BIG DATA AND BUSINESS INTELLIGENCE

TITLE OF REPORT: Sales Performance Analysis and Strategic Insights for Pizza Restaurant Operations

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1. Executive Summary

The **Pizza Restaurant - Sales Performance Dashboard** provides a detailed overview of the restaurant's sales trends, customer preferences, and profit margins. Using Power BI, the dashboard empowers stakeholders to make informed decisions based on key business metrics and visual insights.

1.2 Key findings from the analysis include:

1. **Total Sales and Profit Analysis**: During the reporting period (Year 2015), total sales reached £817,860.05, and the total profit was £15,915.35, reflecting a modest profit margin of 1.95%. This indicates room for improvement in optimizing costs and increasing profitability.

2. **Sales by Pizza Category and Popularity**: Classic pizzas were the highest-performing category, with Supreme pizzas following closely. Certain pizzas, such as the Thai Chicken and Barbecue Chicken, led in sales, while others like Vegan Delight and Four Cheese Special, had lower sales, suggesting areas for improvement in marketing or recipe adjustments.

3. **Customer Behavior and Preferences**: Large-sized pizzas made up nearly half of the total sales, with a high frequency of orders for Classic Deluxe and Barbecue varieties. Notably, order volume peaks occurred during lunch (12 PM - 1 PM) and dinner hours (5 PM - 6 PM), offering insights into optimal staffing and inventory management.

4. **Profitability Analysis**: The California Chicken and Big Meat pizzas were the most profitable, whereas the Pepperoni and Italian Supreme pizzas showed lower margins, highlighting potential opportunities to optimize pricing strategies.
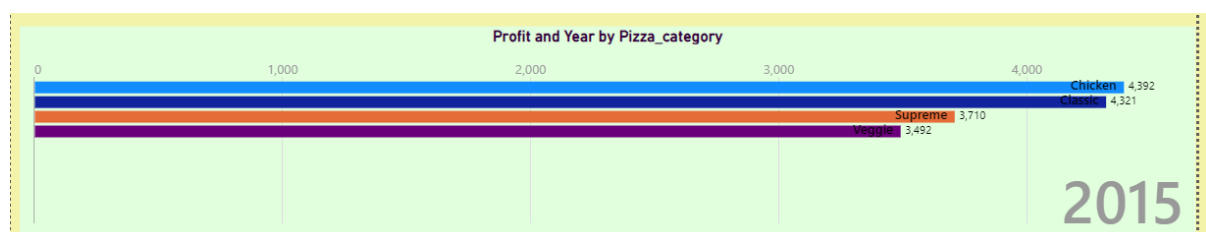

Figure 1: Profit by Year and Pizza Category

1.2 Recommendations:

- **Enhance Menu and Promotions**: Focus marketing efforts on lower-performing pizzas while exploring opportunities for price adjustments or ingredient optimizations for high-cost items.

- **Seasonal and Demand-based Strategies**: Leverage insights from sales trends to plan promotional campaigns around peak months and address off-season slowdowns.
- **Optimize Operations**: Adjust staffing and inventory according to peak order times, ensuring that resources are aligned with demand.

By utilizing this dashboard, restaurant managers and stakeholders can make data-driven decisions that promote profitability, streamline operations, and enhance customer satisfaction.

2. Introduction

The "Pizza Restaurant - Sales Performance" dashboard is structured to address specific questions about sales patterns, product performance, and profitability, helping the restaurant identify opportunities for improvement and growth. This report provides an overview of the dashboard and the key findings, focusing on how these insights can drive actionable strategies for the business.

2.1 Data Source

The dataset was obtained from Kaggle, a well-known repository for diverse datasets used in analytics and machine learning projects(https://www.kaggle.com/datasets/shilongzhuang/pizza-sales). The dataset "Pizza_Sales" provides a simulated record of transactions from a pizza restaurant. The information covers various aspects of restaurant operations, including details about orders, pizzas, pricing, and timing. This makes it an excellent resource for analyzing sales trends and identifying opportunities for performance improvement.

The dataset includes a total of 12 columns, each capturing specific attributes of the restaurant's sales operations. Below is a detailed explanation of these columns:

Table 1: Columns in the Pizza_Sales dataset

Column Name	Description
order_details_id	A unique number assigned to each individual item within an order.
order_id	a record of every full customer order.
pizza_id	A special reference for pizza name
quantity	he quantity of a particular pizza in the order.
order_date	the day the order was placed.

order_time	The moment the order was placed.
unit_price	The cost of one pizza unit.
total_price	Total Price
pizza_size	The pizza's proportions
pizza_category	The sort of pizza
pizza_ingredients	A list of the pizza's ingredients.
pizza_name	Name of the Pizza

This data provides a foundation for understanding restaurant performance by examining key metrics like sales, product popularity, and customer preferences. The structured format of the dataset ensures that patterns and trends can be identified effectively, enabling valuable insights to support business decisions.

2.2 BI Requirements/Questions

The creation of the "Pizza Restaurant - Sales Performance" dashboard was driven by the need to provide stakeholders with valuable insights to guide decision-making. This dashboard seeks to address critical questions about the restaurant's sales performance, product success, and customer behavior.

Key Performance Indicators (KPIs)

To monitor and measure the restaurant's performance effectively, the dashboard emphasizes several essential metrics:

- **Total Sales**: Represents the cumulative revenue generated by pizza sales over a specified period.
- **Total Profit**: Indicates the financial gains after accounting for costs, helping gauge profitability.
- **Average Sales per Order**: A measure of how much revenue, on average, is generated from a single customer transaction.
- **Order Frequency by Pizza Type**: Highlights the popularity of different pizza types to identify customer preferences.
- **Sales by Pizza Name**: Evaluates the products that contribute most significantly to the restaurant's revenue.

Key Business Questions

The dashboard is designed to address several strategic questions that can help the business refine its operations and grow its market presence:

1. What are the monthly, quarterly, and yearly trends in sales?
2. Which pizza categories and specific menu items are the most and least popular?
3. How do pizza size and ingredient combinations influence customer buying decisions?
4. What are the peak times for orders, and how can the restaurant ensure sufficient resources to meet demand during those periods?
5. How can adjustments to the menu or promotional strategies help maximize profitability?

Key Stakeholders

The dashboard caters to a range of stakeholders, each with unique goals and responsibilities:

- **Restaurant Managers**: Require insights into sales patterns to improve daily operations, streamline processes, and optimize resource allocation.
- **Marketing Teams**: Use the data to identify customer preferences and design effective promotional campaigns that drive sales.
- **Business Owners**: Need a holistic view of the business's financial and operational health to make strategic growth decisions.
- **Operations Teams**: Benefit from data on order patterns to align inventory management and staffing levels with customer demand.

Purpose of the Analysis

This analysis aims to provide a clear, data-driven perspective on the restaurant's performance, enabling stakeholders to make informed decisions. By uncovering sales patterns, customer preferences, and profit drivers, the restaurant can optimize its offerings, improve customer satisfaction, and achieve sustained growth. The insights delivered through this dashboard will empower the restaurant to remain competitive, identify areas for improvement, and create opportunities for future success.

3. Findings Based on Analysis and Evaluation

The following section detail the key findings from the analysis, supported by visuals that represent significant trends. The Power BI visuals allow for an in-depth exploration of how sales performance varies across different dimensions, such as pizza categories, customer behaviour, and order patterns.

Page 1: Overview of Total Sales and Profit Trends

Scroller Visuals for Total Sales and Total Profit
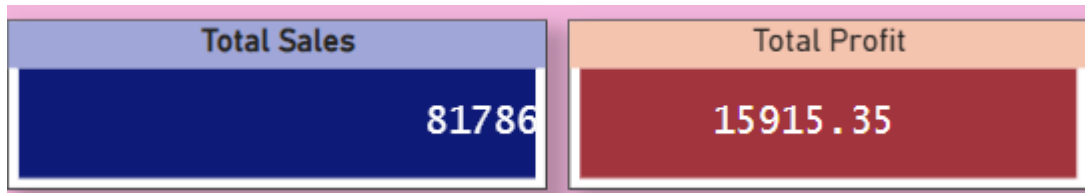

Figure 2: Scroller Visuals for Total Sales and Total Profit

Description: These scroller visuals display the total sales and total profit values which are particularly useful for giving an immediate snapshot of overall financial performance.

Insights: The total sales during the selected period were £ 817,860.05 with total profits amounting to £15915.35. The profit margin is approximately 1.95%. This suggests that the restaurant is generating a relatively small profit compared to its total sales, which indicate opportunities to optimize costs, pricing, or profit-generating strategies.
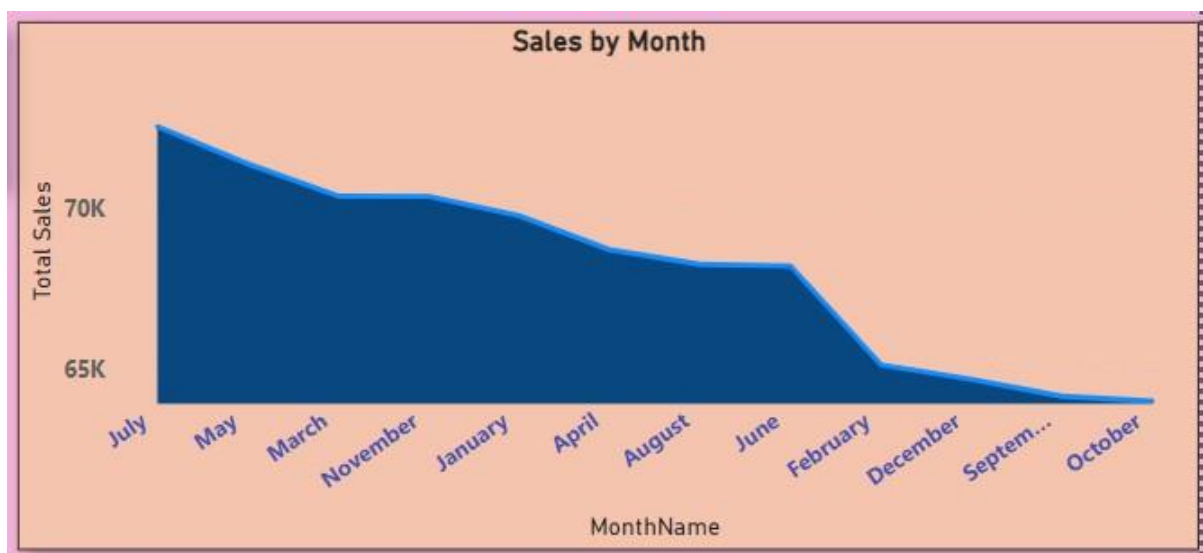
Area Chart for Sales by Month

Figure 3: Area Chart for Sales by Month

Description: The area chart tracks monthly sales fluctuations over time, providing a clear visual of revenue trends.

Insights: The sales experienced a significant spike in the months from July to November, reflecting seasonal demand, likely due to special promotions and holidays. Conversely, sales dropped consistently from February and October, pointing to a potential off-season period.

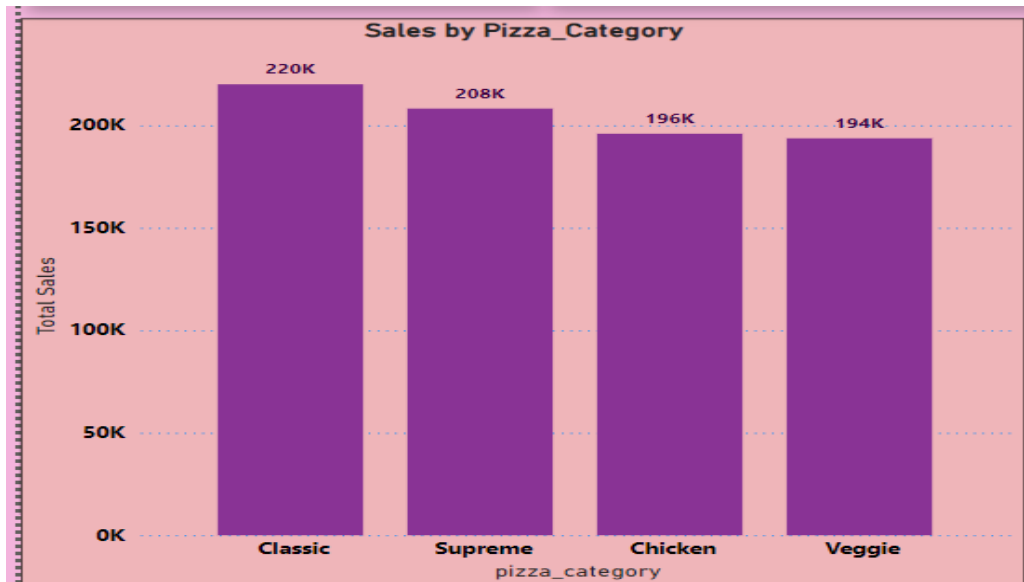**Stacked Column Chart for Sales by Pizza Category**

Figure 4: Stacked Column Chart for Sales by Pizza Category

Description: This chart breaks down total sales by each pizza category (Classic, Supreme, Chicken Veggie), helping identify which product types are performing best.

Insights: Classic pizzas generated highest number of sales, outpacing Supreme pizzas at 40%. Chicken and Veggie pizzas contribute slightly less sales than Classic and Supreme Pizzas, yet they could be further explored with targeted promotions.

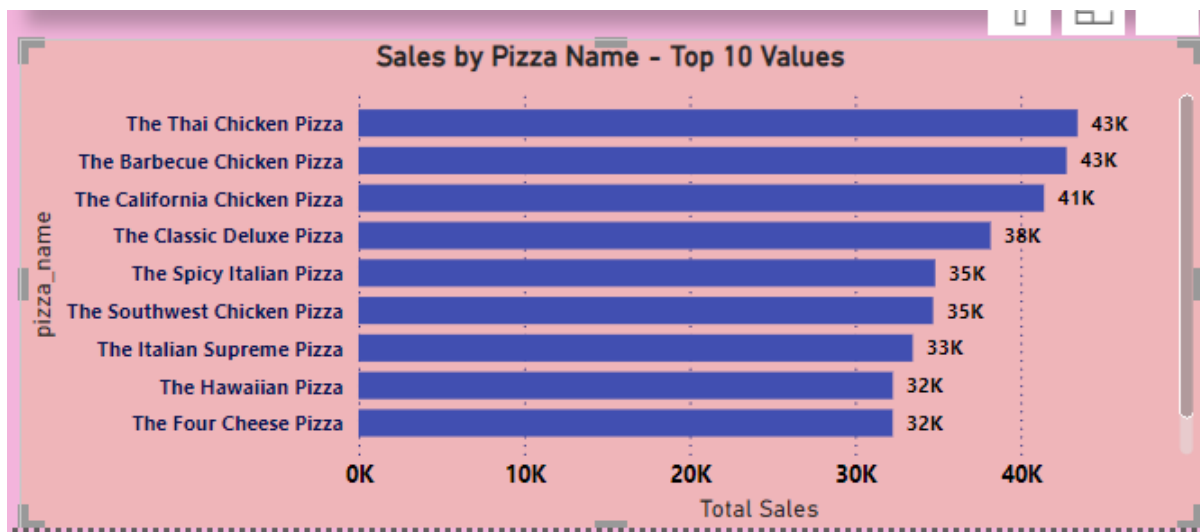**Clustered Bar Chart for Sales by Pizza Name (Top 10 Values)**

Figure 5: Clustered Bar Chart for Sales by Pizza Name (Top 10 Values)

Description: These visual ranks the top 10 best-selling pizzas, based on revenue, and highlights their popularity among customers.

Insights: The Thai Chicken Pizza and the Barbeque Chicken Pizza and the California Chicken pizza were the top sellers, contributing £430434.25, £42768 and £41409.50 in revenue respectively. In contrast, pizzas like Vegan Delight and Four Cheese Special had lower sales figures, indicating potential areas for further marketing focus or menu adjustments.

Page 2: Ingredient and Size Impact on Sales

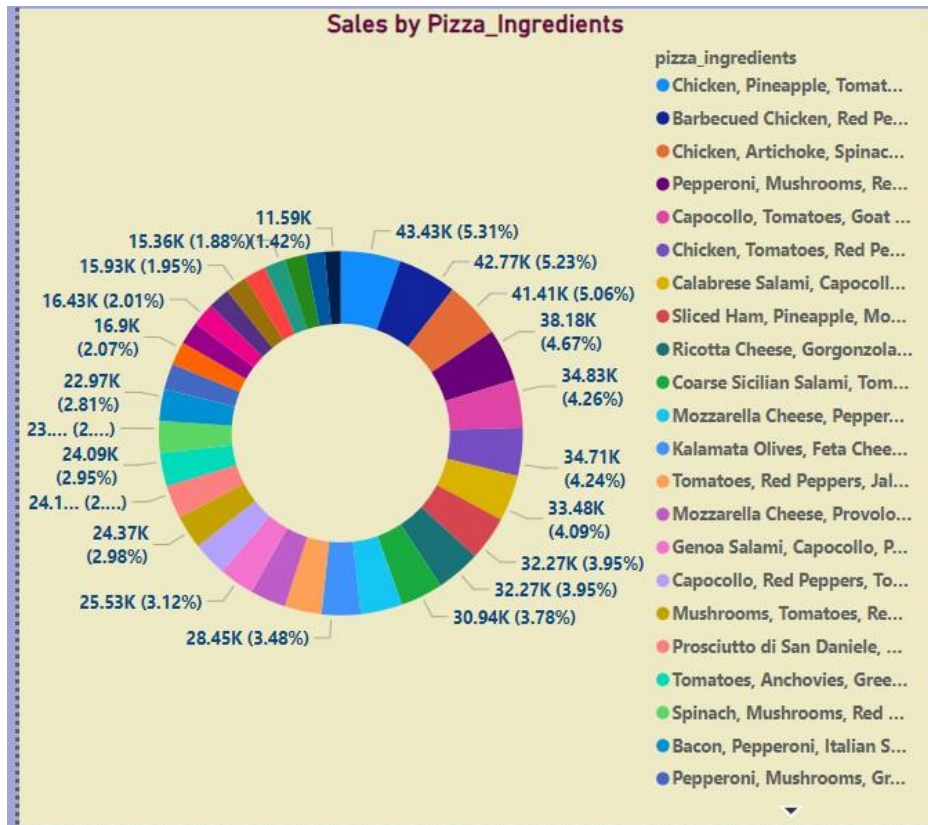**Donut Chart for Sales by Pizza Ingredients**

Figure 6: Donut Chart for Sales by Pizza Ingredients

Description: The donut chart illustrates the contribution of different pizza ingredients to overall sales, providing insights into customer preferences.

Insights: Chicke and veggies pizzas dominated 5.31% of sales, while Barbeque - based pizzas followed closely at 5.23%. Brie Carre Cheese pizzas comprised only 1.42% of total sales, indicating a potential opportunity to expand this segment, especially among health-conscious consumers.
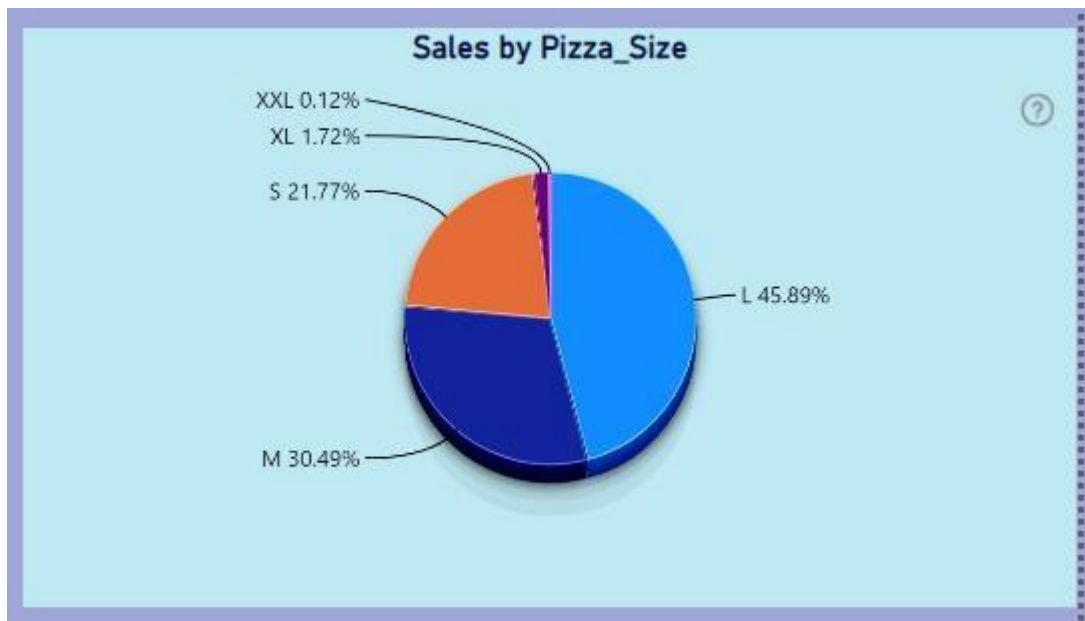
Drill-Down Pie Chart for Sales by Pizza Size

Figure 7: Drill-Down Pie Chart for Sales by Pizza Size

Description: The drill-down pie chart allows for the exploration of sales data based on pizza sizes (Small, Medium, Large, Extra Large, Double Extra Large).

Insights: Large pizzas contributed almost half of the sales, followed by medium pizzas with 30.49% of sales contribution. While Extra Large and Double Extra Large pizzas represented 1.72% and 0.12%, respectively.
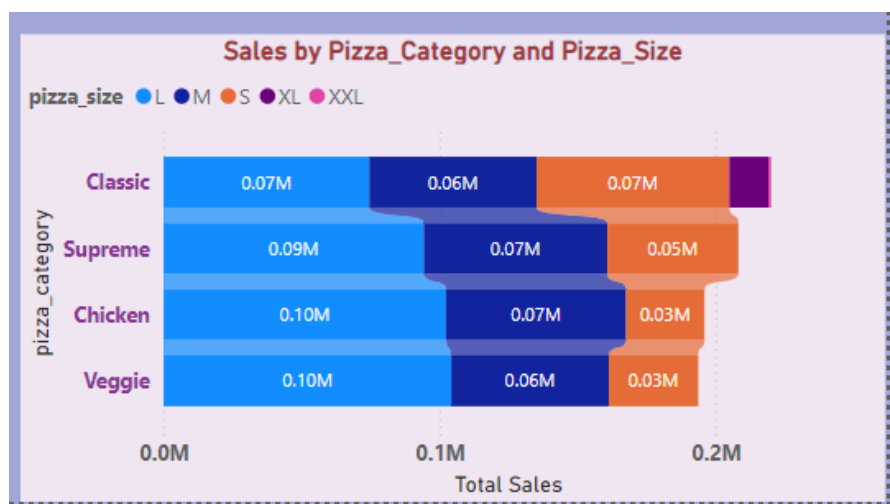
Stacked Bar Chart for Sales by Pizza Category and Size

Figure 8: Stacked Bar Chart for Sales by Pizza Category and Size

Description: This chart combines pizza categories and sizes to show how different combinations of product offerings are performing in terms of sales.

Insights: Specialty pizzas, particularly the large-sized options, contributed significantly to sales. Small veggie pizzas had the lowest sales, indicating that customer demand in this segment might be less than expected, possibly due to pricing or ingredient preferences.

Page 3: Order Frequency and Customer Behavior
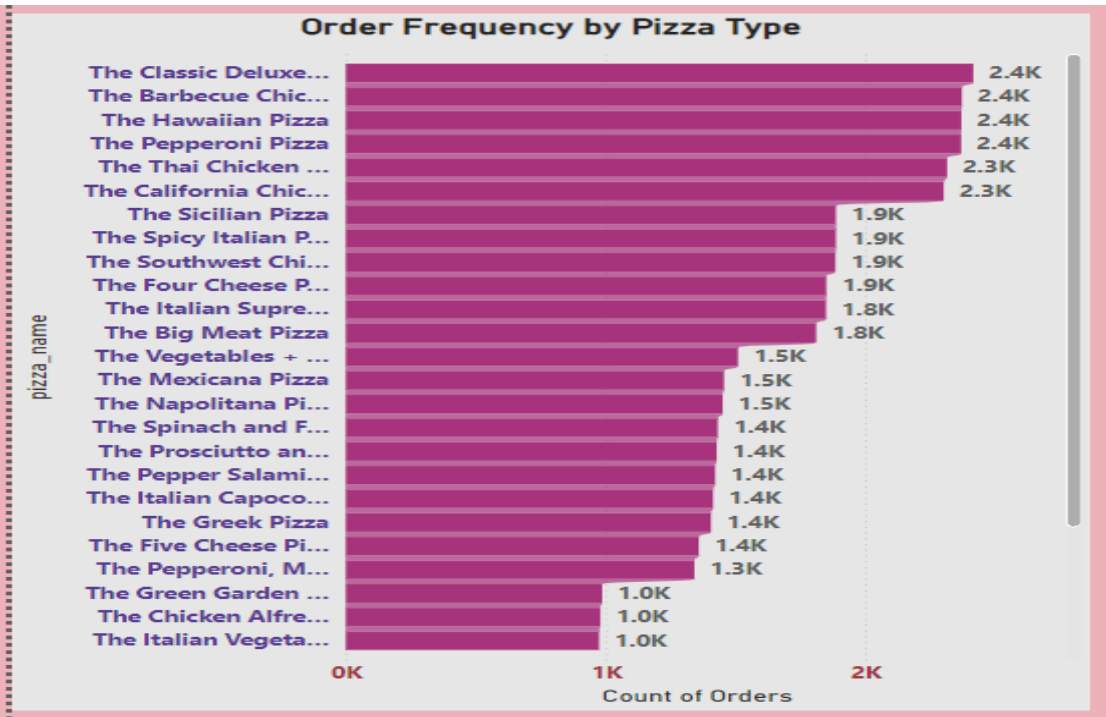
Stacked Bar Chart for Order Frequency by Pizza Type

Figure 9: Stacked Bar Chart for Order Frequency by Pizza Type

Description: This visual analyzes the frequency of orders for various pizza types.

Insights: Classic Deluxe, The Barbeque, The Hawaiian, The Pepporoni pizzas were ordered the most, followed by The Thai Chicken and The California Chicken Pizzas. The Italina Vegetable, The Chicken Alfredo, The Green Garden pizzas had the lowest order frequency, highlighting the opportunity to further market plant-based options.

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Advanced Cards for Average Sales per Order, Total Orders, and Average Order Value

Figure 10: Advanced Cards for Average Sales per Order, Total Orders, and Average Order Value

Description: The advanced cards display the key metrics the average sales per order, total number of orders, and the average value of an order.

Insights: The average sales per order were £17, with a total of 21,000 orders. The average order value stood at £38, indicating that many customers are purchasing multiple items per transaction, which drives higher revenue per visit.

Line Chart for Sales by Hour

Figure 11: Line Chart for Sales by Hour

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Description: This line chart shows how sales vary throughout the day, capturing hourly trends.

Insights: Sales peaked during Lunch hours, 12 PM and 1 PM and during dinner hours 5PM and 6PM. From 6PM to 11PM there is a steady dip in the sales. This data suggests a more concentrated demand during peak dining hours and in mid-afternoon and a lull after 6PM which could inform staffing and inventory planning.

Page 4: Profitability and Long-Term Trends

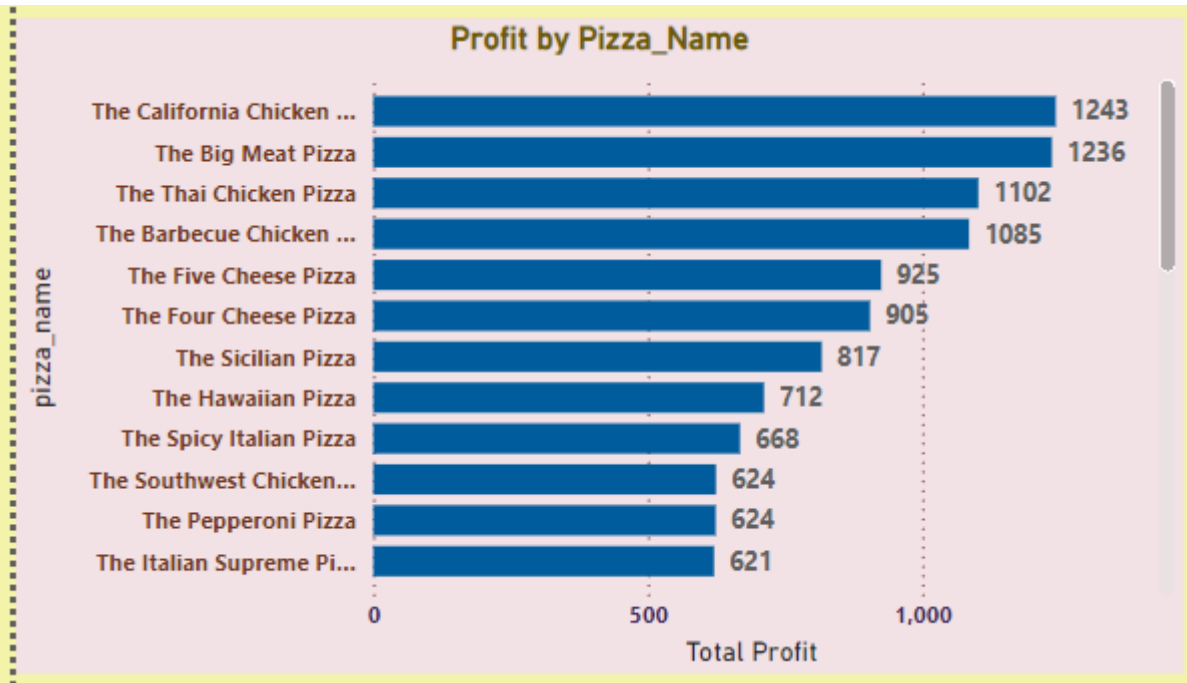**Clustered Bar Chart for Profit by Pizza Name**

Figure 12: Clustered Bar Chart for Profit by Pizza Name

Description: This chart ranks pizzas by their profit margins, allowing for analysis of which menu items are most profitable.

Insights: The California Chicken and The Big Meat Pizzas emerged as the highest contributors to profit. On the other hand, pizzas like Pepporoni and Italian Supreme had lower profitability, possibly due to higher ingredient costs. Adjusting the pricing strategy or ingredient sourcing for these items could improve margins.
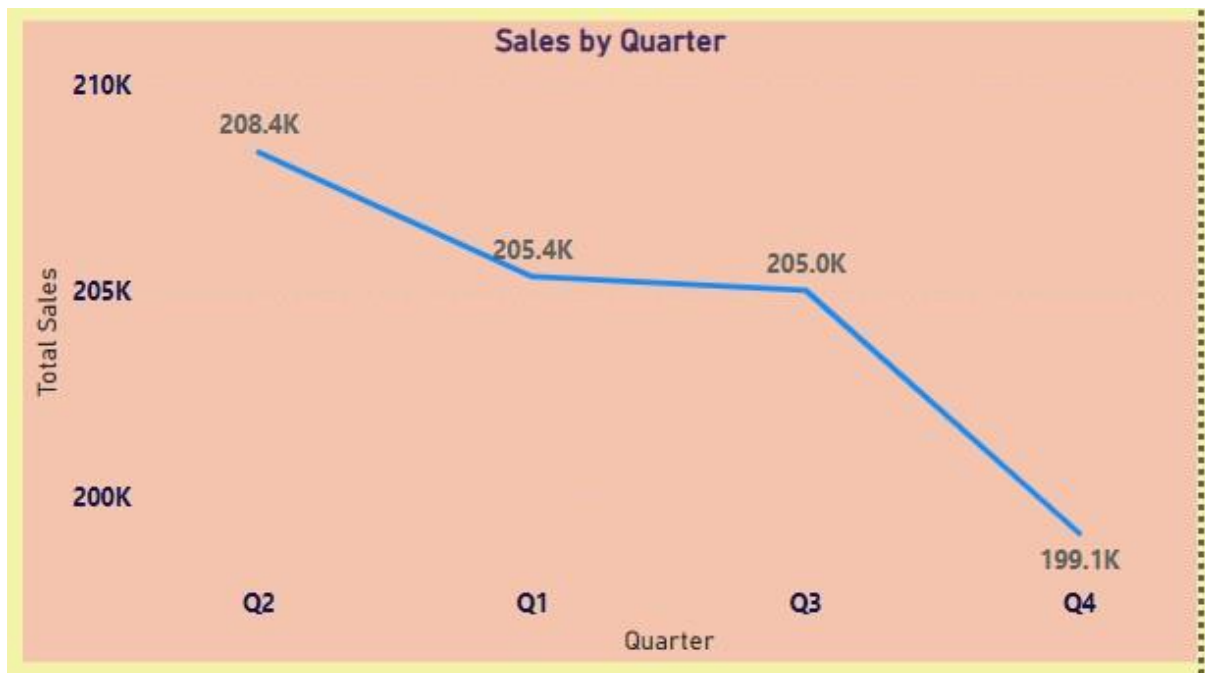
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Line Chart for Sales by Quarter

Figure 13: Line Chart for Sales by Quarter

Description: The line chart tracks sales trends across different quarters, providing an overview of long-term performance.

Insights: Sales growth was highest during 2nd quarter and there was a steady decline from Q2 to Q4 with a respective sales value of £208.4K and £199.1K. The highest performance observed in the second quarter, likely driven by seasonal promotions.
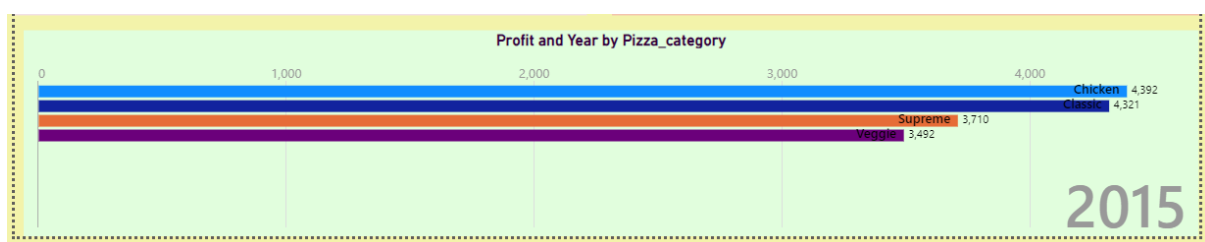
Animated Bar Chart for Profit and Year by Pizza Category

Figure 14: Animated Bar Chart for Profit and Year by Pizza Category

Description: This animated bar chart visually tracks the profit evolution by pizza category over the years.

Insights: Chicken pizzas consistently generated the highest profits, while Veggie pizzas saw comparatively less profitability, especially in the year 2015. This suggests additional promotions and re-pricing required for Veggie pizzas.

4. Conclusions and Recommendations

Based on the comprehensive analysis of the *Pizza Restaurant - Sales Performance* dashboard, several important insights have been uncovered. These insights provide a clear understanding of the restaurant's sales performance, customer preferences, and operational efficiency. The following conclusions and recommendations are derived from the findings, with the aim of enhancing profitability and optimizing business operations.

4.1 Key Conclusions

1. **Sales Performance Overview**

The total sales for the selected period were £817,860.05, with total profits of £15,915.35, resulting in a profit margin of **1.95%**. This relatively low profit margin indicates that while revenue is substantial, there is significant room for improvement in profitability. Efforts should focus on increasing profit margins through cost optimization and pricing strategies.

2. **Pizza Category Trends**
   - **Classic Pizzas** were the top performers, generating the highest sales, followed closely by **Supreme Pizzas**. Meanwhile, **Chicken** and **Veggie Pizzas** contributed less to sales, despite showing some customer demand. These categories offer potential for growth with targeted promotions and adjustments.
   - **Specialty Pizzas**, especially the larger sizes, have shown strong performance. This indicates a market for premium pizzas, where upselling larger sizes and premium ingredients can drive higher revenue.

3. **Customer Behavior**

   Large pizzas were the most popular, contributing almost half of the total sales, followed by **medium pizzas**. On the other hand, **Small Veggie Pizzas** showed the lowest sales, suggesting a need to re-evaluate the demand for smaller sizes and reconsidering the pricing or ingredient choices for these items.

4. **Order Frequency Insights**

   Popular pizza types, such as **Classic Deluxe**, **Barbecue**, and **Pepperoni**, were ordered the most, while niche options like **Italian Vegetable** and **Chicken Alfredo** had lower

order frequencies. This indicates that more attention could be given to promoting underperforming pizzas or revising their recipes to align with current customer tastes.

5. **Profitability Concerns**

The most profitable pizzas were California Chicken and Big Meat Pizzas, while Pepperoni and Italian Supreme had lower margins, likely due to higher ingredient costs. Strategies to improve the profitability of these lower-margin pizzas could include price adjustments or exploring alternative ingredient suppliers.

6. **Seasonal Sales Trends**

Sales experienced significant peaks from July to November, coinciding with holiday promotions and seasonal demand. There was a noticeable decline in sales from February to October, which highlights the potential for improved marketing strategies during off-peak months to maintain consistent performance year-round.

4.2 Recommendations

1. **Enhance Profitability by Adjusting Menu Pricing and Costs**

It is recommended to review the pricing of pizzas with high sales but lower profit margins, such as **Pepperoni** and **Italian Supreme**. By adjusting prices or sourcing lower-cost ingredients, the restaurant can improve profitability without sacrificing product quality.

2. **Focus on Promoting Underperforming Pizza Categories**

Special attention should be given to Chicken and Veggie Pizzas, which, although not as popular as other categories, show potential for growth. Promotional campaigns targeting health-conscious customers or offering discounts could help boost sales in these categories. Additionally, revising recipes and introducing new ingredients could increase customer interest.

3. **Optimize Menu Based on Customer Preferences**

Given the popularity of Large Pizzas, it is advisable to expand the offerings in this category. Special deals for larger pizzas or family-sized options could appeal to group customers. Small pizzas, especially in the **Veggie** category, should be reassessed for potential pricing adjustments or new marketing strategies to increase their appeal.

4. **Promote Sales During Off-Peak Periods**

With sales dipping during mid-afternoon and post-dinner hours, introducing happy hour promotions or discounted meal combos during these times can help attract more customers. Also, promotions aimed at the slower months (February – October) could help maintain more consistent sales throughout the year.

5. **Capitalize on Peak Seasons with Targeted Marketing**
   During **July to November**, when sales typically peak, leveraging limited time offers and seasonal promotions can capitalize on high demand. Special holiday-themed deals and menu items can attract more customers during this period, maximizing revenue opportunities.

6. **Improve Profitability through Menu and Ingredient Optimization**
   To improve the profitability of pizzas like **Pepperoni** and **Italian Supreme**, exploring alternative ingredient sourcing options could lower costs and boost margins. Additionally, revising pricing strategies based on ingredient costs and profit margins will help ensure that each menu item is contributing optimally to profitability.

7. **Data-Driven Inventory and Staffing Optimization**
   Insights from the Sales by Hour and Order Frequency by Pizza Type charts suggest that sales peak during certain hours, such as 12 PM – 1 PM and 5 PM – 6 PM. Staffing levels and inventory management should be aligned with these peak hours to ensure efficient service, while slower periods may benefit from reduced staffing. This strategy would help reduce operational costs while maintaining high service quality.

Conclusion

The Pizza Restaurant - Sales Performance dashboard offers valuable insights into key aspects of the restaurant's operations. By implementing the recommended strategies, the restaurant can enhance its profitability, better cater to customer preferences, and optimize its overall operations. A focus on menu adjustments, pricing strategies, targeted promotions, and efficient resource allocation will drive improvements in sales and profitability, ultimately supporting long-term growth and success.

5. Appendix: BI Design

5.1 Data Pre-Processing or Data Cleansing

The following data pre-processing steps were carried out to ensure the dataset was clean and ready for for analysis:

- Handling Missing Values: Rows with missing or null values in key columns (*order_id*, *pizza_id*, *total_price*) were removed to avoid any disruption in analysis.
- Column Renaming: The columns *pizza_ingredients* was renamed to *pizza ingredients* for consistency and easier understanding. For example, to standardize column names.
- Data Type Conversion: The *order_date* and *order_time* columns were converted to appropriate Date/Time data types to facilitate time-based analysis.
- Duplicate Removal: Removed duplicate rows from the dataset.

5.2 BI Data Modelling via Star Schema - Facts and Dimensions

To facilitate effective analysis, a Star Schema model was applied, organizing the dataset into Fact and Dimension tables. This structure supports efficient querying of sales trends, customer behavior, and operational insights.

Fact Table:

- Fact_Pizza_Sales: This central table captures transaction-level data.

Dimension Tables:

- DIM_Date: Contains date-related details for trend analysis (e.g., day, month, quarter, year).
- DIM_Pizza: Provides pizza-specific attributes (e.g., pizza id, name, category, ingredients, size).
- DIM_Time: Contains time-related details for analyzing order patterns (e.g., hour, minute, period of the day).

Schema Relationships:

- Fact_Pizza_Sales connects to DIM_Date via *order_date*, to DIM_Pizza via *pizza_id*, and to DIM_Time via *order_time*.

The Star Schema was created by designing the Fact_Pizza_Sales table as the central fact table, with the associated DIM_Date, DIM_Pizza, and DIM_Time tables as the dimensions, connected by relevant foreign keys.

This structure enables comprehensive analysis, such as sales by pizza type, time, or date, and optimizes data retrieval in Power BI.
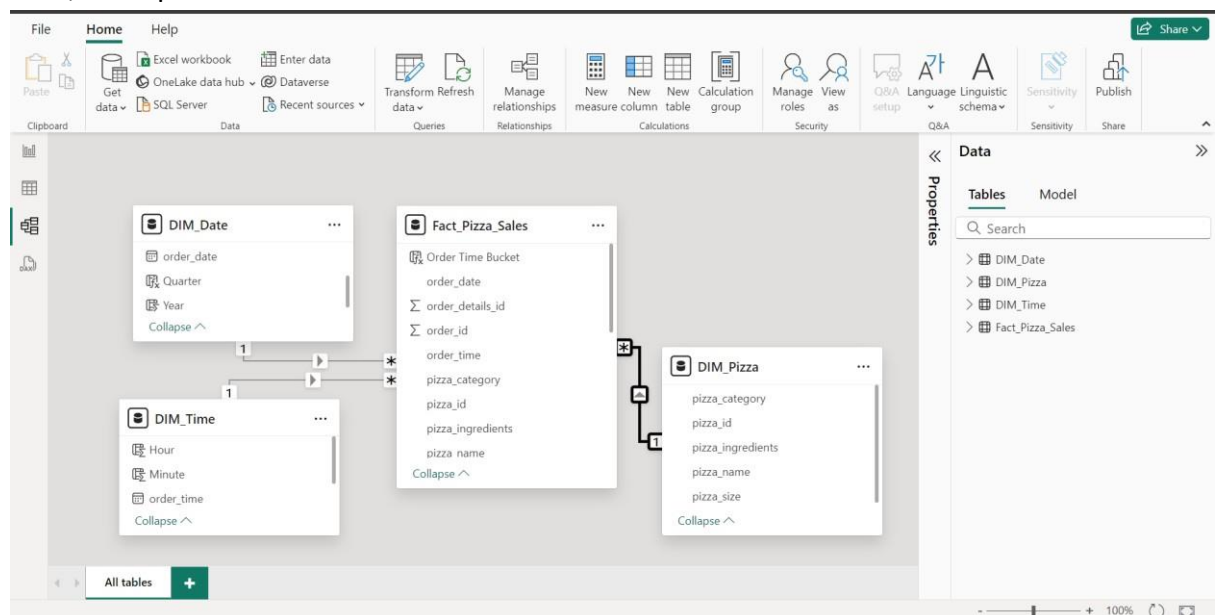

Figure 15: Start Schema – Showing the connections between Fact table and dimension tables.

This Star Schema ensures streamlined, effective analysis and reporting.

5.3 DAX Measures and Calculated Columns

In the Power BI model, several **DAX (Data Analysis Expressions)** measures and calculated columns were created to enhance the analysis and provide key insights into the dataset. Below is a description of the formulas used and their corresponding functionalities:

1. **Average Order Value:** This measure calculates the average value of each order by dividing total sales by the distinct count of unique orders.
   DAX Formula:
   Average Order Value =
   DIVIDE(
   [Total Sales],
   DISTINCTCOUNT(Fact_Pizza_Sales[order_id])
)

2. **Average Pizza Price:** This measure computes the average unit price of pizzas sold based on the unit_price column in the Fact_Pizza_Sales table.
   DAX Formula:
   Average Pizza Price = AVERAGE(Fact_Pizza_Sales[unit_price])

3. **Order Time Bucket**: This calculated column categorizes order times into "Morning", "Afternoon", and "Evening" buckets based on the hour of the order_time column.
   DAX Formula:
   Order Time Bucket =
   IF(HOUR(Fact_Pizza_Sales[order_time]) < 12, "Morning",
   IF(HOUR(Fact_Pizza_Sales[order_time]) < 18, "Afternoon", "Evening"))

4. **Orders by Day**: This measure counts the number of orders on each day by counting the rows in the Fact_Pizza_Sales table.
   DAX Formula:
   Orders by Day = COUNTROWS(Fact_Pizza_Sales)

5. **Sales by Pizza Size:** This measure calculates the total sales for each pizza size by iterating through the Fact_Pizza_Sales table and summing up the total_price.
   DAX Formula:
   Sales by Pizza Size =
   SUMX(
   Fact_Pizza_Sales,

Fact_Pizza_Sales[total_price]
)

6. **Total Cost**:This calculated column calculates the total cost for each pizza sold by multiplying the unit_price by the quantity for each row in the Fact_Pizza_Sales table.
   DAX Formula:
   Total Cost = Fact_Pizza_Sales[unit_price] * Fact_Pizza_Sales[quantity]

7. **Total Orders**:This measure calculates the total number of distinct orders by counting unique order_ids in the Fact_Pizza_Sales table.
   DAX Formula:
   Total Orders = DISTINCTCOUNT(Fact_Pizza_Sales[order_id])

8. **Total Quantity Sold**:This measure sums up the quantity of pizzas sold across all orders.
   DAX Formula:
   Total Quantity Sold = SUM(Fact_Pizza_Sales[quantity])

9. **Total Sales**: This measure sums the total sales value by adding up the total_price for all rows in the Fact_Pizza_Sales table.
   DAX Formula:
   Total Sales = SUM(Fact_Pizza_Sales[total_price])

These DAX formulas provide critical metrics and aggregations to effectively analyze overall business performance, allowing for comprehensive insights into the pizza restaurant's operations.

5.4 Dashboard Description

The **Pizza Restaurant - Sales Performance Dashboard** provides actionable insights into the restaurant's sales, profitability, and customer behavior. The dashboard is organized into four pages:

Page 1: Sales and Profit Overview
- **Scroller Visual for Total Sales**: Displays total sales for quick revenue overview.
- **Scroller Visual for Total Profit**: Shows total profit for financial performance.
- **Area Chart for Sales by Month**: Visualizes monthly sales trends.
- **Stacked Column Chart for Sales by Pizza Category**: Displays sales across pizza categories.
- **Clustered Bar Chart for Top 10 Pizza Sales**: Ranks the top-selling pizzas by revenue.
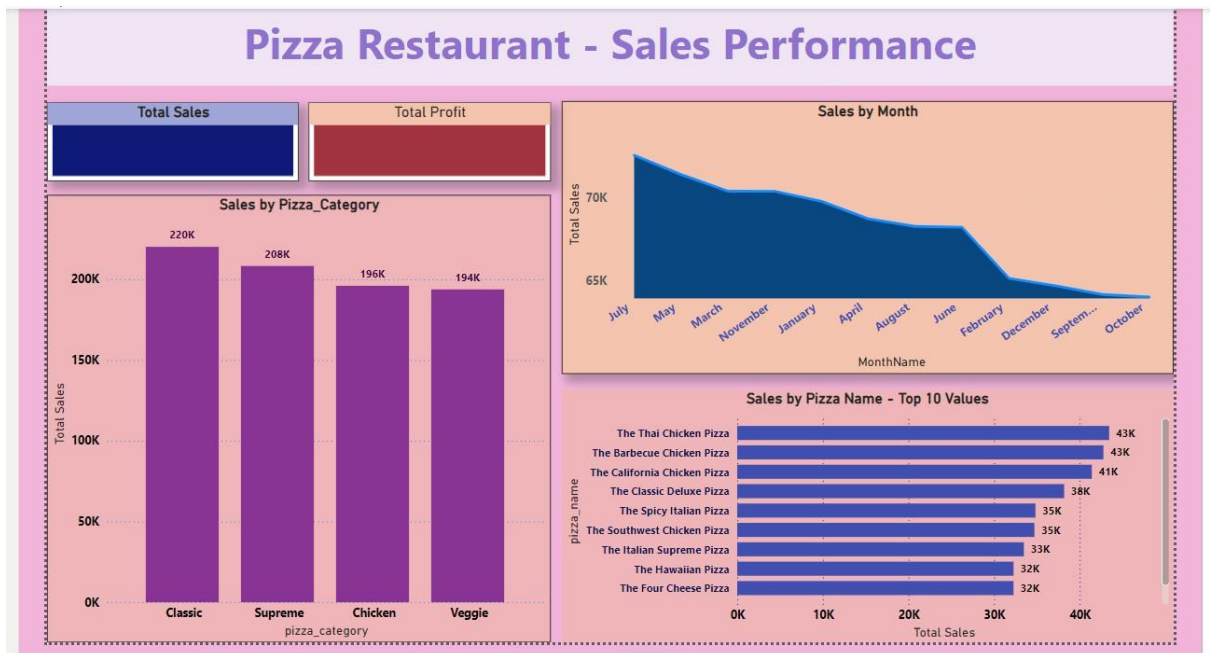
Figure 16: Pizza Restaurant – Sales Performance – Dashboard Page 1

Page 2: Ingredient and Size Impact

- **Donut Chart for Sales by Pizza Ingredients**: Shows contribution of ingredients to sales.
- **Drill-Down Pie Chart for Sales by Pizza Size**: Explores sales by pizza size.
- **Stacked Bar Chart for Sales by Pizza Category and Size**: Analyzes performance by size and category.
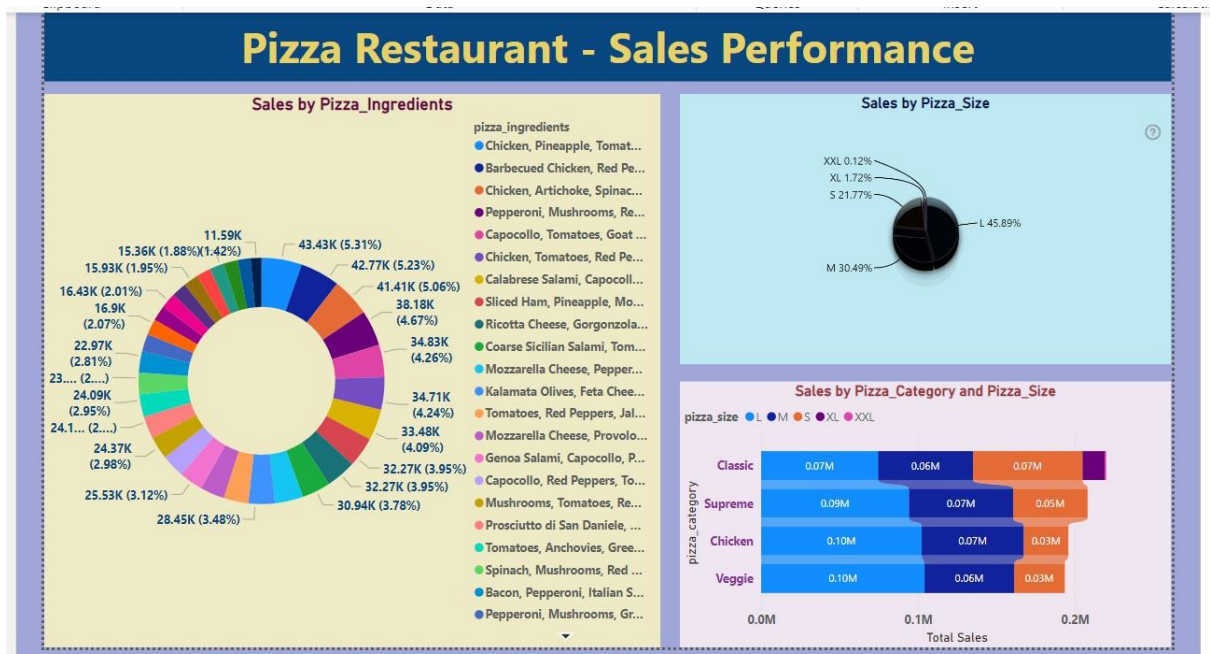

Figure 17: Pizza Restaurant – Sales Performance – Dashboard Page 2

Page 3: Order Frequency and Behavior

- **Stacked Bar Chart for Order Frequency by Pizza Type**: Tracks frequency of orders for each pizza type.
- **Advanced Cards for Key Metrics**: Displays average sales per order, total orders, and average order value.
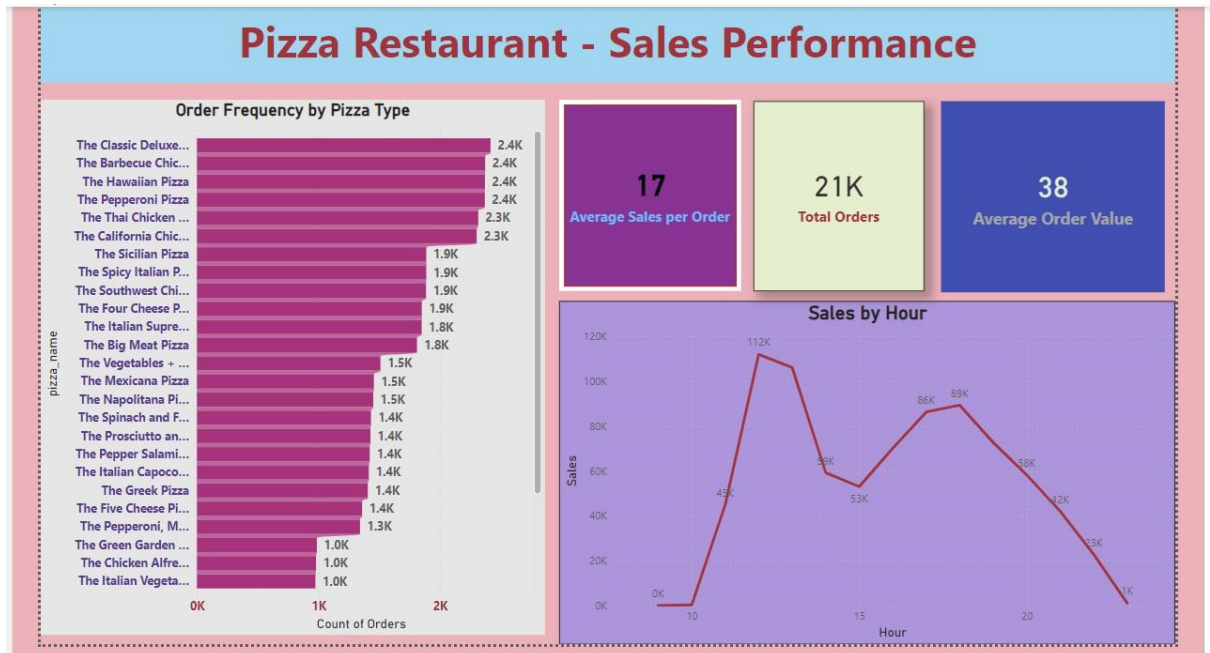- **Line Chart for Sales by Hour**: Shows sales trends throughout the day.

Figure 18: Pizza Restaurant – Sales Performance – Dashboard Page 3

Page 4: Profitability and Long-Term Trends

- **Clustered Bar Chart for Profit by Pizza Name**: Ranks pizzas by profitability.
- **Line Chart for Sales by Quarter**: Tracks sales trends over quarters.
- **Animated Bar Chart for Profit and Year by Pizza Category**: Shows profit evolution by category.
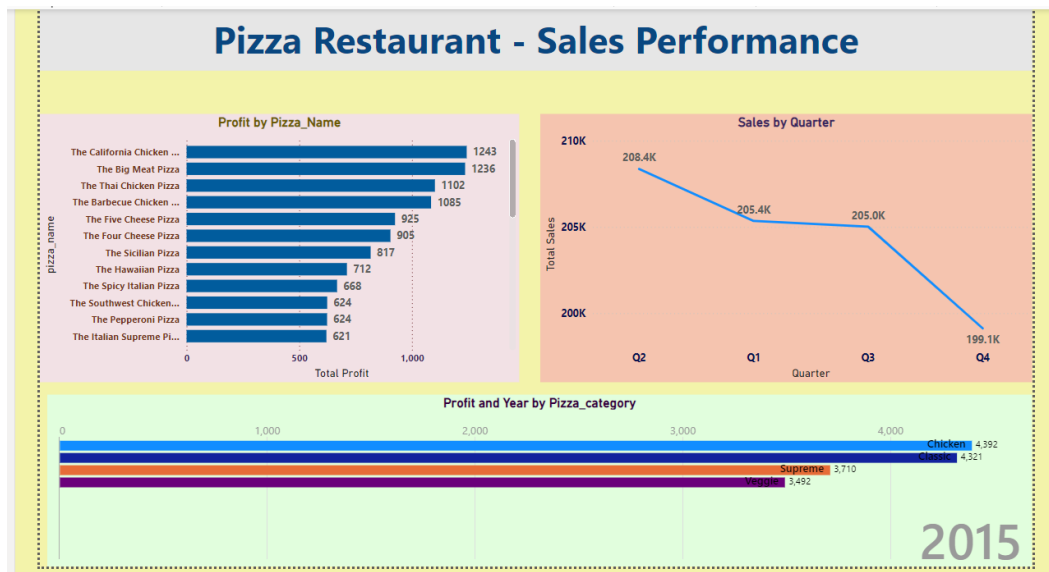
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Figure 19: Pizza Restaurant – Sales Performance – Dashboard Page 4

Dashboard Organization

Each page focuses on specific insights, such as sales trends, customer preferences, and profitability, allowing users to navigate easily and gain targeted insights. Interactive visuals offer drill-down capabilities for deeper analysis.

Figure 20: Figure 16: Pizza Restaurant – Sales Performance - Dashboard Organization

6.Self -Assess Form Table:

Report Section	Description	Grade your work from 0 to 10
Report Structure	The report is well-written, and it contains all the relevant sections	10
Data Pre-processing and Data Modelling	Many pre-processing steps have been applied. The data model is well-structured	9.5
Dax and M language	Both DAX and M Language have been extensively used in the report	9.5
Dashboard Design	The dashboard contains a variety of charts, including advanced ones not covered in the module	10
Average		9.75