Financial & Customer Analytics Dashboard
Dataset: analytics (Google BigQuery)
Tool: Power BI
Architecture: Star Schema
Project Type: End-to-End BI & Financial & Customer Analytics Solution

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1. Project Overview

1.1 Background

The organization operates a multi-category e-commerce business capturing transactional data across products, brands, departments, customers, acquisition channels, and geographic regions. Despite the volume and richness of operational data, several challenges existed:

- Financial and customer data were siloed in raw tables without a unified reporting framework.
- Revenue performance was assessed only at aggregate levels, with limited understanding of underlying drivers such as volume, pricing, or customer expansion.
- Profitability by category, brand, and department lacked transparency.
- Refunds' impact on net revenue was not quantified.
- Customer churn and retention patterns were not systematically monitored.
- Marketing acquisition channels were not evaluated in terms of customer quality or revenue contribution.

These gaps led to reactive decision-making based on static reports rather than proactive, data-driven insights.

1.2 Business Problem

The organization faced a core challenge: the absence of an integrated analytics solution capable of addressing critical financial and customer questions.

Financial Perspective:

- Is revenue growth sustainable year-over-year?
- Which product categories and brands drive profitable growth?
- How do costs and refunds affect net revenue?
- Are high-performing regions expanding profitably?

Customer Perspective:

- Which customer segments generate the majority of revenue?
- How quickly are customers churning?
- What is the financial impact of churn?
- Which acquisition channels attract high-value customers?

Without a unified BI framework, the organization lacked actionable visibility into both growth drivers and profitability risks.

1.3 Project Objective

This project aimed to design and implement a scalable BI solution that:

- Establishes a structured Star Schema data model for reliable financial reporting.
- Integrates advanced customer behavior analytics using RFM segmentation and churn analysis.
- Separates financial health monitoring from customer intelligence tracking.
- Enables time-based performance analysis, including YoY, MoM, and seasonal trends.
- Quantifies revenue loss associated with customer churn.
- Supports executive-level strategic decision-making.

Technology Stack:

- BigQuery – Data transformation, aggregation, and behavioral modeling.
- Power BI – Semantic modeling and executive visualization.
- DAX – Advanced KPI and time intelligence calculations.

1.4 Strategic Value

The solution transforms raw transactional data into a unified decision-support system delivering:

- Transparent revenue, margin, and profitability insights.
- Early detection of churn and retention risk.
- Segment-level revenue concentration analysis.
- Pricing and volume decomposition insights.
- Geographic and brand-level performance benchmarking.
- Marketing channel ROI evaluation.

This capability moves the organization from reactive reporting to proactive, data-driven decision-making.

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2. Solution Architecture

System Flow:

BigQuery Raw Tables → SQL Transformation Layer → Power BI Star Schema → DAX Measures Layer → Executive Dashboards

This architecture ensures:

- Scalable transformations.
- Behavioral modeling for customer intelligence.
- High-performance reporting and executive-ready visualizations.

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3. Data Cleaning & Transformation

3.1 SQL Data Cleaning (BigQuery Layer)

1. Data Standardization:

- Trimmed whitespace for product names, brand names, country fields, and customer identifiers.
- Standardized text case (UPPER / INITCAP) to prevent category duplication (e.g., “usa” vs “USA”).

2. Duplicate Removal:

- Used ROW_NUMBER() OVER (PARTITION BY order_id ORDER BY created_at DESC) to retain the latest valid transaction per order.
- Ensured one row per unique order to avoid metric inflation.

3. Data Quality Validation:

- Checked for nulls in critical fields (product_id, user_id, sale_price, created_at).
- Removed negative revenue or invalid refund entries.
- Ensured valid foreign key relationships.
- Corrected inconsistent date formats and excluded incomplete records.

4. Outlier Detection & Treatment:

- Analyzed revenue and sale_price distributions using Z-score and IQR methods.
- Filtered extreme system error values while retaining valid high-value transactions.

5. Derived Analytical Views:

- customer_base: Aggregated transactional metrics at user level.
- customer_purchase_cycle: Average purchase frequency per customer.
- customer_churn: Flags churned customers.
- customer_rfm: Recency, frequency, monetary scoring.
- customer_segments: Segment assignment based on RFM scores.
- monthly_churn: Monthly active customer and churn metrics.
- churn_revenue_loss: Revenue lost due to churn.

This separation enabled clean transactional, behavioral, and financial reporting layers.

3.2 Power Query Transformations (Power BI Layer)

1. Data Type Optimization:

- Converted date columns to Date type.
- Enforced numeric types for revenue, cost, and quantity.

- Ensured consistency of foreign key columns.

2. Column Cleaning:

- Removed unnecessary system or intermediate columns.
- Renamed columns for clarity and split composite columns where required.

3. Additional Validation:

- Verified blanks after joins and relationship integrity.
- Reconciled row counts with SQL outputs for accuracy.

3.3 Data Modeling, Transformations & KPI Framework

Star Schema Core Model:

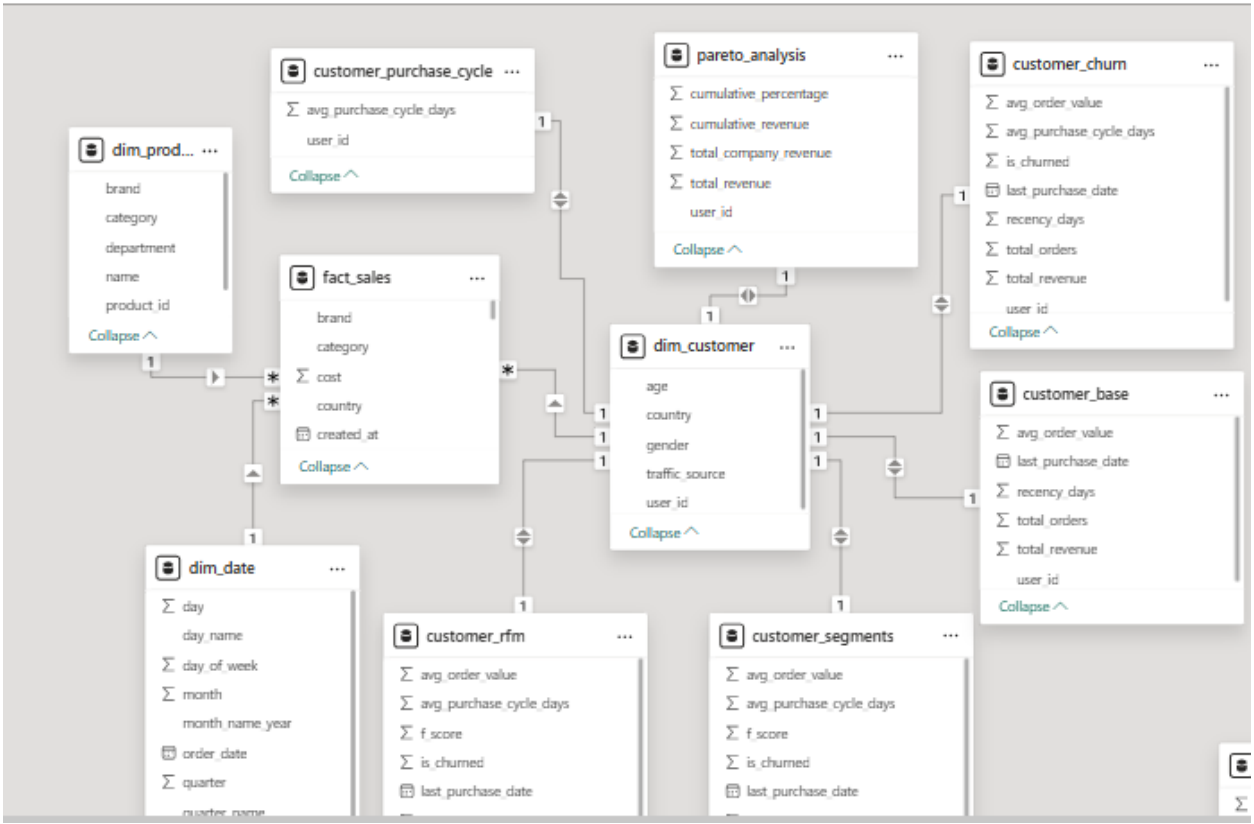
- Fact Table: fact_sales (transaction-level).
- Dimension Tables: dim_product, dim_customer, dim_date, dim_geography, dim_brand.
- Relationships: Single-direction filtering to ensure no ambiguity, optimized DAX, and high-performance time intelligence.

Customer Intelligence Layer:

- Behavioral views: customer_base, customer_purchase_cycle, customer_churn, customer_rfm, customer_segments.
- All linked via dim_customer[user_id].
- Filter Flow: customer_segments → dim_customer → fact_sales.

Time-Based Aggregations:

- monthly_churn linked to dim_date for churn trend visualization.
- churn_revenue_loss used via measure to prevent total distortion.



Calculated Columns & Core KPI Measures:

- Revenue = Quantity × Unit Price
- Net Revenue = Revenue – Refund Amount
- Profit = Net Revenue – Cost

- Customer Active Flag for churn analysis

Financial KPIs: Total Revenue, Net Revenue, Total Cost, Gross Profit, Contribution Margin %, Average Order Value, Total Orders, YoY Revenue Growth %, Refund Impact

Customer KPIs: Total Customers, Active Customers, Churn Rate %, Revenue Lost to Churn, Revenue by Segment, Revenue by Acquisition Channel, Revenue by Gender

Time Intelligence Functions: SAMEPERIODLASTYEAR(), DATEADD(), TOTALYTD()

Governance & Data Integrity Controls:

- Cross-validation between SQL aggregates and Power BI totals.
- Margin reconciliation and refund impact verification.
- Churn logic back-testing for mathematical and logical accuracy.

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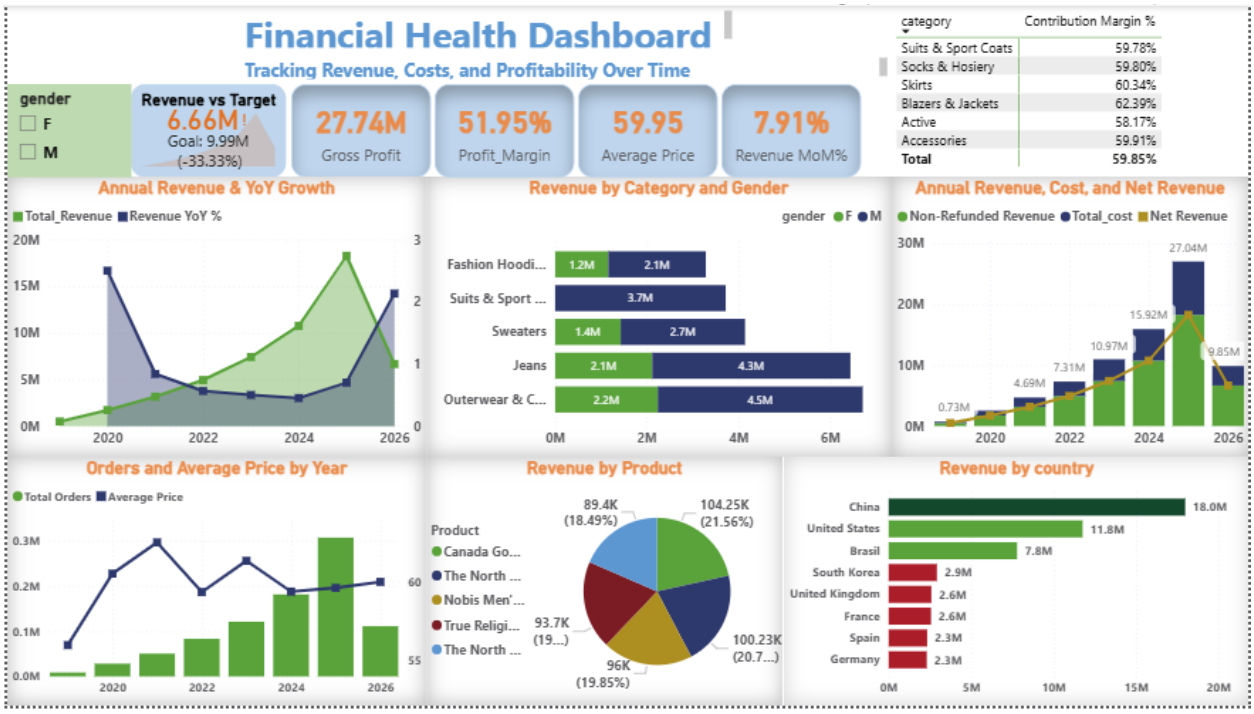
4. Dashboard Structure

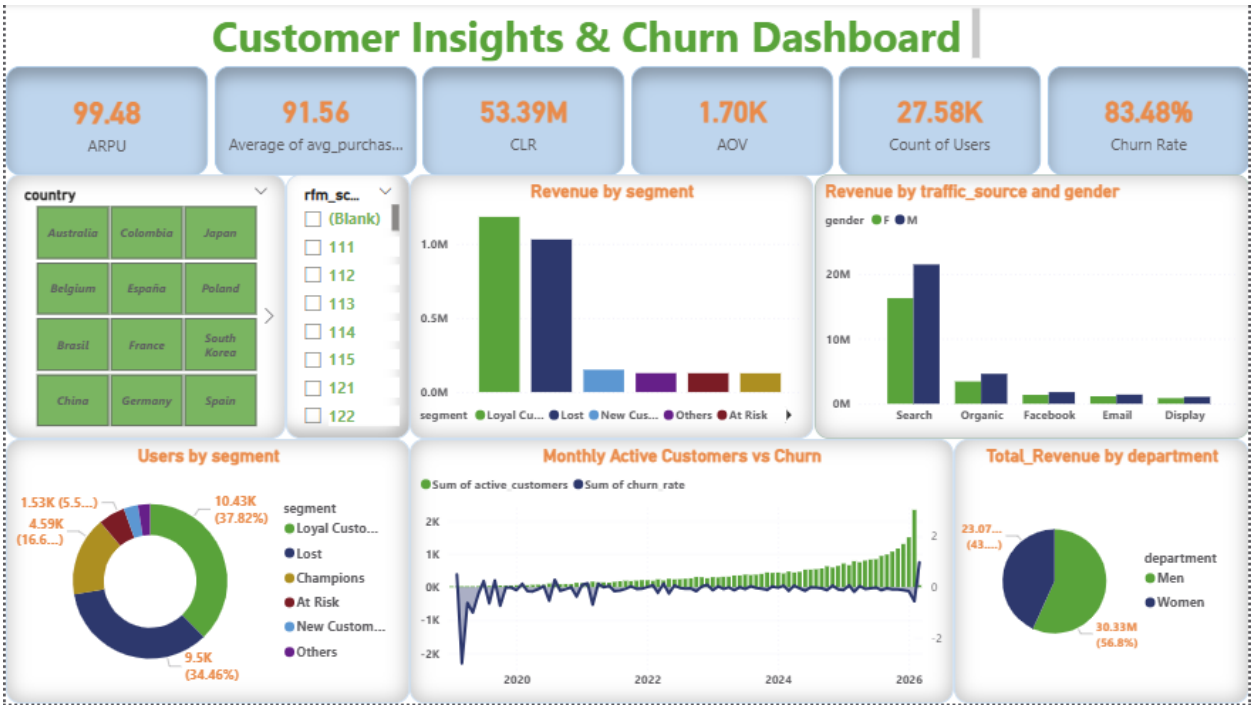
Financial Health Dashboard

- Executive KPIs: Total Revenue, YoY Growth %, Net Revenue, Contribution Margin %.
- Revenue Trend: Line + Column Chart.
- Orders vs Average Price: Combo Chart.
- Revenue by Category & Gender.
- Revenue by Brand.
- Revenue by Country.
- Margin by Category.



Customer Insights & Churn Dashboard

- Executive KPIs: Total Customers, Active Customers, Churn Rate, Revenue per Customer.
- Revenue by Segment.
- Customer Distribution.
- Revenue by Traffic Source.
- Department Revenue Split.
- Churn Trend.



5. Key Insights

Financial Health Dashboard:

- Revenue Growth: Consistent YoY growth, primarily driven by high-volume categories; pricing sensitivity reflected in fluctuations of average order value.
- Profitability: Contribution margin averages ~52%; high-margin categories drive overall profitability while low-margin categories (e.g., Active products) require attention.
- Category Performance:
    - Highest margins: Suits & Sport Coats, Blazers & Jackets.
    - Lowest margins: Active products – indicates cost and pricing optimization opportunity.
- Geographic Concentration: Revenue concentrated in China, US, Brazil – strong markets but risk exposure exists.
- Orders & Pricing: Steady increase in orders; average price fluctuates 55–65, showing sensitivity to promotions.
- Brand Distribution: Revenue diversified across brands; The North Face slightly leads.
- Refund Impact: Moderate refunds do not significantly distort net revenue.

Customer Insights & Churn Dashboard:

- Segment Contribution: Champions (~38% of customers) generate the largest revenue share.
- Retention Risk: At-risk customers (~34%) nearly equal Champions, indicating retention vulnerability.
- Churn Rate: High (~83%), highlighting critical retention needs.
- Loyalty: Loyal customers only ~5.5%, indicating weak engagement.
- Acquisition Channels: Search and Organic traffic drive highest revenue; Display campaigns underperform.
- Gender Revenue Split: Women contribute 57% of revenue vs 43% men, highlighting targeted marketing opportunities.
- Customer Trends: Active customer counts fluctuate monthly; churn spikes suggest gaps in lifecycle management and opportunities for predictive retention interventions.

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6. Strategic Recommendations

Financial Health:

- Scale high-performing geographies while exploring new markets to diversify risk.
- Prioritize high-margin categories for marketing and promotional efforts.
- Stabilize pricing through controlled promotions and value-based strategies.
- Optimize procurement and supply chain to protect margins.
- Strengthen secondary brands to reduce reliance on top-performing brands.
- Implement predictive revenue forecasting for inventory, marketing, and financial planning.

Customer Insights & Retention:

- Implement proactive retention programs targeting At-Risk customers.
- Expand loyalty programs with tiered rewards and repeat-purchase incentives.
- Launch win-back campaigns for Lost customers with behavioral triggers.
- Reallocate marketing spend to high-performing channels and optimize ROI.
- Apply segment-based personalization for messaging, promotions, and product recommendations.
- Develop gender-focused campaigns to balance revenue contributions.
- Establish a monthly churn monitoring framework integrating early warning metrics.

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7. Technical Competencies Demonstrated

- Data Warehousing & Star Schema Modeling
- SQL View Development in BigQuery
- RFM Segmentation & Churn Modeling
- Advanced DAX & Time Intelligence
- KPI Architecture & Financial Analysis
- Executive Dashboard Development
- Data Governance & Validation

8. Limitations & Future Enhancements

Current Limitations:

- No predictive forecasting implemented.
- Churn analysis based solely on transactional activity.
- Customer Lifetime Value (CLV) not yet modeled.

Future Enhancements:

- Customer Lifetime Value prediction.
- Integration of forecasting models.
- Cohort retention analysis.
- Drill-through product and category profitability reports.

9. Conclusion

The project successfully delivered a unified Financial and Customer Intelligence platform that provides:

- Revenue transparency and margin visibility.
- Customer retention insights and churn monitoring.
- Segment-level and geographic revenue analysis.
- Executive-ready dashboards for data-driven decision-making.

The organization demonstrates strong financial performance; however, implementing retention-focused strategies is critical for long-term, sustainable growth.