Operational Optimization Analysis of a Cafe

Food & Beverage (Cafe Retail)

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Summary

Problem

The café operates in a high-volume, low-ticket environment, recording 9,498 orders and generating **$84,732.50** in revenue from 28,693 items sold in 2023. While overall revenue performance appears stable, management lacks clarity on:

- Which products truly drive profitability
- Customer payment behavior patterns
- Location performance differences
- Seasonal or monthly revenue fluctuations
- Operational inefficiencies due to data quality gaps

Approach

The project utilized cleaned transactional data from 2023 and implemented a structured KPI-driven dashboard in Google Sheets using pivot tables and calculated metrics.
The analysis focused on:

- Product-level revenue and quantity contribution
- Payment method distribution
- Location-based sales performance
- Cross-analysis between item category and payment preference

Insights

- **Top revenue generators:** Salad **($16,550.00)**, Sandwich, and Smoothie
- **Low average order value: ($8.92)** confirms high-volume, low-ticket model
- **Data classification gaps: 'Not Specified'** dominates payment and location categories
- **Payment distribution:** Cash, Credit Card, and Digital Wallet nearly evenly split
- **Operational stability:** Monthly revenue fluctuates within narrow range

Recommendations

- Improve data capture processes to eliminate **'Not Specified'** categories
- Focus promotions on high-revenue products
- Implement upselling strategies to increase average order value
- Use stable monthly trends for improved forecasting and inventory planning
- Replicate success factors from high-performing locations across network

Sector & Business Overview

Sector Overview

The café industry operates within the quick-service food and beverage (QSR) segment, characterized by high transaction volume and low average ticket size. Revenue depends on repeat purchases, efficient service, and optimized product mix.

Cafés typically generate income through:

- In-store dining
- Takeaway services
- Multiple payment channels (cash, card, digital wallets)

Due to thin margins and perishable inventory, performance monitoring and demand planning are critical for profitability.

Current Challenges

Key operational and analytical challenges in café businesses include:

- Low average order value requiring upselling strategies
- Inventory wastage risk due to demand variability
- Managing multiple payment channels
- Incomplete or inconsistent transaction data
- Evaluating location-based performance effectively

Why This Problem Was Chosen

This case represents a high-volume transactional business where small performance improvements can significantly impact revenue.

With:

- 9,498 transactions
- **$84,732.50** annual revenue
- Multiple product categories
- Diverse payment methods
- Location-based operations

The dataset allows structured KPI analysis to identify revenue drivers, payment behavior, and operational inefficiencies, while also addressing real-world data classification gaps.

Problem Statement & Objectives

Formal Problem Definition

Despite recording 9,498 transactions and generating **$84,732.50** in annual revenue, the café lacks structured visibility into:

- Key revenue-driving products
- Payment behavior patterns
- Location performance comparison
- Monthly performance trends
- Data classification gaps affecting accuracy

Without a defined KPI framework and analytical structure, management cannot make data-backed operational or strategic decisions.

Project Scope

This project focuses on analyzing 2023 transactional sales data to:

- Establish a clear KPI framework
- Evaluate product-wise revenue contribution
- Compare payment method distribution
- Assess location-based performance
- Identify monthly revenue trends
- Highlight data quality limitations

The analysis is limited to available transaction-level data and does not include cost, profit margins, or customer demographic information.

Success Criteria

The project will be considered successful if it:

- Identifies the top revenue-driving products.
- Quantifies payment and location distribution patterns.
- Establishes average order value and performance benchmarks.
- Detects operational inefficiencies from data gaps.
- Produces a functional dashboard supporting management-level decision-making.

Data Description

Dataset Source

The dataset used for this analysis is a transactional café sales dataset for the year 2023.
Kaggle Link for current dataset: [Kaggle Link]

Dataset Structure & Column Explanation

Column Name	Data Type	Description
Transaction ID	String	Unique identifier for each transaction
Item	Categorical	Product category (Coffee, Tea, Sandwich, etc.)
Payment Method	Categorical	Payment type (Cash, Credit Card, Digital Wallet)
Location	Categorical	Service location (In-store, Takeaway, Not Specified)
Transaction Date	Date	Date of transaction (DD-MM-YYYY format)
Quantity	Numeric	Number of items purchased
Price Per Unit	Numeric	Unit price in dollars
Total Spent	Numeric	Total transaction amount in dollars

Data Size & Explanation

- **Total Orders:** 9,498
- **Total Revenue: $84,732.50**
- **Total Items Sold:** 28,693
- **Granularity:** One row per transaction
- **Time Period:** January 2023 – December 2023

Data Limitations

- A significant portion of records are labeled as **“Not Specified”** for payment method and location.
- No cost or profit data is available, limiting profitability analysis.
- No customer demographic data is included.
- Analysis is limited to a single year (2023), restricting long-term trend evaluation.

Data Cleaning & Preparation

Missing Values Handling

- Records with missing or blank entries in critical fields were standardized.
- Missing categorical fields (Payment Method, Location) were labeled as **"Not Specified"** to preserve transaction count integrity.
- "UNKNOWN", "ERROR", or (Blanks) were changed to reflect as "Unknown"
- Quantity, Price per Unit, and Total Spent values were imputed to save dropping of ~5,000 rows.

Outlier Treatment

- No outlier removal required
- All values fell within acceptable boundaries
- Validated against business rules
- No significant deviations detected

Transformations

- Standardized text formatting (consistent naming for items, payment methods, and locations).
- Ensured proper date formatting for monthly and weekday analysis.
- Verified that **Total Spent = Quantity × Price Per Unit** for all records.

Feature Engineering

Additional analytical fields were derived using pivot tables and formulas:

- Total Revenue, Orders, Items Sold
- Average Order Value
- Monthly Revenue
- Day-of-Week, Product-wise, Location-wise Revenue Contribution
- Payment-wise Distribution
- Location-wise Revenue

These derived metrics formed the foundation of the KPI dashboard.

Assumptions

- All transactions in the dataset represent completed and valid sales.
- “Not Specified” categories reflect missing classification rather than actual payment/location types.
- Pricing remained consistent within recorded values throughout 2023.

KPI & Metric Framework

KPI	Value	Business Significance
Total Revenue	**$84,732.50**	Overall business performance
Avg Transaction Value	**$8.92**	Customer spending behavior
Total Transactions	9,498	Sales volume indicator
Items Sold	28,697	Product movement velocity
Avg Items/Transaction	3.02	Basket size metric
Daily Avg Revenue	**$232.14**	Daily performance benchmark
Top Product Share	19.5%	Product concentration risk

KPI Definitions & Formulas

- **Total Revenue:** Sum of all Total Spent values
  - **Formula**: Σ(Total Spent)
  - **Business Meaning:** Primary business outcome metric

- **Average Transaction Value:** Mean transaction amount
  - **Formula:** Total Revenue / Total Transactions
  - **Business Meaning:** Customer spending pattern indicator

- **Items Per Transaction:** Average basket size
  - **Formula:** Total Items Sold / Total Transactions
  - **Business Meaning:** Cross-selling effectiveness

- **Revenue Per Day:** Daily revenue average
  - **Formula:** Total Revenue / Number of Days
  - **Business Meaning:** Operational performance baseline

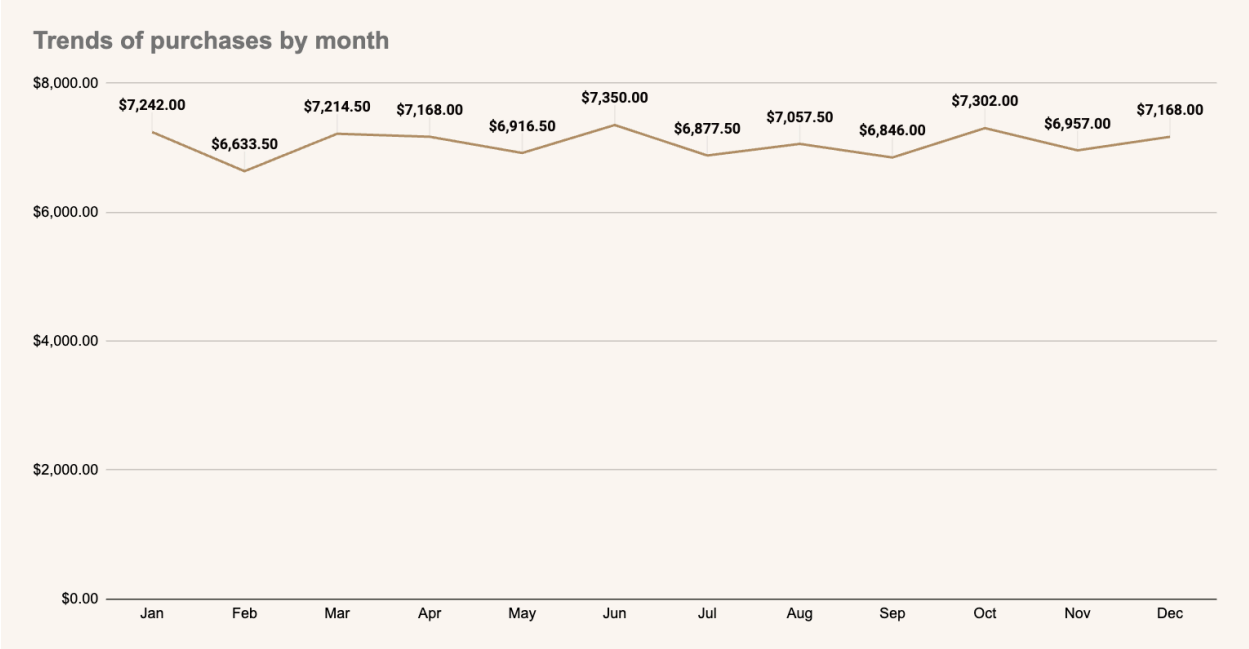
- **Category Revenue Share:** Product contribution
  - **Formula:** (Category Revenue / Total Revenue) × 100
  - **Business Meaning:** Product portfolio analysis

Exploratory Data Analysis (EDA)

Trend Analysis (Monthly Revenue)

Monthly revenue remains relatively stable throughout 2023.

- Highest month: June - **$7,350.00**
- Lowest Month: **February – $6,633.50**
- Revenue range fluctuation: ~ **$700**

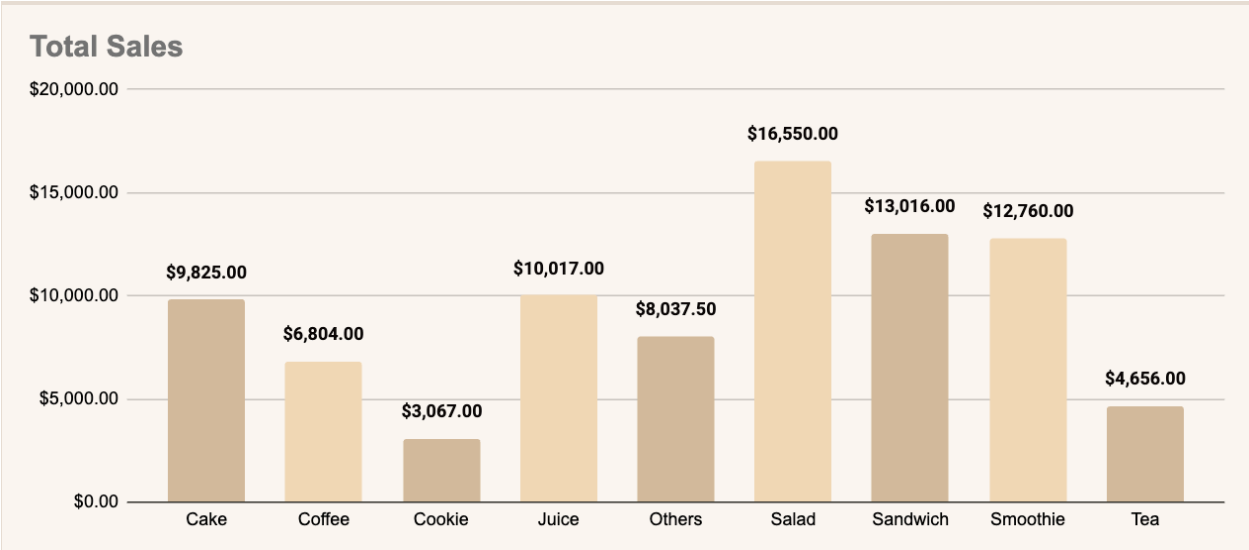


This narrow variation indicates consistent demand and limited seasonality. The business does not heavily depend on a specific month for performance.

Comparison Analysis (Product Performance)

Revenue contribution varies significantly across items:

- Top Performer: **Salad - $16,550.00**
- Strong Performers: **Sandwich ($13,016.00), Smoothie ($12,760.00)**
- Lowest Contributor: **Cookie – $3,067.00**

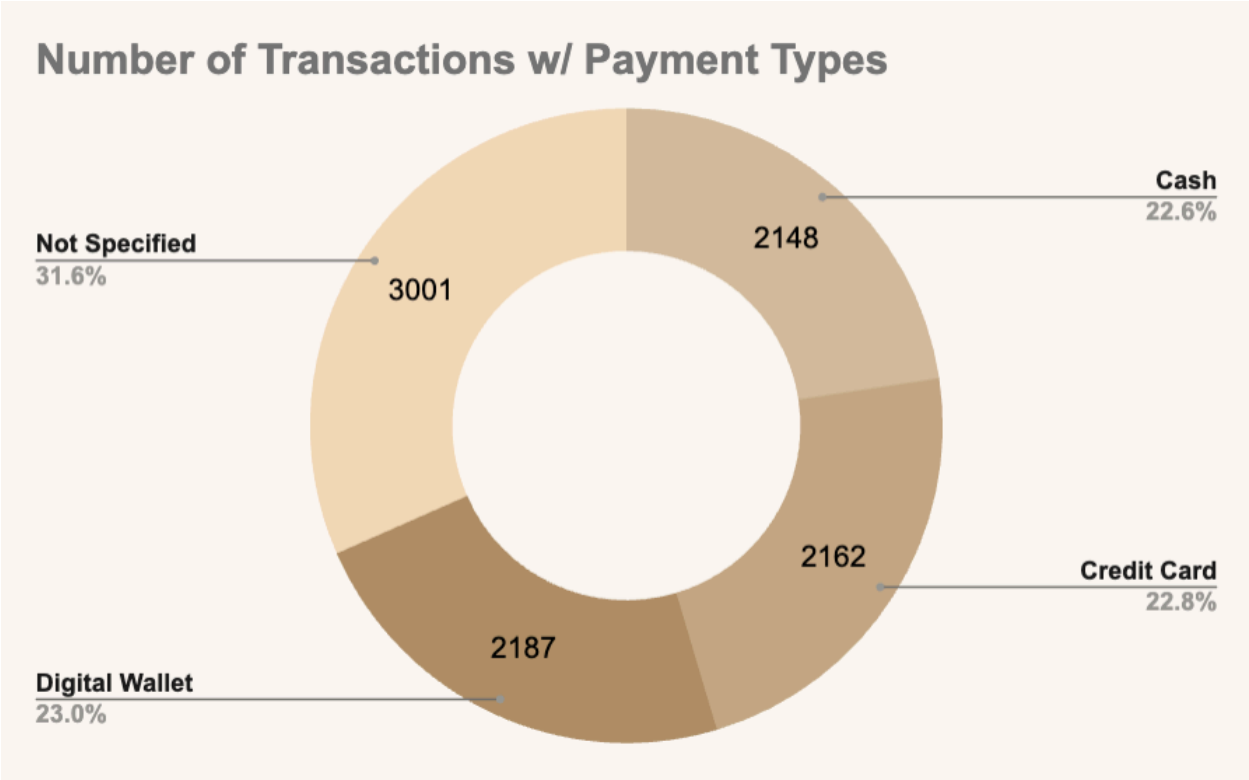


Revenue concentration in a few core items suggests reliance on specific product categories.

Distribution Analysis (Payment Methods)

Transaction counts are balanced across formal payment channels:

- Cash: **2,148**
- Credit Cards: **2,162**
- Digital Wallet: **2,187**



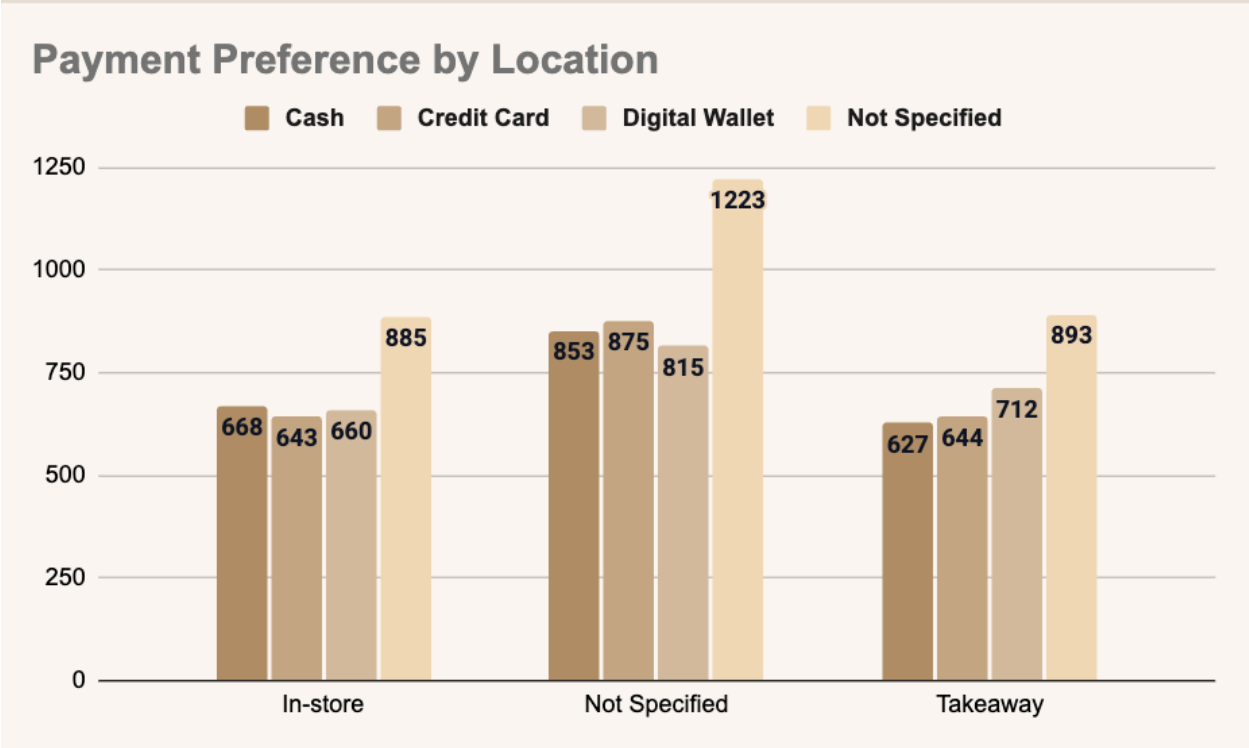
However, **Not Specified (3,001 transactions)** represents the largest category, indicating data classification issues.

Revenue distribution across payment types is similarly balanced, excluding the unspecified category.

Location-Based Analysis

Revenue by location:

- In-store: **$25,804.50**
- Takeaway: **$25,321.50**
- Not Specified: **$33,606.50**



In-store and takeaway performance are nearly identical, suggesting dual-channel operational strength.

Weekly Pattern Analysis

Revenue is evenly distributed across all days of the week, with no extreme peak or drop days. This indicates steady daily demand rather than weekend dependency.

Correlation Insights

- Higher quantity items directly drive higher revenue (as expected in a fixed-price menu structure).
- No strong indication of payment method influencing revenue size.
- Revenue stability suggests consistent purchasing behavior rather than sporadic high-value spikes.

Advanced Analysis

Revenue Concentration Analysis

A limited number of products contribute a significant portion of total revenue.

- Top 3 products (Salad, Sandwich, Smoothie) generate a substantial share of overall revenue
- Lower-performing items (e.g., Cookie, Tea) contribute comparatively less.

This indicates moderate revenue concentration risk and highlights the importance of maintaining strong performance in core menu items.

Channel Segmentation (Location-Based)

In-store and takeaway revenues are nearly equal:

- In-store: **$25,804.50**
- Takeaway: **$25,321.50**

This suggests balanced demand across service formats. Operational resources (staffing, inventory allocation) should therefore be evenly optimized across both channels.
However, the large “Not Specified” category limits deeper channel-level insights.

Payment Segmentation

Formal payment methods (Cash, Credit Card, Digital Wallet) are almost evenly distributed in both transaction count and revenue.
This indicates:

- No heavy dependency on a single payment mode
- Customers exhibit flexible payment behavior

However, the large “Not Specified” category introduces reporting and reconciliation risk.

Risk & Data Quality Analysis

Two structure risks are identified:

- **Classification Risk**
  - 3,001 transactions with unspecified payment
  - 3,766 transactions with unspecified location
  - This weakens analytical reliability
- **Low Average Order Value Risk**
  - AOV ≈ **$8.92**
  - Revenue growth is volume-dependent rather than ticket-dependent, increasing sensitivity to demand fluctuation

Scenario Insights

If average order value increases by even $1:

- New AOV ≈ **$9.92**
- Potential revenue increase ≈ **$9,498** annually

This demonstrates that small pricing or upselling improvements can significantly impact total revenue.

Dashboard Design

Dashboard Objective

The dashboard was designed to provide a clear, management-level view of café performance using transactional data from 2023.
It's purpose is to:

- Monitor revenue and order performance
- Identify top-performing products
- Analyze payment and location distribution
- Track monthly sales trends
- Support operational decision-making

Implementation

The dashboard was implemented in **Google Sheets & Looker Studio** using:

- Pivot Tables
- Calculated formulas
- KPI summary cards
- Structured layout sections

All visual outputs are dynamically linked to the cleaned dataset.

View Structure

The dashboard is organized into structured sections:

- **Top KPI Section**
  - Total Orders (9,498)
  - Total Revenue **($84,732.50)**
  - Total Items Sold (28,693)
- **Product Performance Section**
  - Revenue by Item
  - Quantity by Item
- **Payment Analysis Section**
  - Transaction count by payment method
  - Revenue by payment method
- **Location Analysis Section**
  - Revenue by location
  - Payment preference by location

- **Time Trend Section**
    - Monthly revenue
    - Day-of-week revenue

Filters & Drilldowns

The dashboard enables analysis by:

- Item
- Payment Method
- Location
- Month

Pivot filters allow users to drill down into specific categories without altering the underlying dataset.

Insights Summary

- **Revenue is Stable Across the Year**
  Monthly revenue fluctuates within a narrow range (**~$6.6K–$7.35K**), indicating consistent demand without strong seasonality.
- **Business Operates on a Low-Ticket Model**
  Average Order Value ≈ $8.92, meaning revenue growth depends primarily on transaction volume or upselling.
- **Revenue Concentration in Core Products**
  Salad, Sandwich, and Smoothie are the primary revenue drivers, contributing a significant share of total sales.
- **Underperforming Product Categories Exist**
  Items like Cookie and Tea contribute comparatively lower revenue, indicating potential for repositioning or bundling.
- **Balanced Channel Performance**
  In-store and Takeaway revenues are nearly identical, suggesting operational strength across both service formats.
- **Even Payment Distribution (Formal Channels)**
  Cash, Credit Card, and Digital Wallet usage are almost evenly split, indicating flexible customer payment behavior.
- **Data Classification Weakness**
  “Not Specified” represents the largest category in both payment and location, reducing analytical precision.
- **Revenue Evenly Distributed Across the Week**
  No heavy weekend dependency; demand remains steady throughout the week.
- **Small AOV Improvements Can Drive Noticeable Growth**
  A $1 increase in average order value could generate approximately $9,498 in additional annual revenue.
- **Operational Stability with Optimization Potential**
  The café shows consistent performance but has clear opportunities for structured improvement through data accuracy and upselling strategies.

Recommendations

- **Improve Data Classification Accuracy**
  - **Mapped Insight**: High “Not Specified” categories
  - **Action**:
    - Enforce mandatory selection of payment method and location in POS systems.
    - Introduce data validation controls.
- **Business Impact:**
  - Improves reporting accuracy and enables precise channel and payment strategy decisions.
  - **Feasibility:** High (process-level improvement).

- **Focus on High-Revenue Products**
  - **Mapped Insight**: Revenue concentration in Salad, Sandwich, Smoothie
  - **Action**:
    - Prioritize promotion of top-performing items.
    - Ensure consistent stock availability.
    - Highlight them in menu placement.
- **Business Impact:**
  - Protects and strengthens primary revenue streams.
  - **Feasibility:** High (marketing and operational alignment).

- **Increase Average Order Value (AOV)**
  - **Mapped Insight**: Low AOV (**$8.92**)
  - **Action**:
    - Introduce combo offers (e.g., Sandwich + Drink).
    - Train staff in upselling add-ons.
    - Offer limited-time bundle discounts.
  - **Business Impact:**
    - Even a **$1** increase in AOV can add **~$9,498** annually.
    - **Feasibility:** Medium to High (requires pricing and promotional planning).

- **Optimize Underperforming Items**
  - **Mapped Insight**: Lower revenue items (e.g., Cookie, Tea)
  - **Action**:
    - Bundle with high-performing products.
    - Review pricing or reposition on the menu.
    - Evaluate removal if consistently weak.
  - **Business Impact:**
    - Improves menu efficiency and inventory turnover.
    - **Feasibility:** Medium (requires sales testing).

- **Maintain Balanced Channel Strategy**
  - **Mapped Insight**: In-store and Takeaway revenues are similar
  - **Action**:
    - Maintain equal staffing efficiency across both channels.
    - Align promotions for both service formats.
  - **Business Impact:**
    - Ensures operational efficiency and customer satisfaction.
    - **Feasibility:** High.

Impact Estimation

- **Revenue Increase from AOV Improvement**
  - Current AOV ≈ **$8.92**
  - If AOV increases by **$1**:
    - Additional Revenue = 9,498 orders × $1
    - Potential Increase ≈ **$9,498** annually
  - If AOV increases by $1.50:
    - **Potential** Increase ≈ **$14,247** annually
    - **Impact:** Direct revenue growth without increasing transaction volume.

- **Revenue Optimization Through Product Focus**
  - Top-performing products (Salad, Smoothie, Sandwich) generate a major share of revenue.
  - If targeted promotions increase their sales by 5%:
    - Estimated uplift ≈ **$2,000–$3,000** annually (approximate proportional increase).
    - **Impact:** Strengthens high-margin revenue streams.

- **Efficiency Gains from Accurate Data Capture**
  - Reducing "Not Specified" classifications improves:
    - Location-level decision accuracy
    - Payment reconciliation efficiency
    - Marketing targeting precision
  - Even a 2-3% improvement in operational efficiency (reduced wastage, better staffing alignment) can translate into measurable cost savings over time.

- **Inventory & Demand Planning Stability**
  - Stable monthly revenue patterns allow:
    - More accurate inventory ordering
    - Reduced spoilage risk
    - Better workforce scheduling
  - Even a small reduction in wastage (e.g., 2–4%) can improve net margins significantly in a low-ticket café model.

Limitations

- **Data Classification Gaps**
  - A significant portion of transactions are labeled as **“Not Specified”** for both payment method and location.
  - This limits the accuracy of payment and channel-level analysis.
- **No Cost or Profit Data**
  - The dataset includes only revenue-related variables.
    Without cost data, margin analysis and profitability evaluation cannot be performed.
- **No Customer-Level Information**
  - The dataset includes only revenue-related variables.
    Without cost data, margin analysis and profitability evaluation cannot be performed.
- **Single-Year Dataset**
  - The analysis is limited to 2023 data only.
  - Long-term growth trends, multi-year seasonality, and structural changes cannot be assessed.
- **No External Factors Included**
  - The dataset does not account for:
  - Promotions
  - Price changes
  - Market competition
  - External events
  - Therefore, causal conclusions cannot be established - only performance patterns can be observed.

Future Scope

- **Profitability & Margin Analysis**
  - Incorporating cost data (ingredient cost, labor, overheads) would allow:
  - Product-level margin analysis
  - Identification of high-profit vs high-revenue items
  - True profitability optimization

- **Customer Segmentation**
  - Adding customer identifiers would enable:
  - Repeat purchase analysis
  - Loyalty program evaluation
  - Customer lifetime value estimation

- **Multi-Year Trend Analysis**
  - Including historical data from multiple years would allow:
  - Growth rate measurement
  - Seasonality detection
  - Forecasting models for demand prediction

- **Predictive & Forecasting Models**
  - Advanced techniques such as time-series forecasting could:
  - Predict monthly revenue
  - Improve inventory planning
  - Optimize staffing requirements

- **Menu Engineering**
  - Combining sales volume and margin data would support:
  - Product repositioning decisions
  - Removal of underperforming items
  - Strategic pricing adjustments

Conclusion

This project developed a structured, KPI-driven analysis of a 2023 café transactional dataset comprising 9,498 orders, 28,693 items sold, and **$84,732.50** in total revenue. The analysis revealed that the café operates on a stable, high-volume, low-ticket business model with consistent monthly demand. Revenue is concentrated in a few core products, while payment behavior is evenly distributed across formal channels. However, significant data classification gaps reduce analytical precision and decision clarity.

By implementing targeted improvements - particularly increasing average order value, strengthening data accuracy, and optimizing high-performing products - the café can achieve measurable revenue growth and operational efficiency.

Overall, the project demonstrates how structured KPI frameworks and dashboard-based analytics can transform raw transactional data into actionable business intelligence for performance optimization and strategic planning.

Appendix

Data Dictionary

Column Name	Description	Data Type
Transaction ID	Unique identifier for each transaction	Text
Item	Product Purchased	Text
Payment Mode	Mode of Payment	Text
Location	Order channel	Text
Transaction Date	Date of transaction	Date
Quantity	Number of units purchased	Numeric (Integer)
Price per Unit	Selling price per item	Numeric (Decimal)
Total Spent	Total transaction value	Numeric (Decimal)

KPI Formulas Used

- **Total Revenue** = SUM(Total Spent)
- **Total Orders** = COUNTA(Transaction ID)
- **Total Items Sold** = SUM(Quantity)
- **Average Order Value (AOV)** = Total Revenue ÷ Total Orders
- **Product Revenue Contribution (%)** = Item Revenue ÷ Total Revenue
- **Location Revenue Share (%)** = Location Revenue ÷ Total Revenue
- **Payment Distribution (%)** = Payment Orders ÷ Total Orders

Additional Observations

- In-store and Takeaway revenues are nearly equal.
- Formal payment channels show balanced usage patterns.

Contribution Matrix

Team Member	Dataset & Sourcing	Cleaning	KPI & Analysis	Dashboard	Report	PPT	Overall Role
Hemanth	✓	✓	-	-	✓	✓	**Data Lead & Report Coordinator**
Aaloke	-	-	✓	✓	-	✓	**KPI & Dashboard Lead**
Yash	✓	-	-	-	✓	-	**Data Sourcing & Documentation Support**
Saksham	✓	-	-	-	✓	-	**Data Sourcing & Documentation Support**
Harsha	-	✓	✓	✓	-	-	**Dashboard & Analysis Support**
Gourav	-	-	-	-	-	-	**Project Support / Coordination**

Team Signature Team Signature