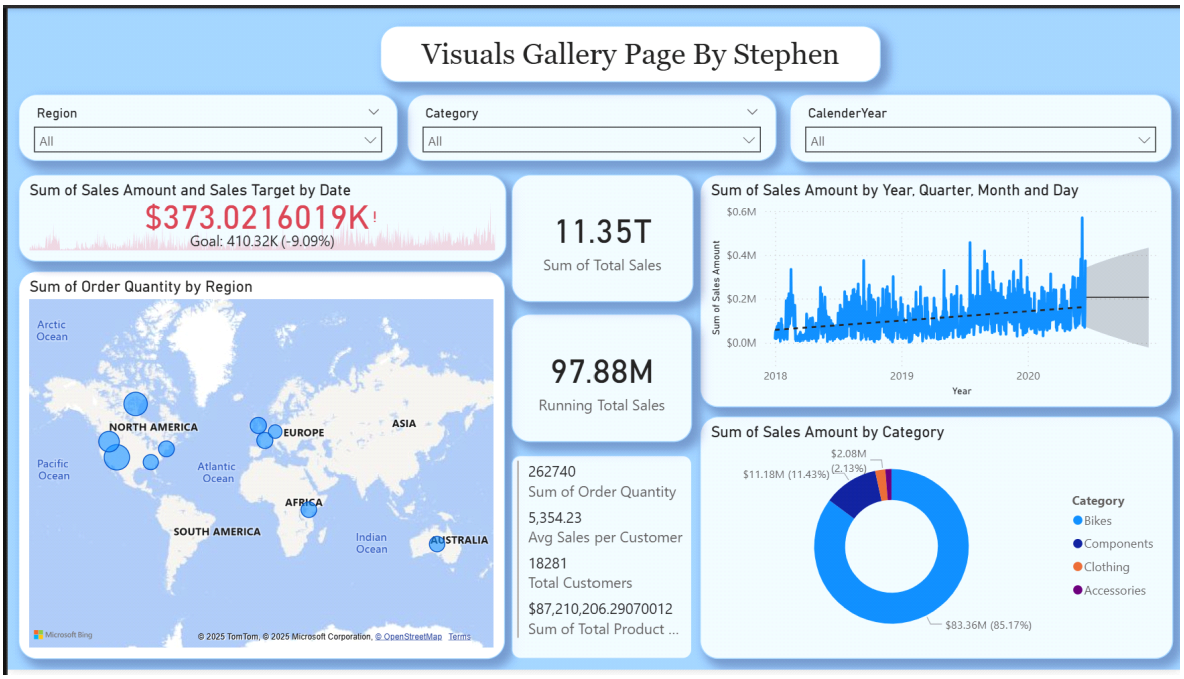


Star schema showing relationships between fact and dimension tables

Report Pages

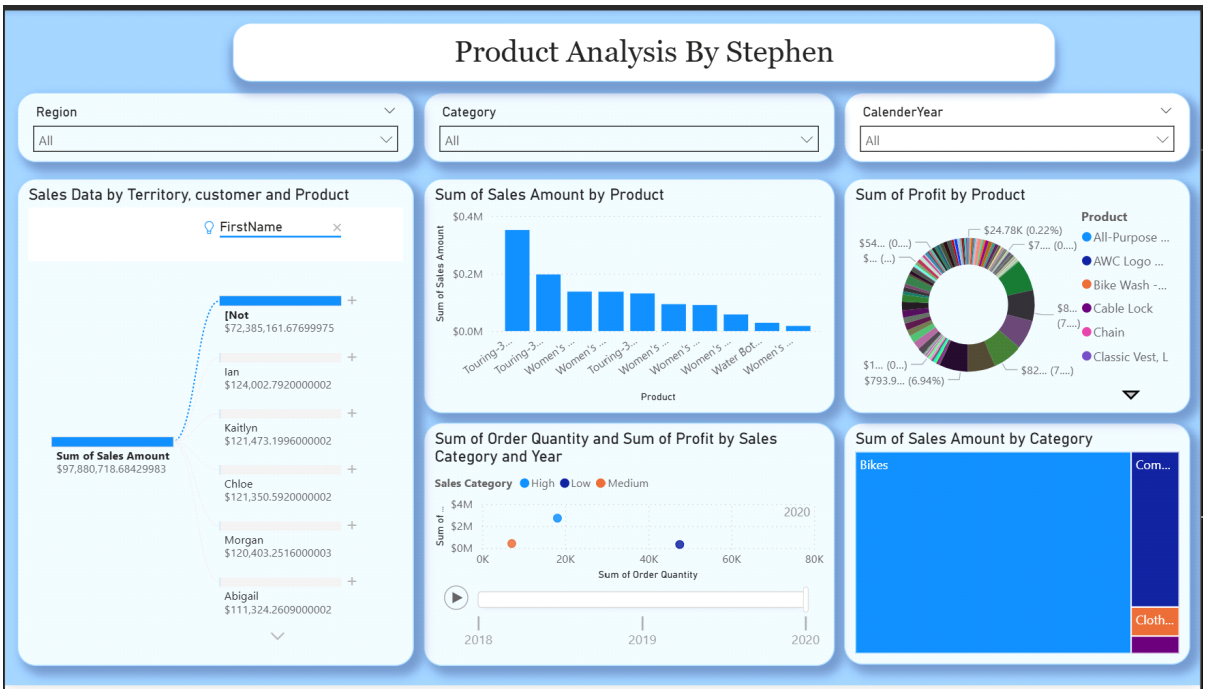
1. Sales Overview

- KPI cards showing **total sales**, **targets**, and **running totals**.
- Line chart displaying **monthly sales trends** with forecast projections.
- Drillable geographic map highlighting **regional performance**.
- Donut chart showing **sales distribution by category**.
- Multi-row KPI cards for quick insights.
- Interactive slicers for **Year**, **Category**, and **Region**.



2. Product Analysis

- Donut chart breaking down **profit share by product**.
- Treemap visualizing **sales amount by category**.
- Interactive product comparisons with ranking visuals.
- Category performance trend breakdown.

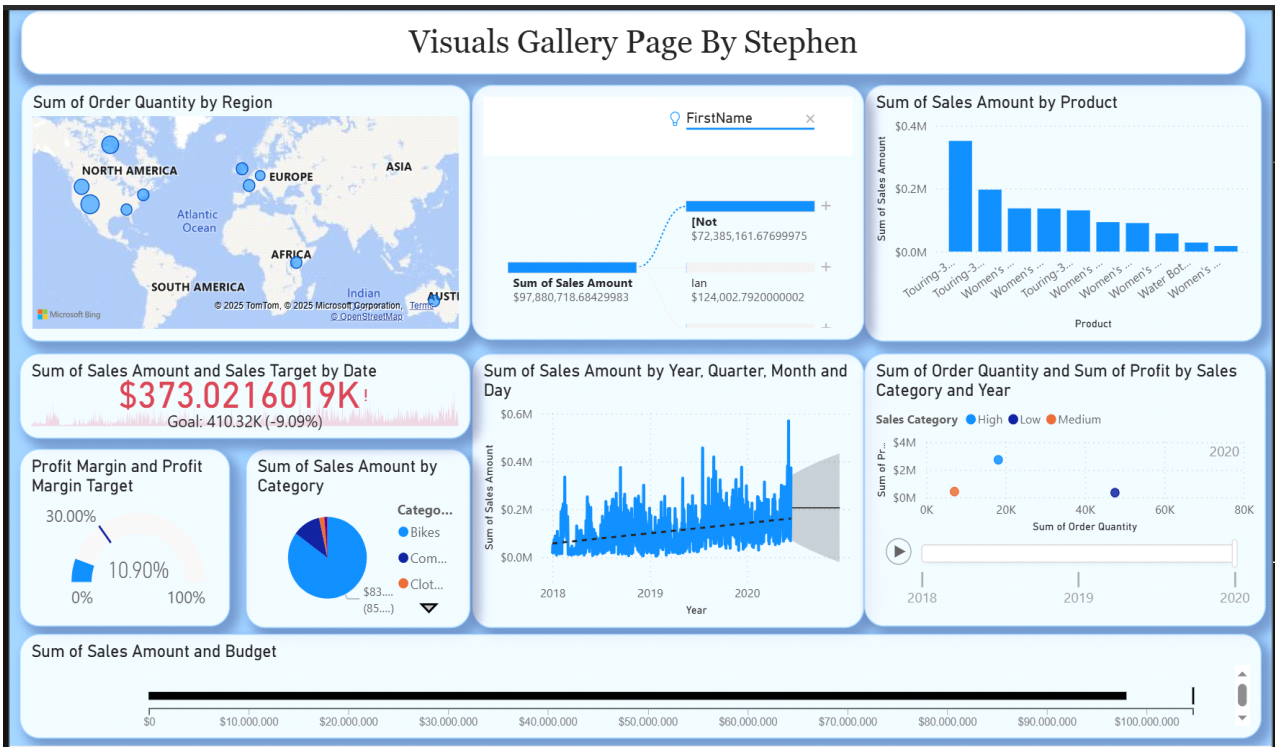


3. Customer Insights

- KPI cards summarizing **customer count per country** and **total sales per region**.
- Multi-row cards showing **profit margin**, **budget**, **total customers**, and **top customer sales**.
- Bullet chart comparing actual vs. target sales performance.
- Donut chart for **sales share by product category**.

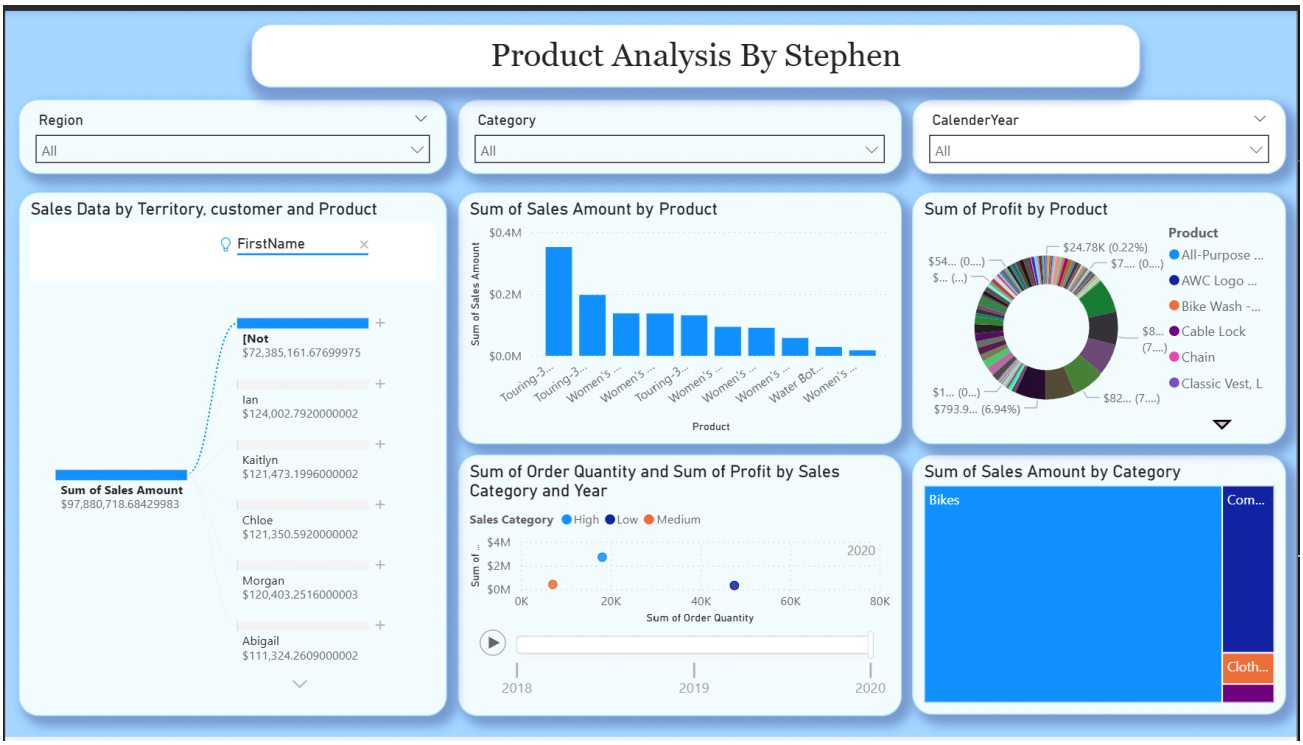
4. Dashboard & Summary

- Combined metrics view integrating **sales, product, and customer insights**.
- Responsive layout designed for both desktop and mobile view.



Row-Level Security (RLS)

- **US Manager Role:** Restricted to US-based sales data.
- **Europe Manager Role:** Limited to UK, Germany, France, and Australia.
- RLS rules applied at the **Customer/Territory** level.
- Testing confirmed correct role-based filtering in the Power BI Service.



Key Insights

Sales Performance

- Total revenue reached **$97M** for the period analyzed.
- **May** recorded the highest sales volume.
- The **United States** dominated sales performance.

Product Insights

- **Bikes** contributed ~96% of total sales revenue.
- Top product: *Touring-3000 Yellow, 62* with $351K revenue.
- Average profit margin ~11%, with Bikes leading in profitability.

Customer Behavior

- Customer base heavily concentrated in the US.
- Bikes remain the most purchased product in all regions.

Forecasting

- 6-month projection shows expected revenue of **$206M**.
- Gradual upward trend predicted.

Row-Level Security Implementation

- **US Manager Role**: Access restricted to United States data only
- **Europe Manager Role**: Access to UK, Germany, France, and Australia data
- **Testing**: Successfully validated role-based data filtering in PowerBI Service
- **Security Model**: Applied at Customer/Territory level with country-based filters

Challenges Faced and Solutions

Challenge 1: Date Table Complexity

Issue: Multiple date-related tables after transformations **Solution**: Maintained both original Date table (for relationships) and Date Summary table (for aggregations)

Challenge 2: Relationship Ambiguity

Issue: Multiple potential relationship paths between tables **Solution**: Carefully designed star schema with Sales as central fact table, ensuring single active relationships

Challenge 3: DAX Performance

Issue: Complex calculations affecting report performance **Solution**: Optimized DAX formulas using CALCULATE and proper filter contexts

Challenge 4: RLS Testing

Issue: Difficulty testing security roles during development **Solution**: Used PowerBI Service testing features and documented results with screenshots

Assumptions and Limitations

Assumptions

- **Data Quality**: Assumed source data accuracy after basic cleaning
- **Currency**: All monetary values assumed to be in USD
- **Forecast Model**: Linear trend assumption for 6-month projection
- **Geographic Data**: Country classifications based on available dataset values
- **Business Rules**: Standard fiscal year calendar assumed
- **Customer Segmentation**: Arbitrary thresholds used for High/Medium/Low categorization

Limitations

- **Real-time Data**: Analysis based on historical data only, no real-time updates
- **External Factors**: Does not account for external market conditions, seasonality beyond historical patterns
- **Data Scope**: Limited to AdventureWorks sample data, may not reflect real-world complexity
- **Security Model**: Simplified RLS implementation, enterprise scenarios may require more granular control
- **Forecast Accuracy**: Linear projection may not account for business cycles or market changes
- **Geographic Granularity**: Limited to country/region level, city-level analysis constrained by data availability
- **Product Lifecycle**: Does not account for product launch dates or discontinuation
- **Currency Fluctuations**: Single currency assumption may not reflect multi-national operations