

# **Operational Optimization & Performance Analysis of a Restaurant**

Food & Beverage Sector (Restaurant Retail)

## **Team Members**

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## **Institute Name & Faculty Details**

**Institute Name** - Newton School Of Technology,  
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**Faculty Name** - Archit Raj, Satyaki Das

**Course** - Data Visualization and Analytics

## **Summary**

### **Problem**

The restaurant operates in a competitive multi-channel food service environment, recording 9,015 transactions across 2022–2023 and generating \$180124.5 in total revenue.

While overall revenue appears strong, management lacks clarity on:

- Causes of 4.35% revenue decline in 2023
- Product-level revenue concentration risk
- Channel-wise performance comparison
- Customer satisfaction impact (Avg Rating: 2.99/5)
- Operational inefficiencies due to missing data

### **Approach**

The project utilized cleaned transactional data from 2022–2023 and implemented a structured KPI-driven analytical framework in Google Sheets. The analysis focused on:

- Year-over-Year revenue trend
- Category and product contribution
- Payment method distribution
- Channel segmentation (Dine-in / Delivery / Takeaway)
- Customer rating analysis
- Revenue concentration risk
- Scenario-based AOV modeling

### **Insights**

- Revenue declined by 4.35% in 2023
- Main Dishes contribute ~47% of total revenue
- Channel revenue evenly distributed across 3 service formats
- Average customer rating is 2.99/5
- Payment distribution is balanced across Cash, Card & Digital

### **Recommendations**

- Improve customer satisfaction to raise rating above 4.0
- Upsell drinks to increase AOV
- Protect high-performing menu items
- Strengthen POS data validation

## SECTOR & BUSINESS CONTEXT

**Sector Overview** The restaurant industry operates in a high-velocity, customer-sensitive F&B environment. Revenue growth depends on menu engineering, channel optimization, and pricing. Key challenges include high operational costs, competitive pressure, and repeat-purchase dependency.

### Current Challenges

- Revenue volatility due to competition and seasonal shifts
- Managing Dine-In, Takeaway & Delivery simultaneously
- Low AOV makes upselling critical; inconsistent POS data creates blind spots

**Why This Problem Was Chosen** With 9,015 transactions, 5 categories, 3 channels, and a visible 4.35% YoY decline, this dataset offers a rich, real-world case ideal for KPI-driven analysis linking data visualization to business strategy.

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## LIMITATIONS

**Data Issues:** No cost/margin data (revenue-only analysis); missing ratings imputed with median; no customer demographics; only 2 years of data; no timestamp/hour granularity.

**Assumption Risks:** External factors (promotions, competition) unaccounted for; channel share used as efficiency proxy; AOV assumes stable price sensitivity.

**What Cannot Be Concluded:** Channel or category profitability; customer segment value; whether revenue decline is seasonal or structural; promotion ROI.

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## FUTURE SCOPE

**More Analysis Possible:** YoY month-level root cause drill-down; Market Basket Analysis for combo design; RFM customer segmentation; time-series revenue forecasting; cohort analysis; profitability modelling with COGS.

**New Data Needed:** Cost/margin data; customer demographics; order timestamps; promotion/discount records; staff shift data; inventory & waste data.

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## **PROBLEM STATEMENT & OBJECTIVES**

### **Formal Problem Definition**

Despite generating substantial revenue, the restaurant lacks structured visibility into:

- Revenue decline in 2023
- Category-level revenue concentration
- Channel efficiency
- Customer satisfaction risks
- Payment distribution behavior

Without structured KPI monitoring, management cannot make data-driven strategic decisions.

### **Project Scope**

This project focuses on:

- Establishing KPI framework
- Evaluating category contribution
- Measuring YoY performance
- Analyzing channel and payment distribution
- Identifying service quality risks
- Providing actionable recommendations

The analysis excludes:

- Cost data
- Profit margins
- Customer demographics

### **Success Criteria**

The project is successful if it:

- Identifies revenue drivers
- Quantifies YoY decline
- Establishes AOV benchmark
- Detects operational inefficiencies
- Produces management-level insights

**Dataset Source :** [Kaggle link](#)

### **Dataset Structure & Column Explanation**

<b>Column Name</b>	<b>Data Type</b>	<b>Description</b>
Order Id	String	Unique identifier for each transaction
Customer ID	String	Unique identifier for customer
Category	Categorical	Product category (Main Dishes, Starters, etc.)
Item	Categorical	Name of product sold
Price(in \$)	Numeric	Unit selling price
Quantity	Numeric	Number of units purchased
Order Total(in \$)	Numeric	Total transaction amount
Order Date	Date	Date of transaction
Payment Method	Categorical	Mode of payment (Cash, Card, Digital Wallet)
Rating	Numeric	Customer rating (1–5 scale)
Order Type	Categorical	Channel type (Takeaway, Delivery, Dine-In)

### **Data Size & Explanation -**

- Total Transactions: 9,015
- Total Revenue: \$180,124.5
- Average Order Value (AOV): \$19.98

## DATA CLEANING & PREPARATION

### Missing Values Handling

- Records with missing or blank entries in critical numeric fields were identified and corrected.
- Missing categorical fields (**Payment Method, Order Type**) were replaced using the **mode value** to preserve realistic distribution.
- Missing **Rating** values were imputed using the **median value (3)** to avoid skewness in customer satisfaction analysis.
- Rows with blank **Item names** were removed as they were analytically unusable.
- Numeric columns (Price, Quantity, Order Total) were converted from text to numeric format using **VALUE()** to prevent aggregation errors.

### Outlier Treatment

- No statistical outlier removal was required.
- All numeric values fell within operationally acceptable business boundaries.
- Order Total values were validated against the rule:  
$$\text{Order Total} = \text{Quantity} \times \text{Price}$$
- No negative or zero-quantity transactions were detected.
- No extreme deviations or suspicious transaction spikes were observed.

### Transformations

- Standardized text formatting using **PROPER( TRIM() )** for consistent naming of Categories, Items, Payment Methods, and Order Types.
- Ensured proper date formatting to enable monthly trend and time-based analysis.
- Created derived **Month-Year column** using:  
**=TEXT(OrderDate, "MMM-YYYY")**
- Verified that all numeric fields were suitable for pivot-based KPI aggregation.

## KPI & METRIC FRAMEWORK

KPI	Value	Business Meaning
Total Revenue	\$180124	Overall Performance
Total Transaction	9015	Sales volume indicator
Total Items Sold	27232	Product movement volume
Average Order Value (AOV)	\$19.98	Customer spending behavior
Average Rating	2.98 / 5	Customer satisfaction level
Top Category Share (Main Dishes)	47.29%	Revenue concentration risk

## KPI DEFINITIONS & FORMULAS

### Total Revenue

Formula:  $\Sigma$  (Order Total)

Business Meaning: Primary financial performance metric.

### Average Order Value (AOV)

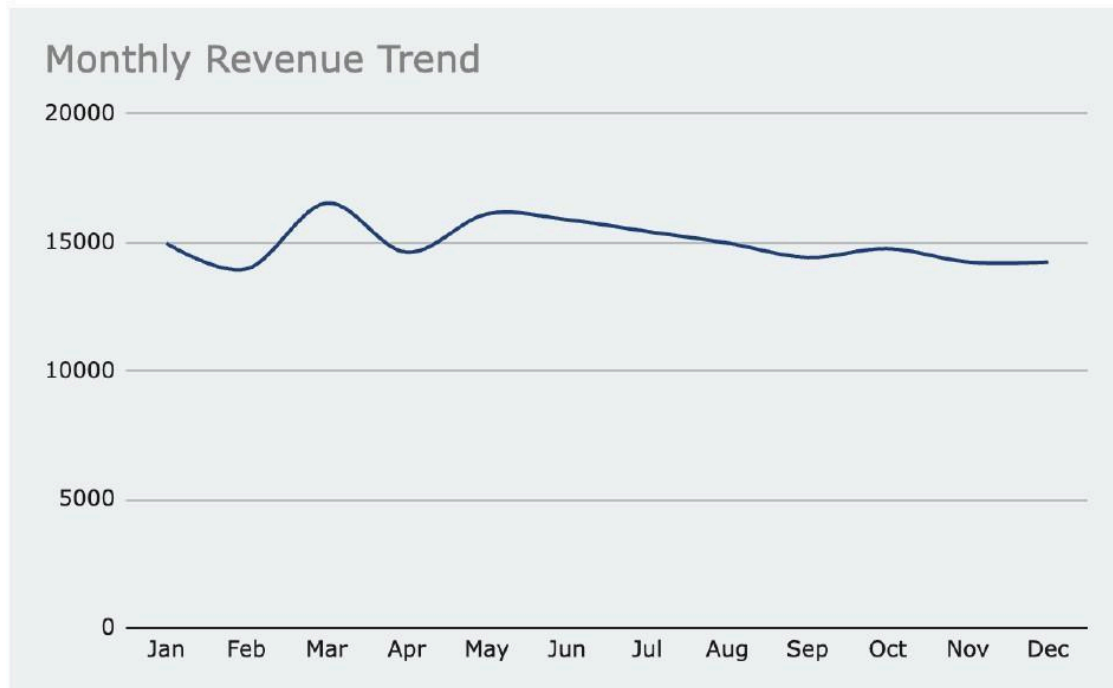
Formula:  $\text{Total Revenue} \div \text{Total Transactions} = 180,124.5 \div 9,015 = 19.98$

Business Meaning: Indicates customer spending per visit.

## EXPLORATORY DATA ANALYSIS

### Revenue Trend Analysis

- Highest month : March
- Lowest month : February



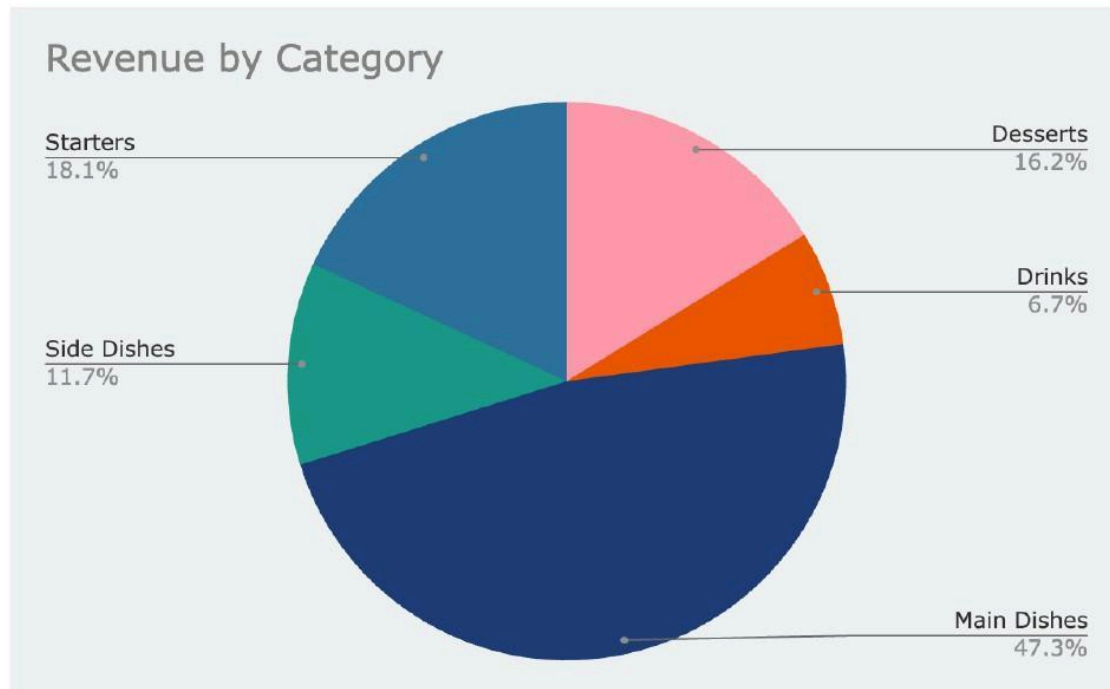
This narrow variation indicates consistent demand and limited seasonality. The business does not heavily depend on a specific month for performance.



## CATEGORY PERFORMANCE ANALYSIS

**Category-wise revenue distribution shows clear concentration:**

- Top Performance : **Main Dishes** - \$85,174
- Strong Performance : **Starters** - \$32,619
- Lowest Contributor : **Drinks** - \$12,004.5



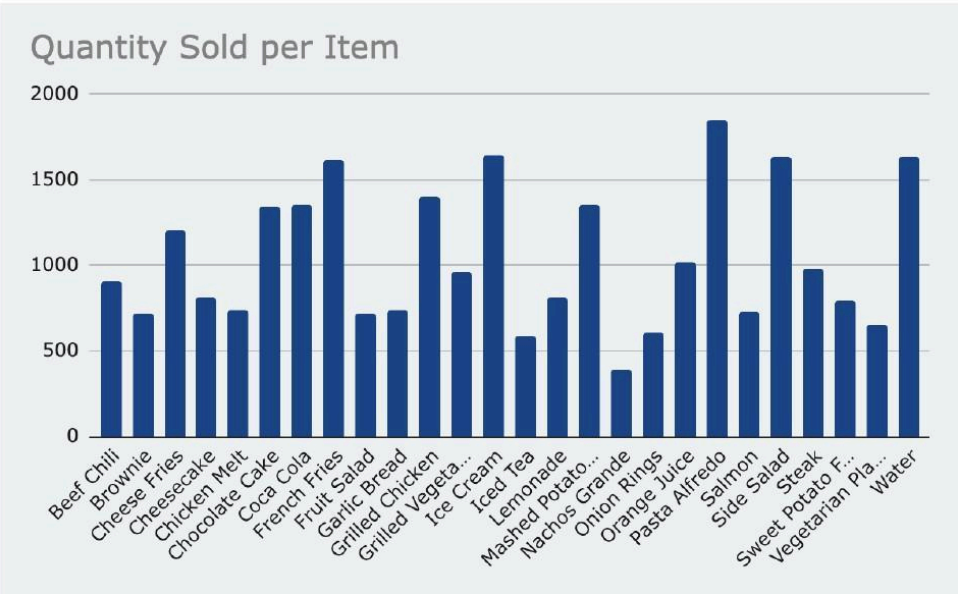
### Interpretation:

Main Dishes contribute nearly half of total revenue. This indicates moderate revenue concentration risk.

## PRODUCT PERFORMANCE ANALYSIS

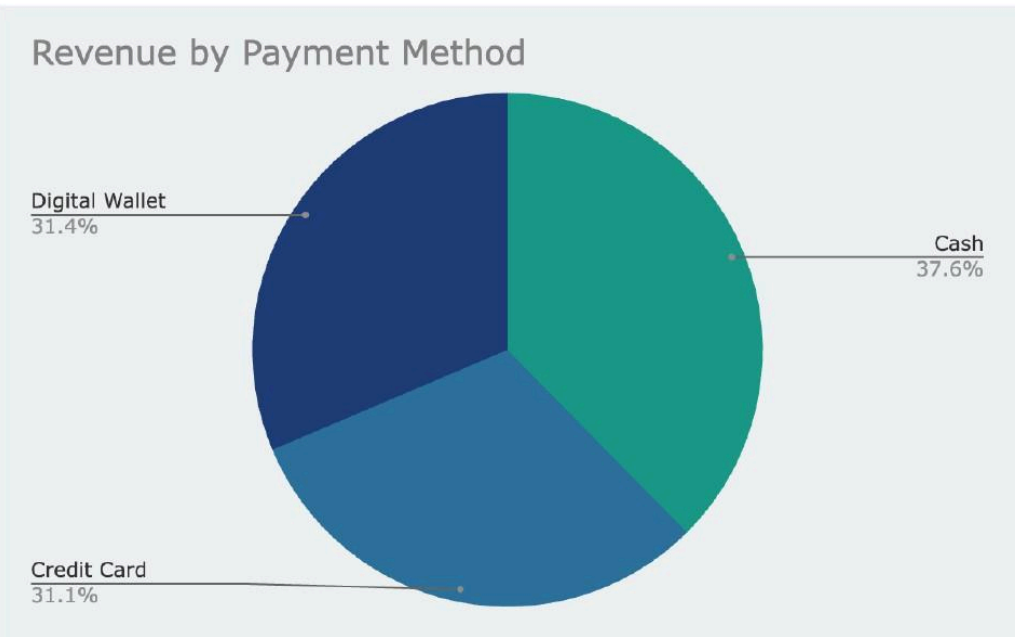
Top revenue-generating items (from pivot analysis):

- Grilled Chicken
- Pasta Alfredo
- Steak



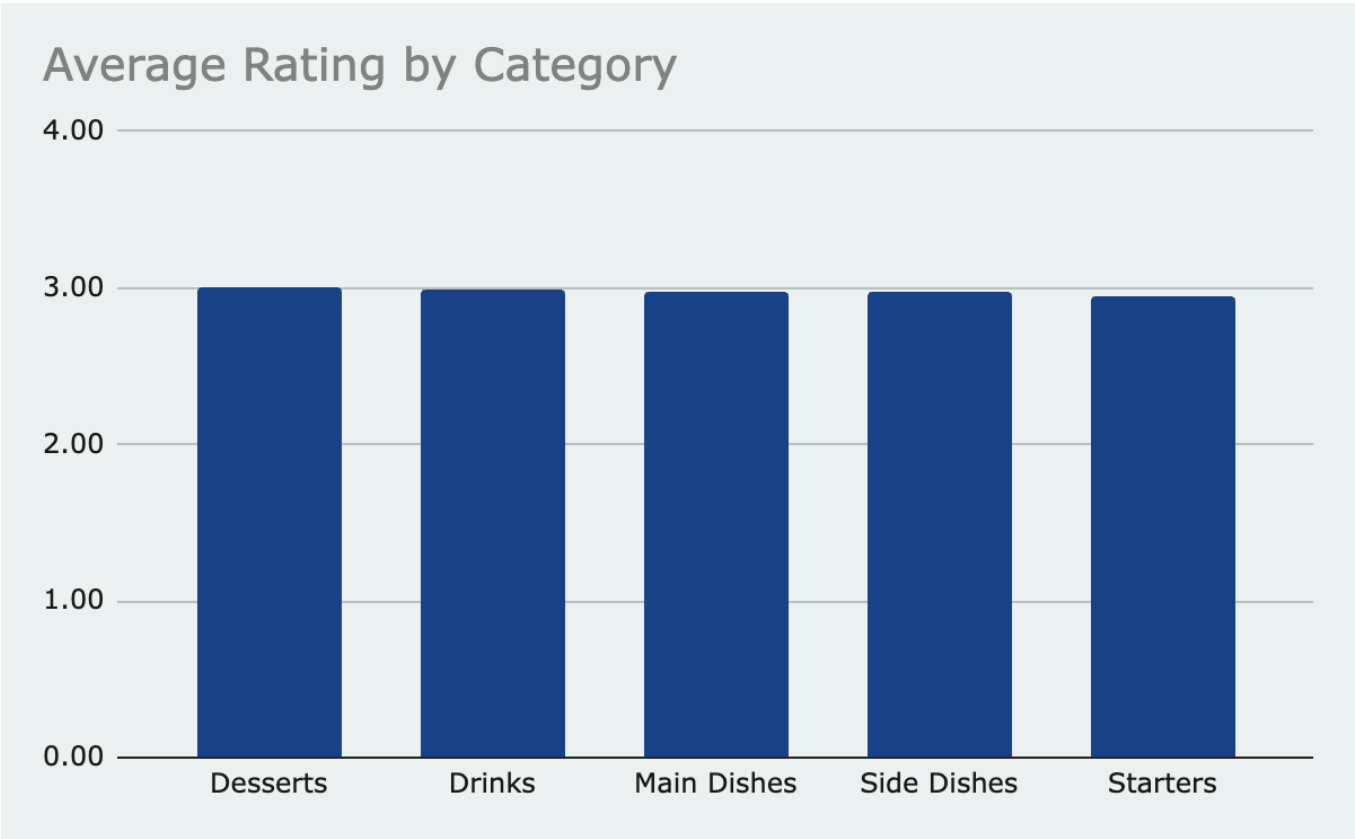
## PAYMENT DISTRIBUTION ANALYSIS

Payment structure is balanced with slight dominance of Cash.



# RATING & CUSTOMER SATISFACTION ANALYSIS

Here shows the average rating by category



## Customer Rating Analysis by Category

- Average ratings across all categories are consistent, with scores close to 3.0 out of 5.
- No category shows significantly higher or lower satisfaction, indicating uniform customer experience.
- This suggests overall service and product quality improvements are needed across all categories to increase customer satisfaction.

## **ADVANCED ANALYSIS**

### **Revenue Concentration Analysis**

Category-level revenue shows:

- Main Dishes → \$85,174 (47.29%)
- Remaining 4 categories → 52.71% combined

### **Interpretation**

Nearly half of total revenue depends on one category.

Risk:

If demand for Main Dishes declines by 10%, overall revenue impact  $\approx$  \$8,517.

This indicates moderate concentration risk and highlights the importance of diversifying revenue streams.

### **Product Concentration Analysis**

Top 3 products:

- Pasta Alfredo – \$22,236
- Grilled Chicken – \$21,030
- Steak – \$19,560

Combined revenue from Top 3  $\approx$  \$62,826

Contribution  $\approx$  34.87% of total revenue

Implication:

Business performance is strongly influenced by a small number of core products.

## CHANNEL SEGMENTATION ANALYSIS

### Revenue Split:

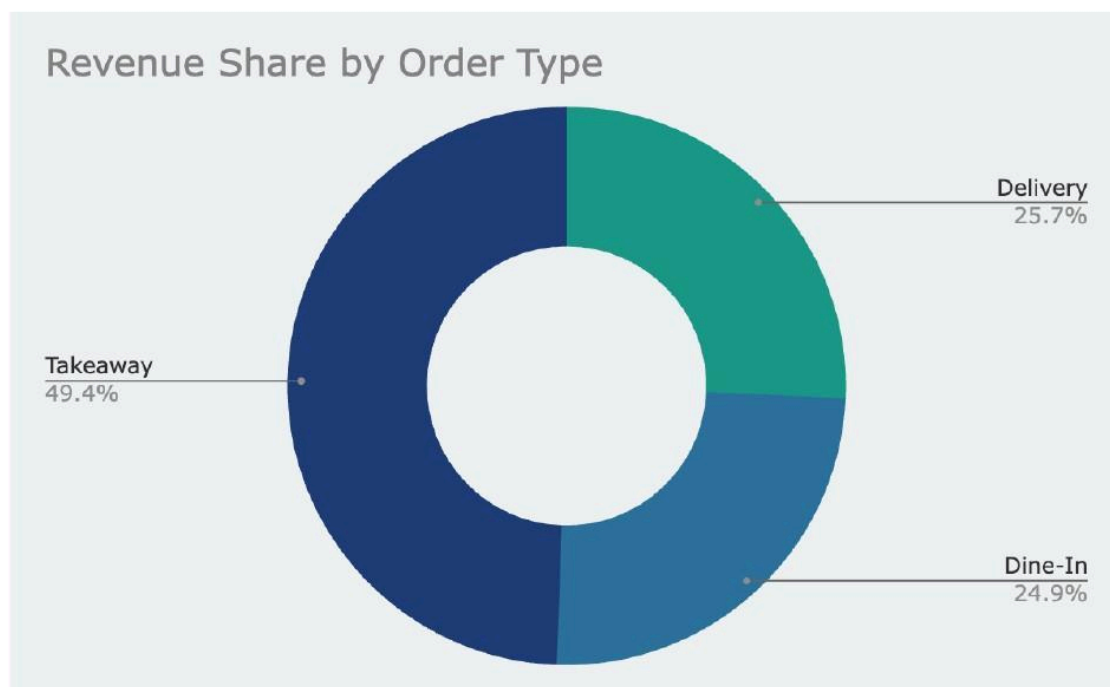
- Takeaway – 49.43%
- Delivery – 25.70%
- Dine-In – 24.86%

### Insights

- Takeaway is dominant channel.
- Business has moderate dependency on takeaway operations.
- Delivery and Dine-In contribute almost equally.

### Operational Implication:

Staff allocation, kitchen flow, and packaging efficiency are critical.



## **RISK & DATA QUALITY ANALYSIS**

### **Identified Structural Risks**

Revenue Concentration Risk

### **Channel Dependency Risk**

49% revenue from takeaway model.

### **Revenue Sensitivity Risk**

AOV-driven model; small decline impacts overall revenue.

## **Scenario Risk Analysis**

If:

- Main Dish revenue drops by 10%  
→ Impact  $\approx$  -\$8,517
- AOV decreases by \$1  
→ Impact  $\approx$  -\$9,015

This shows revenue sensitivity to small operational changes.

## **Dashboard Layout Structure**

### **Top KPI Section**

Displayed at the top for quick management visibility:

- Total Revenue → \$180,124.5
- Total Orders → 9,015
- Average Order Value → \$19.98
- Average Rating → 2.98

### **Product Performance Section**

Includes:

- Revenue by Category pie chart
- Quantity sold per item Chart

### **Channel Performance Section**

Includes:

- Donut Chart showing Takeaway, Delivery, Dine-In share

### **Payment Analysis Section**

Includes:

- Pie Chart of Cash vs Digital Wallet vs Credit Card

### **Trend Analysis Section**

Includes:

- Monthly Revenue Line Chart

## **INSIGHTS SUMMARY**

### **Revenue Stability with Concentration Risk**

Total Revenue = \$180,124.5

While revenue appears stable, nearly 47% comes from a single category (Main Dishes).

This creates moderate concentration risk.

### **Moderate Ticket-Size Model**

Average Order Value = \$19.98

The business operates in a mid-ticket model where revenue growth depends on:

- Upselling
- Bundle offers
- Add-on optimization

Small AOV improvements have high financial impact.

### **Channel Dependency Pattern**

Takeaway contributes 49.43% of total revenue.

This indicates:

- Strong reliance on takeaway operations
- Potential vulnerability if takeaway demand declines

Diversification across Dine-In and Delivery should be strengthened.

### **Balanced Payment Ecosystem**

Cash = 37.57%

Digital Wallet + Credit Card ≈ 62%

This shows healthy payment diversification and strong digital adoption.



## **STRATEGIC RECOMMENDATIONS**

### **Improve Customer Experience**

Mapped Insight: Low Average Rating (2.98)

Actions:

- Implement staff training programs
- Monitor feedback trends weekly
- Improve service speed
- Enhance dining experience

### **Business Impact:**

Raising rating to 4.0 improves:

- Repeat purchase probability
- Brand reputation
- Long-term revenue sustainability

Feasibility: High (process-driven improvement)

### **Increase Average Order Value (AOV)**

Mapped Insight: AOV = \$19.98

Actions:

- Introduce Main Dish + Drink combo
- Offer Dessert add-ons at discount
- Implement limited-time premium bundles

### **Reduce Revenue Concentration Risk**

Mapped Insight: 47% from Main Dishes

Actions:

- Promote Desserts and Starters

## CONCLUSION

This structured KPI-driven analysis of 9,015 transactions and \$180,124.5 revenue demonstrates how cleaned transactional data can be transformed into strategic insights.

Key Findings:

- Moderate revenue base with strong Main Dish dependency
- Channel imbalance favoring Takeaway
- Balanced payment ecosystem
- Moderate service quality concern (2.98 rating)
- Significant AOV improvement opportunity

The restaurant operates on a stable but moderately concentrated revenue model.

By implementing:

- AOV optimization
- Service quality enhancement
- Channel diversification
- Data quality improvements

the business can achieve measurable and sustainable growth.

This project highlights the value of structured data analytics in transforming operational data into actionable strategic intelligence.

# APPENDIX

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## Appendix A – Data Dictionary

The following table defines all variables used in the analysis.

**Order ID**

Unique identifier assigned to each transaction.

**Customer ID**

Anonymized identifier assigned to each customer.

**Category**

Product category classification (Main Dishes, Starters, Desserts, Drinks, Side Dishes).

**Item**

Name of the specific menu item sold.

**Price (\$)**

Unit selling price of the item.

**Quantity**

Number of units purchased per transaction.

**Order Total (\$)**

Total revenue generated per transaction.  
Calculated as: Quantity × Price.

**Order Date**

Date of transaction (January 2022 – December 2023).

**Payment Method**

Mode of payment used (Cash, Credit Card, Digital Wallet).

**Rating**

Customer satisfaction score on a 1–5 scale.  
Missing values were imputed using the median (3).

**Order Type**

Service channel (Dine-In, Takeaway, Delivery).

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## Appendix B — KPI Calculation Logic

This section outlines the mathematical logic used to calculate performance metrics.

### Total Revenue

Total Revenue = Sum of all Order Total values

Result: \$180,124.5

### Total Transactions

Total Transactions = Count of unique Order IDs

Result: 9,015

### Average Order Value (AOV)

$AOV = \text{Total Revenue} \div \text{Total Transactions}$

$= 180,124.5 \div 9,015$

$= \$19.98$

### Category Revenue Contribution (%)

$\text{Category Share} = \text{Category Revenue} \div \text{Total Revenue} \times 100$

Main Dishes Contribution: 47.29%

### Channel Revenue Contribution (%)

$\text{Channel Share} = \text{Channel Revenue} \div \text{Total Revenue} \times 100$

Results:

Takeaway – 49.43%

Delivery – 25.70%

Dine-In – 24.86%

### Payment Distribution (%)

$\text{Payment Share} = \text{Payment Revenue} \div \text{Total Revenue} \times 100$

Results:

Cash – 37.57%

Digital Wallet – 31.36%

Credit Card – 31.06%

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## Appendix C — Chart Construction Logic

This section describes how dashboard visualizations were generated.

### Revenue by Category (Pie Chart)

Calculated using aggregated revenue grouped by Category.

Displayed as percentage of total revenue.

**Revenue by Channel (Donut Chart)**

Revenue grouped by Order Type to analyze service channel performance.

**Payment Method Distribution (Pie Chart)**

Revenue grouped by Payment Method to identify payment behavior trends.

**Monthly Revenue Trend (Line Chart)**

A derived Month-Year column was created from Order Date.

Revenue aggregated by month to visualize seasonality and trend movement.

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**Appendix D — Data Cleaning & Validation Logic**

**Missing Value Treatment**

- Categorical fields filled using mode to preserve realistic distribution.
- Missing Rating values replaced using median (3).
- Blank item records removed due to analytical irrelevance.

**Data Validation**

Order Total verified using:

$$\text{Order Total} = \text{Quantity} \times \text{Price}$$

No inconsistencies, negative quantities, or invalid values were detected.

**Standardization**

Text fields standardized to ensure consistent category and item naming.

Date fields formatted to enable time-based aggregation.

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**Appendix E — Revenue Sensitivity Analysis**

This analysis evaluates financial impact under different operational scenarios.

**AOV Increase Scenario**

+\$1 increase in AOV → +\$9,015 revenue

+\$2 increase in AOV → +\$18,030 revenue

+\$3 increase in AOV → +\$27,045 revenue

Impact Formula:

$$\text{Revenue Change} = \text{AOV Change} \times \text{Total Orders}$$

### **Category Risk Scenario**

If Main Dish revenue declines by 10%:

$$\text{Impact} = -\$8,517$$

This highlights moderate revenue concentration risk.

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## **Appendix F — Dashboard Architecture**

The dashboard consists of:

- KPI Summary Cards (Revenue, Orders, AOV, Rating)
- Category Contribution Chart
- Channel Distribution Chart
- Payment Distribution Chart
- Monthly Revenue Trend
- Interactive Filters (Category, Order Type, Payment Method, Month)

All visual components are directly linked to the cleaned dataset to ensure real-time updates and analytical consistency.

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## **Appendix Summary**

This Appendix provides full technical transparency for all KPIs, charts, and calculations used in the report. It ensures methodological clarity, reproducibility, and professional analytical integrity.

## Contribution Matrix

Team Member	Dataset & Sourcing	Cleaning	KPI & Analysis	Dashboard	Report	PPT
Daksh	✓	✓	✓	✓	–	–
Saksham	–	✓	✓	✓	–	–
Shagun	–	✓	✓	✓	–	–
Kaustubh	–	–	–	–	✓	–
Om	–	–	–	–	–	✓
Ram	–	–	–	–	✓	–