

SUPERSTORES SALES TIMESERIES ANALYSIS PROJECT

Group 16

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BUSINESS PROBLEM

- Superstores struggle with furniture and office supplies inventory due to inaccurate forecasts, limited consumer insights, and ineffective strategies, causing understocking, overstocking, missed sales, or higher carrying costs.

BUSINESS OBJECTIVE

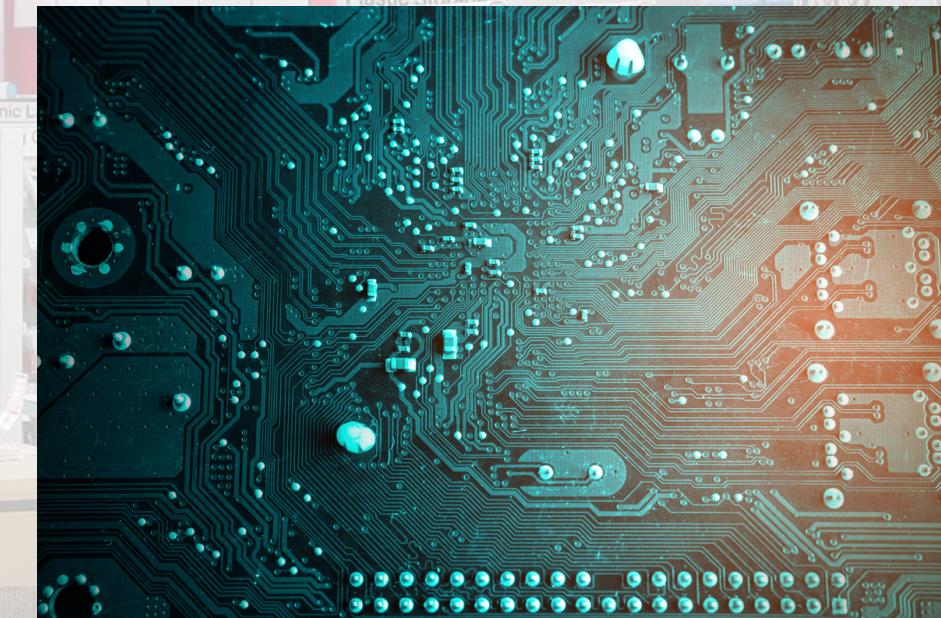
1. Forecasting Future Sales



2. Identifying Trends,
Patterns, and
Seasonality



3. Actionable Insights for
Inventory Management



4. Enhancing Marketing
Strategies

5. Improving Overall
Business Performance

DATA UNDERSTANDING

Data Source:

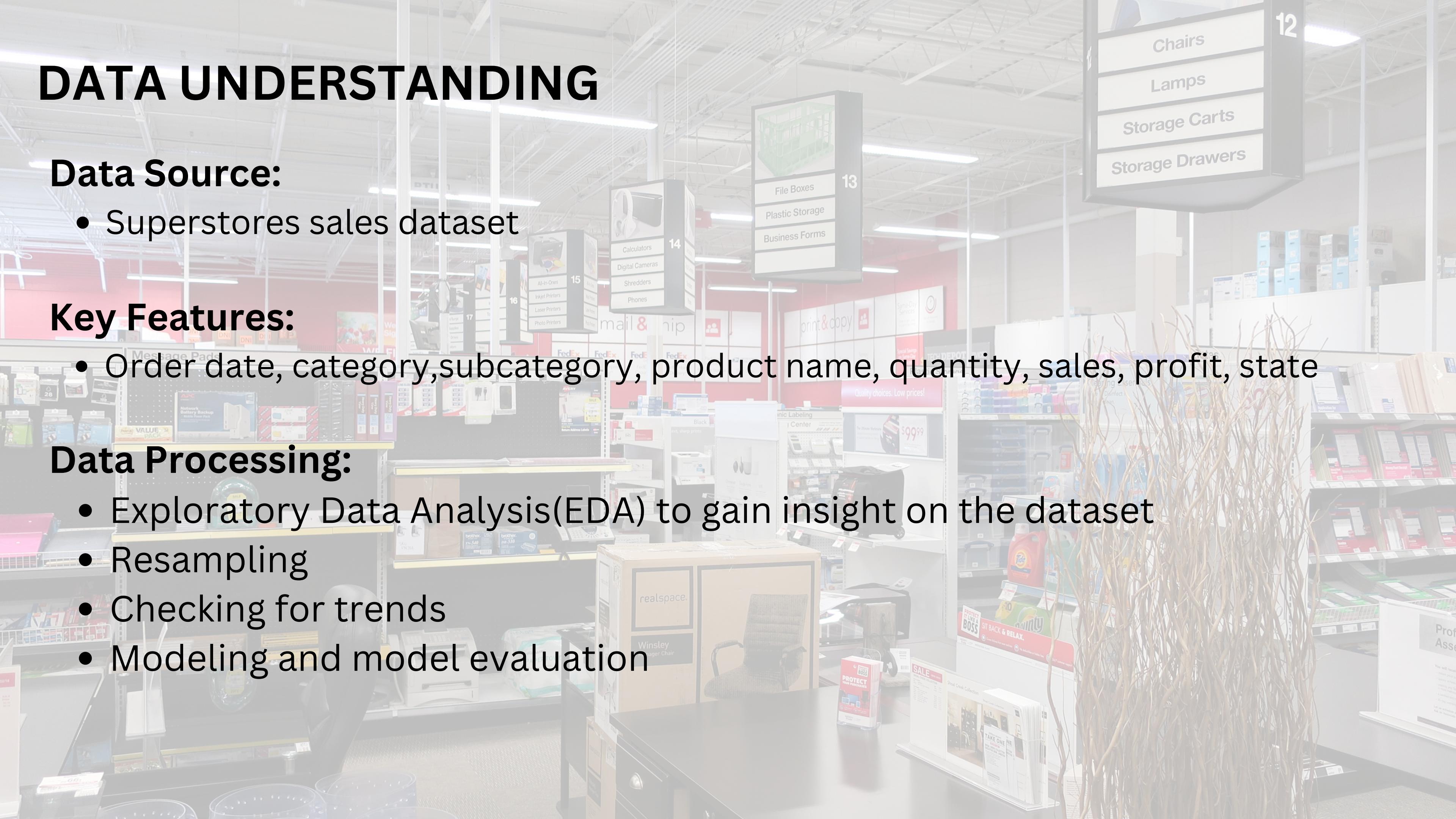
- Superstores sales dataset

Key Features:

- Order date, category,subcategory, product name, quantity, sales, profit, state

Data Processing:

- Exploratory Data Analysis(EDA) to gain insight on the dataset
- Resampling
- Checking for trends
- Modeling and model evaluation



MODEL SELECTION

ARIMA - serves as the base model, well-suited for time series analysis.

SARIMA - extends ARIMA by incorporating seasonality.

Facebook Prophet - user-friendly, automatically handling seasonality, holidays, and trend changes.

LSTM (Long Short-Term Memory) - type of neural network, powerful for capturing complex patterns in sequential data.

MODEL EVALUATION

MAE (Mean Absolute Error)

Average absolute differences.

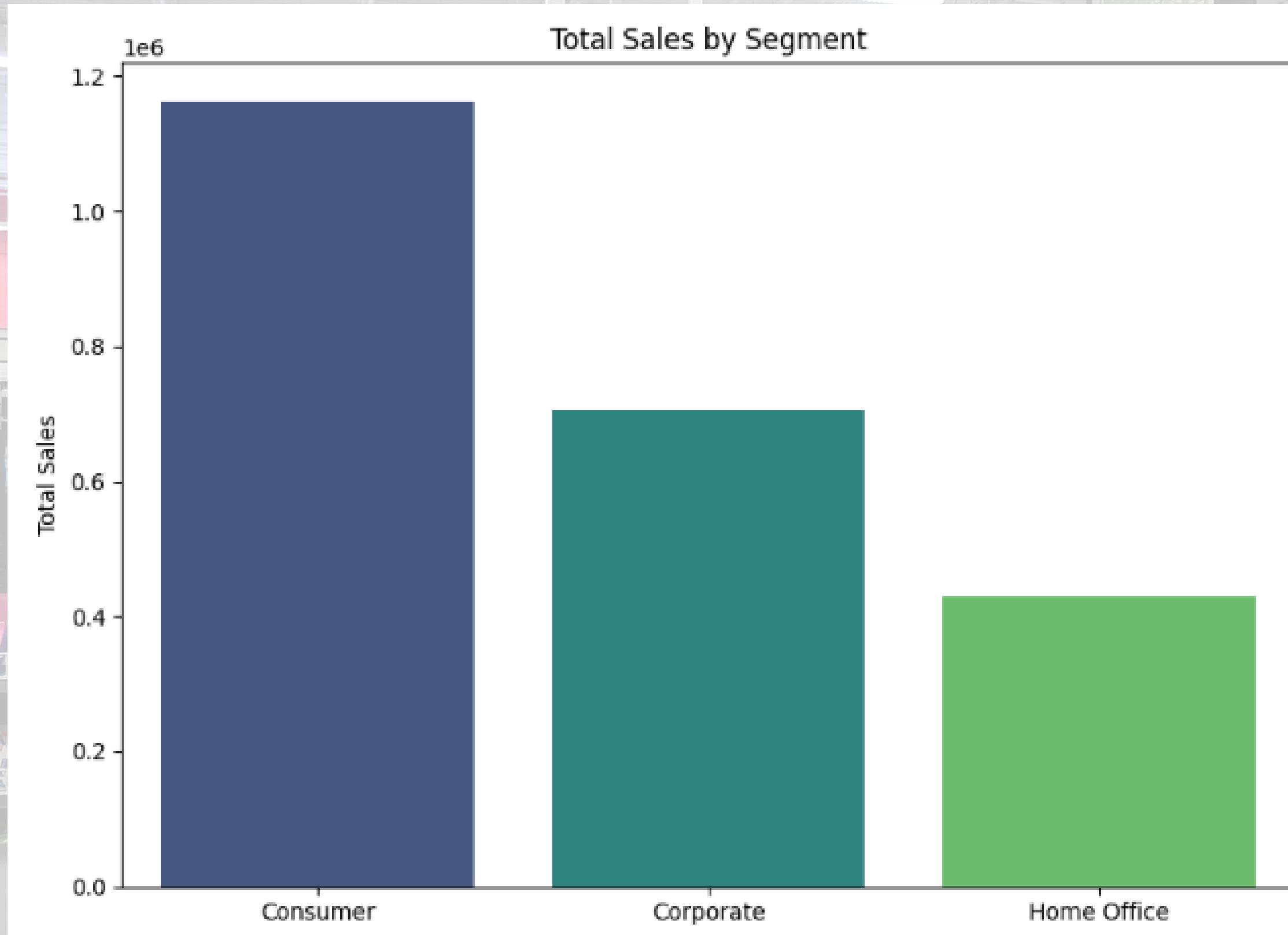
Lower MAE = better accuracy, less sensitive to outliers.

RMSE (Root Mean Squared Error)

Square root of average squared differences.

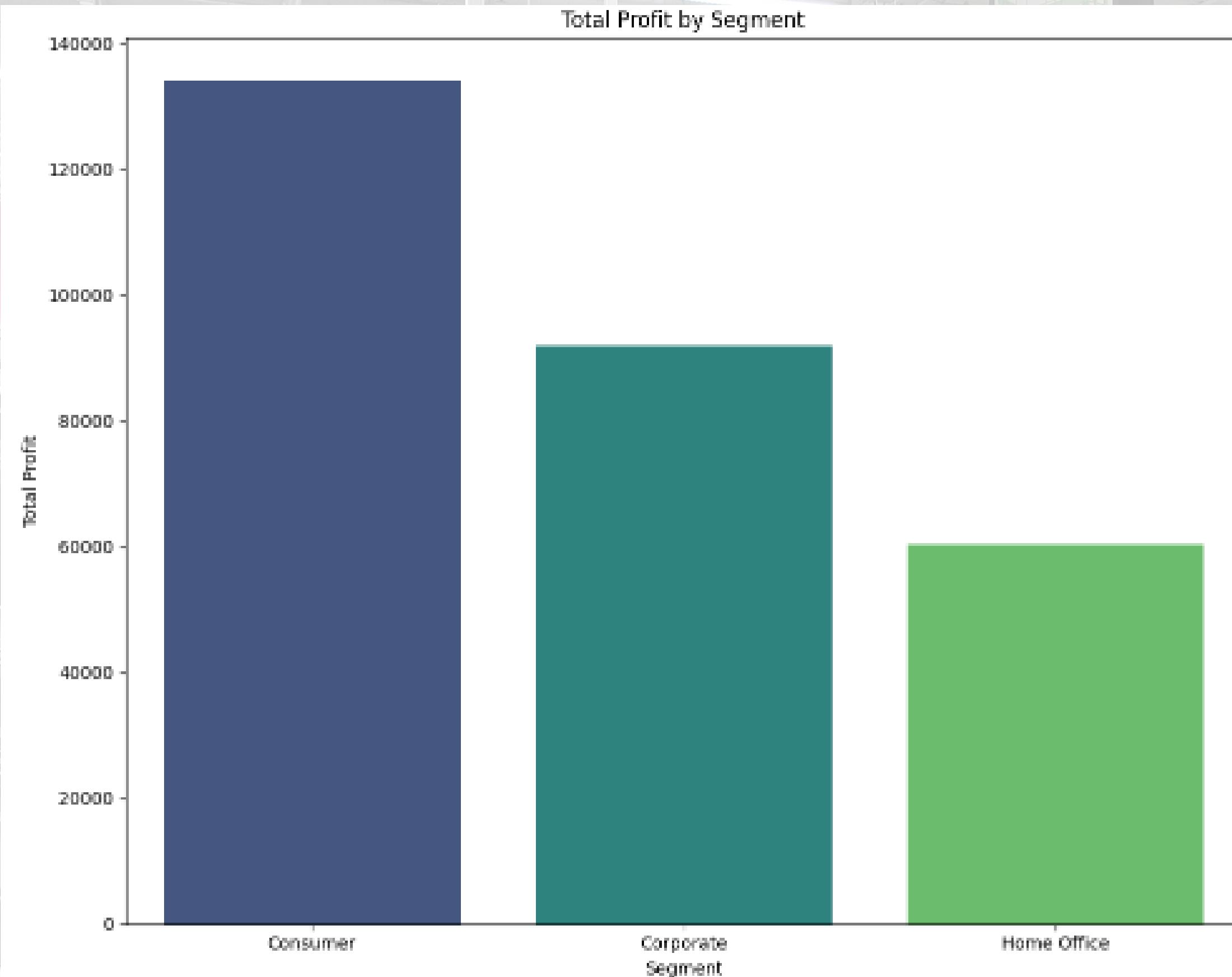
Lower RMSE = better accuracy, more sensitive to outliers.

SALES PER SEGMENT



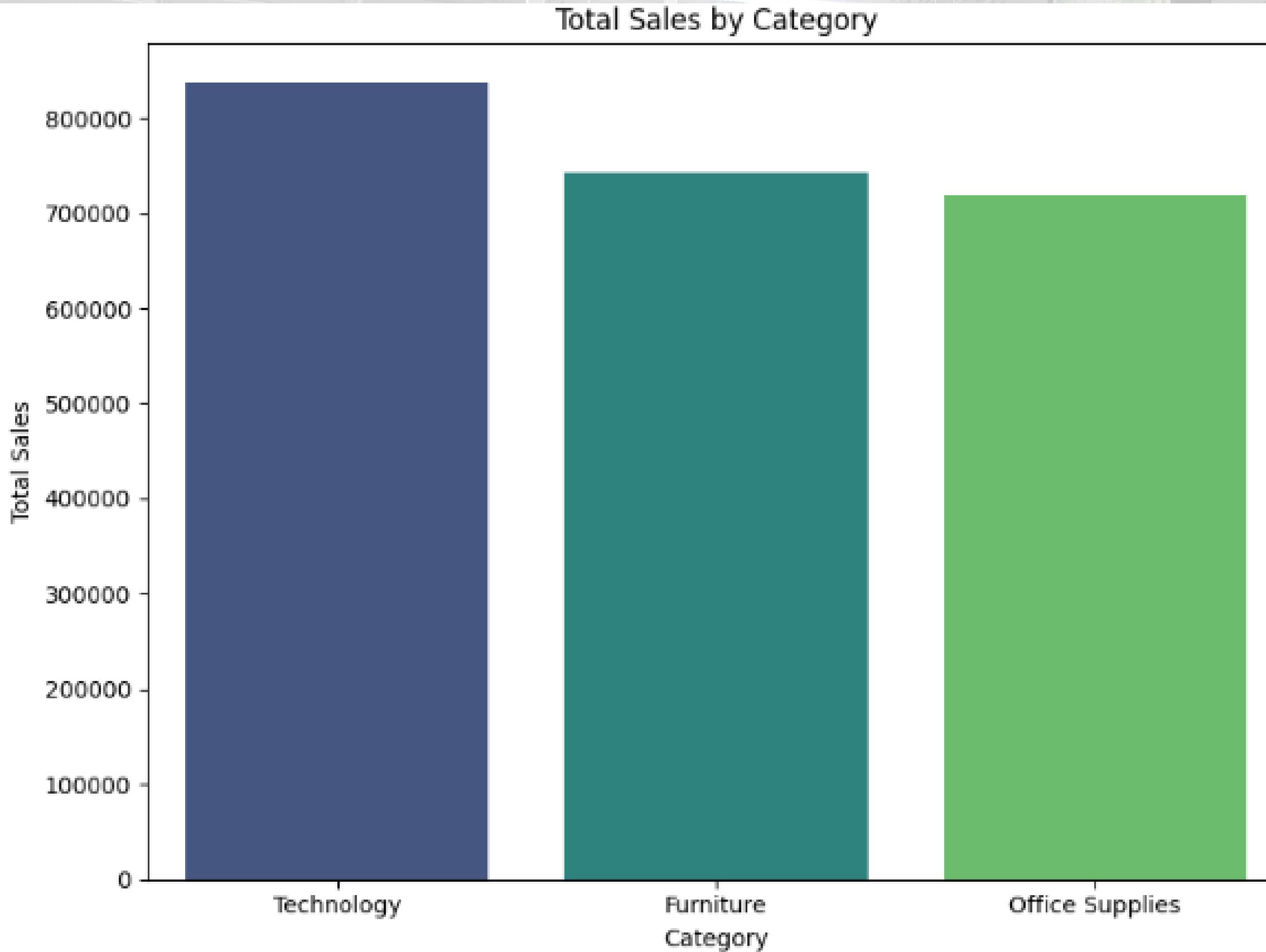
Consumer sales lead with \$1.16 million, followed by Corporate at \$706,146. Home Office contributes \$429,653, making a substantial impact on total revenue.

PROFIT PER SEGMENT



Consumer dominates with the highest revenue and \$134,119.21 profit. Corporate, despite notable sales, shows lower profit at \$91,979.13. Home Office lags in both sales and profitability, earning \$60,298.68.

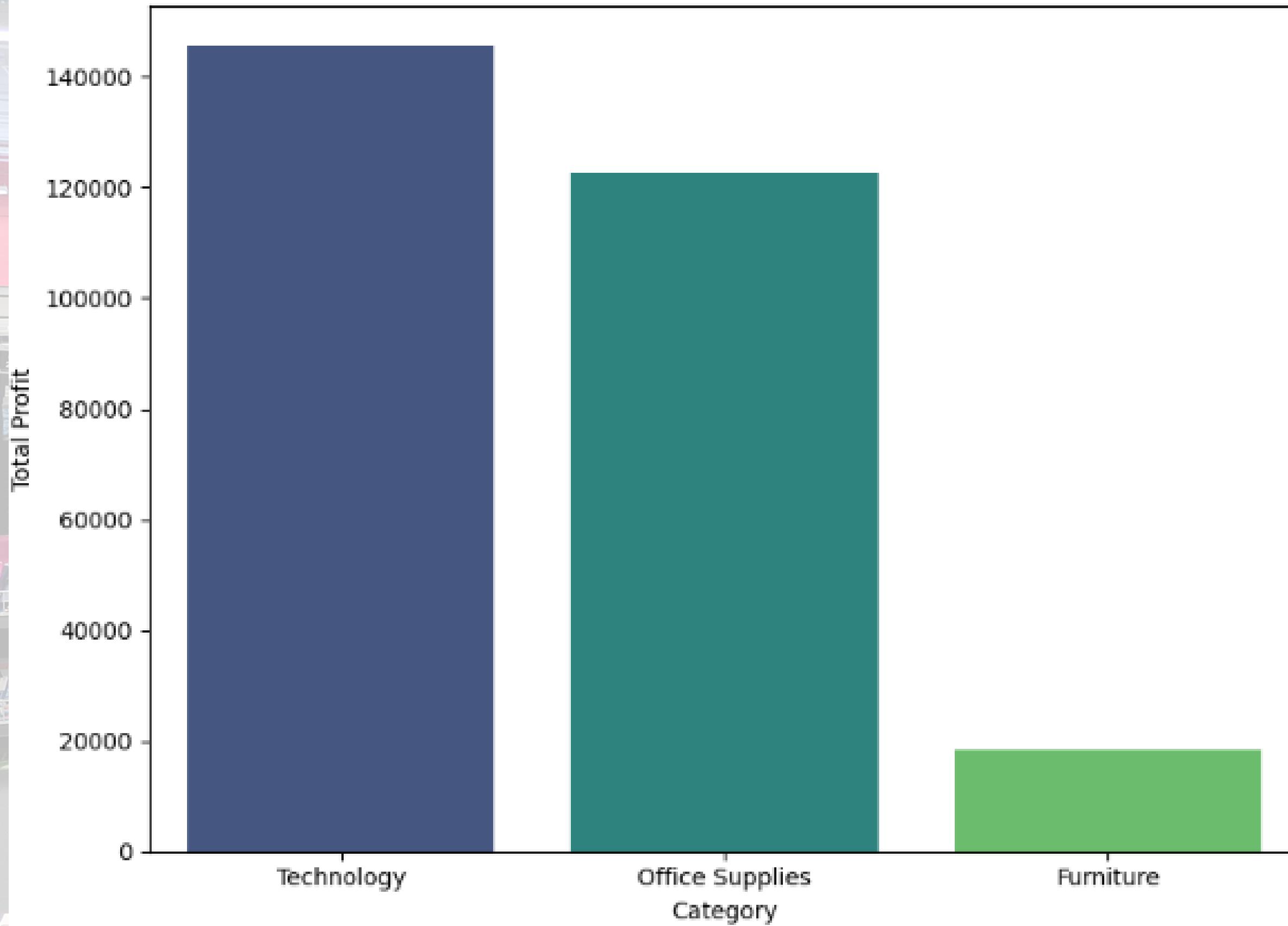
SALES BY CATEGORY



Technology leads in revenue with \$836,154.03 in sales. Furniture follows closely with substantial sales of \$741,999.80, reflecting consumer interest. Office Supplies secures \$719,047.03 in sales, slightly behind Furniture

PROFIT BY CATEGORY

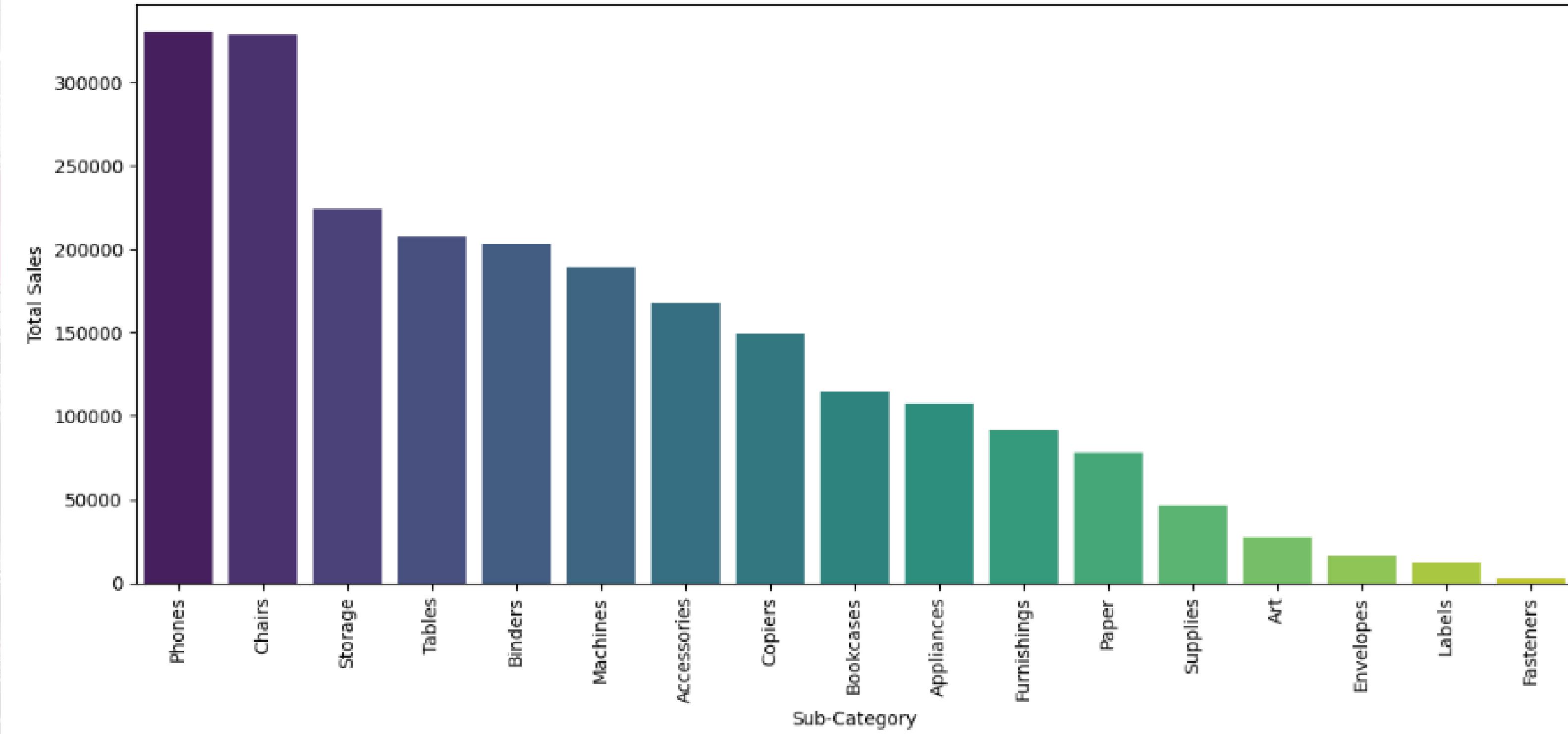
Total Profit by Category



Technology tops in profitability at \$145,454.95, showing efficiency. Office Supplies follow with \$122,490.80 profit. Furniture reports a lower \$18,451.27 profit, signaling higher production costs and a comparatively lower margin.

SALES BY SUB-CATEGORY

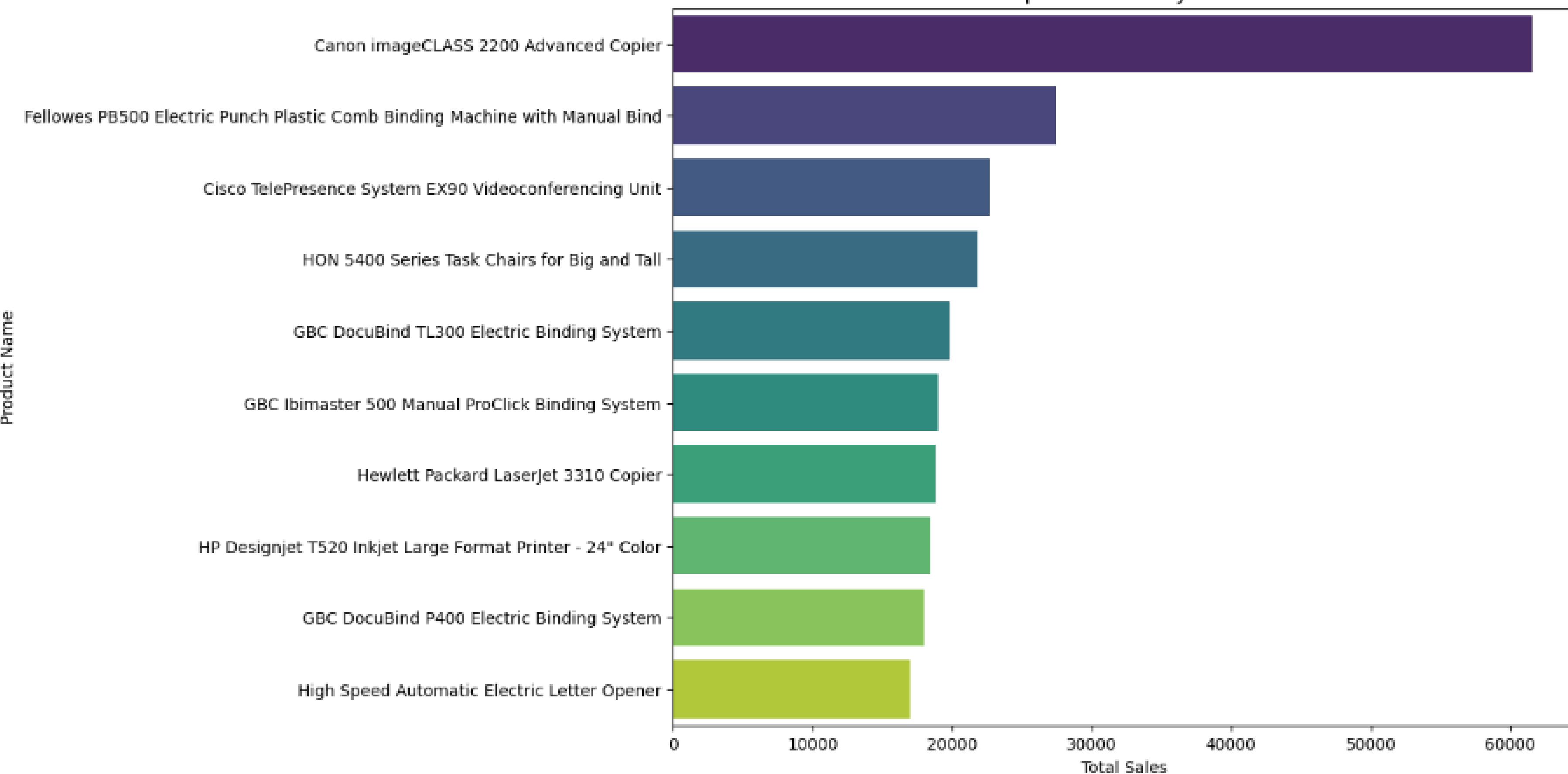
Total Sales by Sub-Category



Phones and Chairs lead in sales (\$330,007.05, \$328,449.10). Storage and Tables follow (\$223,843.61, \$206,965.53). Binders and Machines report strong sales. Labels, Fasteners, Envelopes have lower figures (\$12,486.31, \$3,024.28, \$16,476.40).

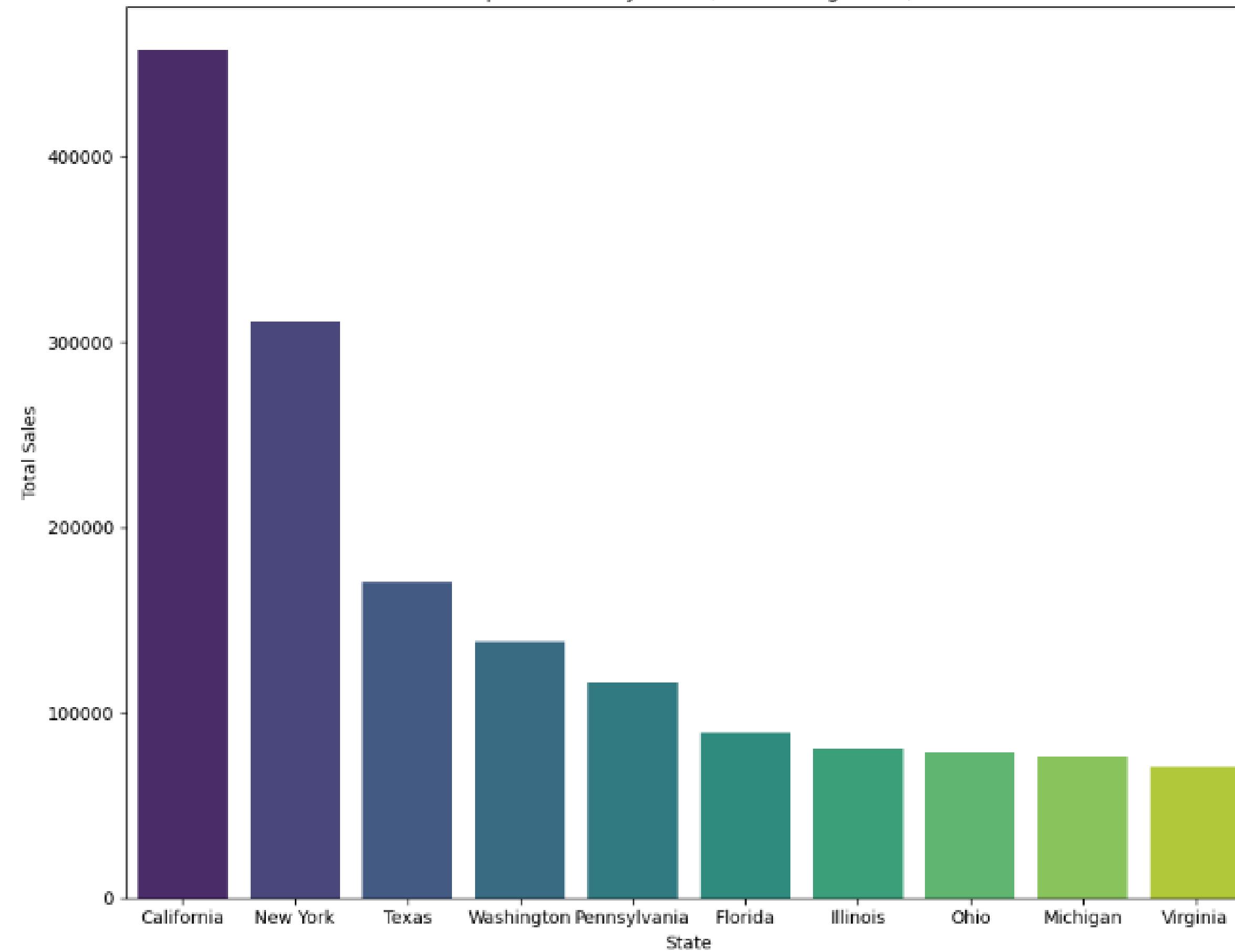
TOP 10 PRODUCTS BY SALES

Top 10 Products by Sales



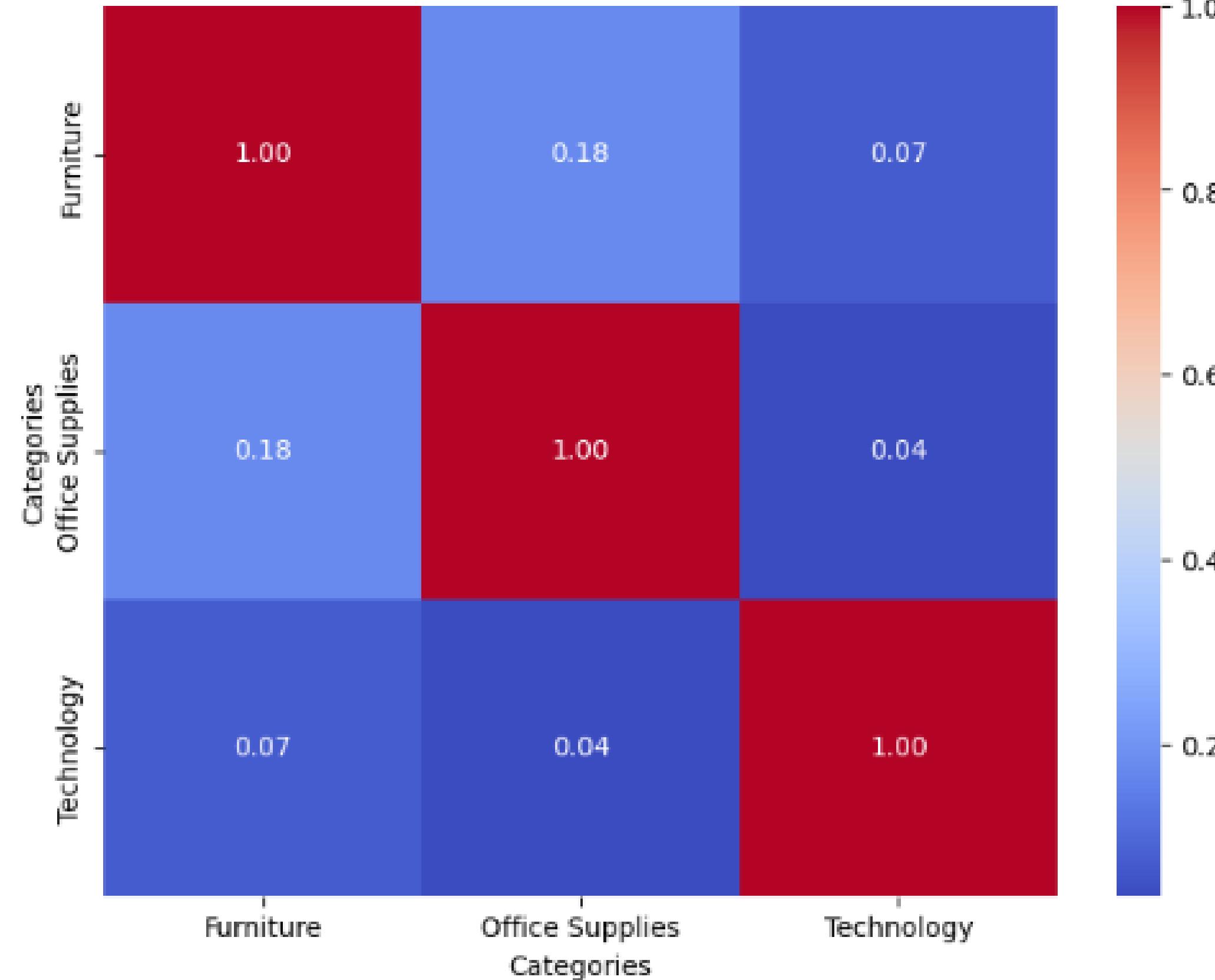
TOP 10 STATES BY SALES

Top 10 States by Sales (Descending Order)



Correlation between sales of furniture, office supplies and technology

Correlation between Sales of Furniture, Office Supplies, and Technology



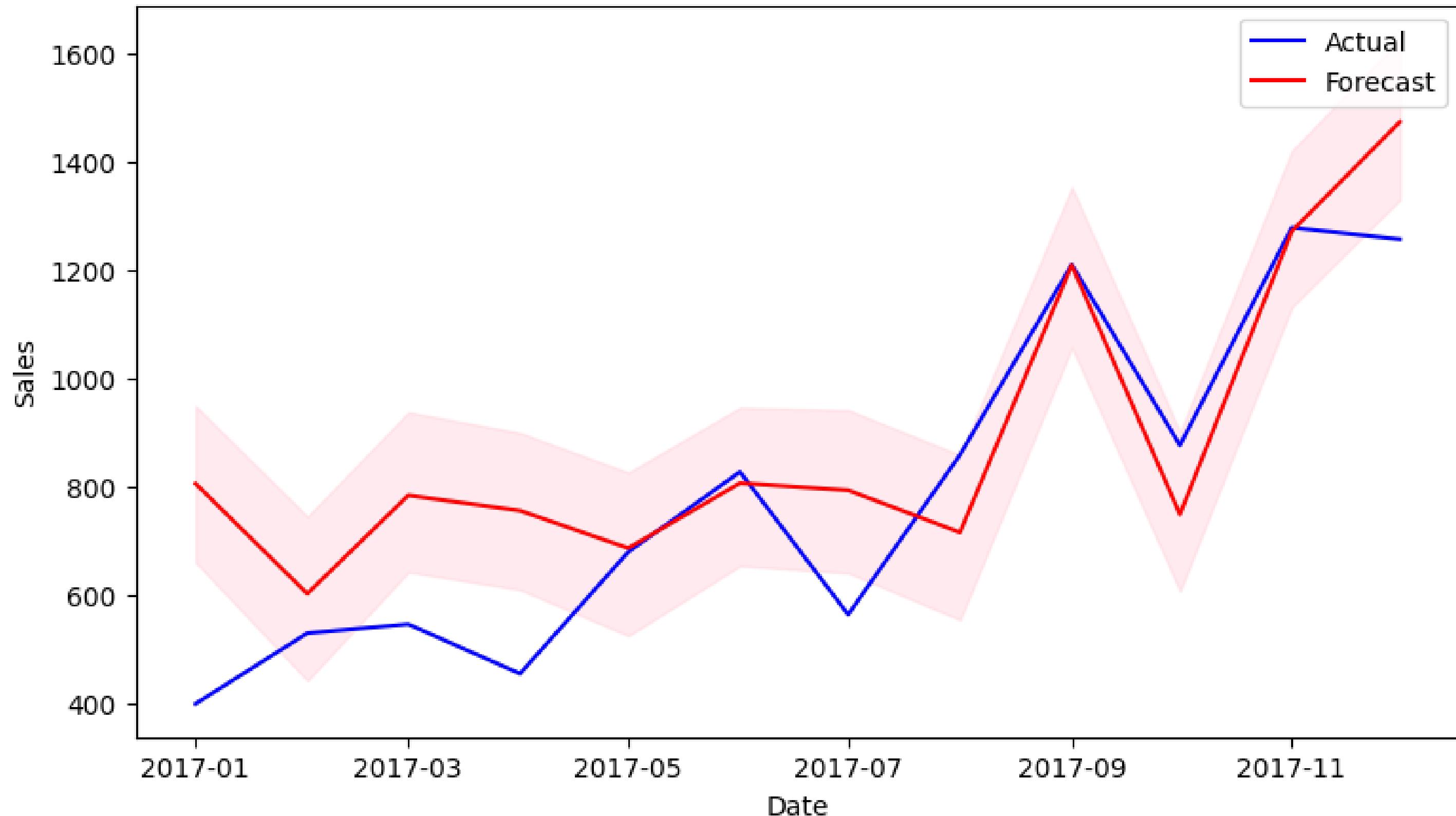
Weak positive correlations (approximately 0.023 to 0.056) exist among category sales, suggesting minor tendencies to move together. Changes in one category minimally influence another, but the relationships aren't robust.

MODEL PERFORMANCE

- Facebook Prophet excels in furniture and technology sales, delivering precise forecasts with the lowest MAE and RMSE. SARIMA and ARIMA follow closely, effective in capturing patterns. LSTM, while intricate, shows higher errors.
- For office supplies, SARIMA leads with the lowest errors, while ARIMA and Prophet trail closely. LSTM displays higher errors in both furniture and office supplies.

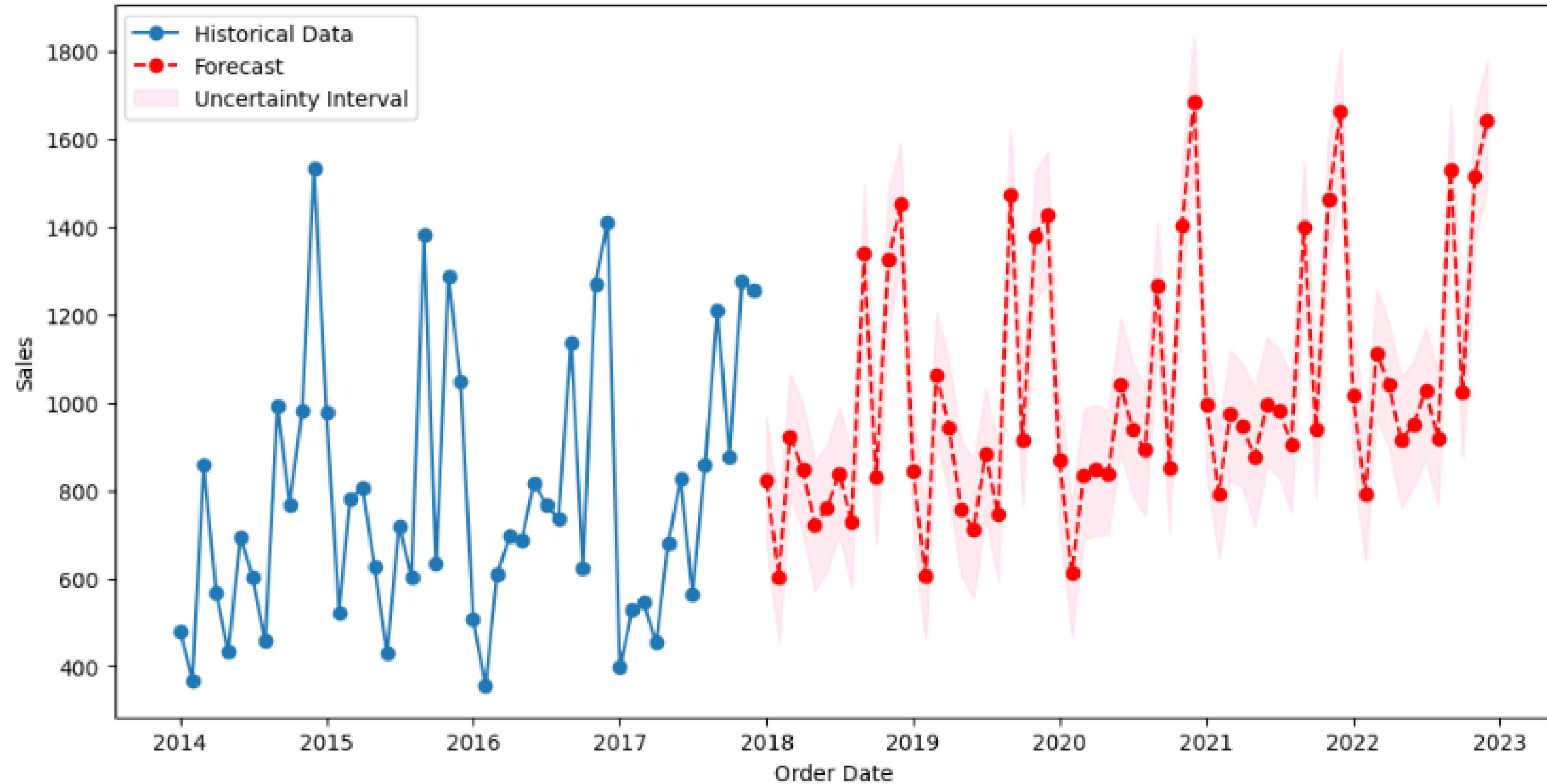
Furniture Sales Forecast using Facebook Prophet

Facebook Prophet Forecast vs Actual Test Data

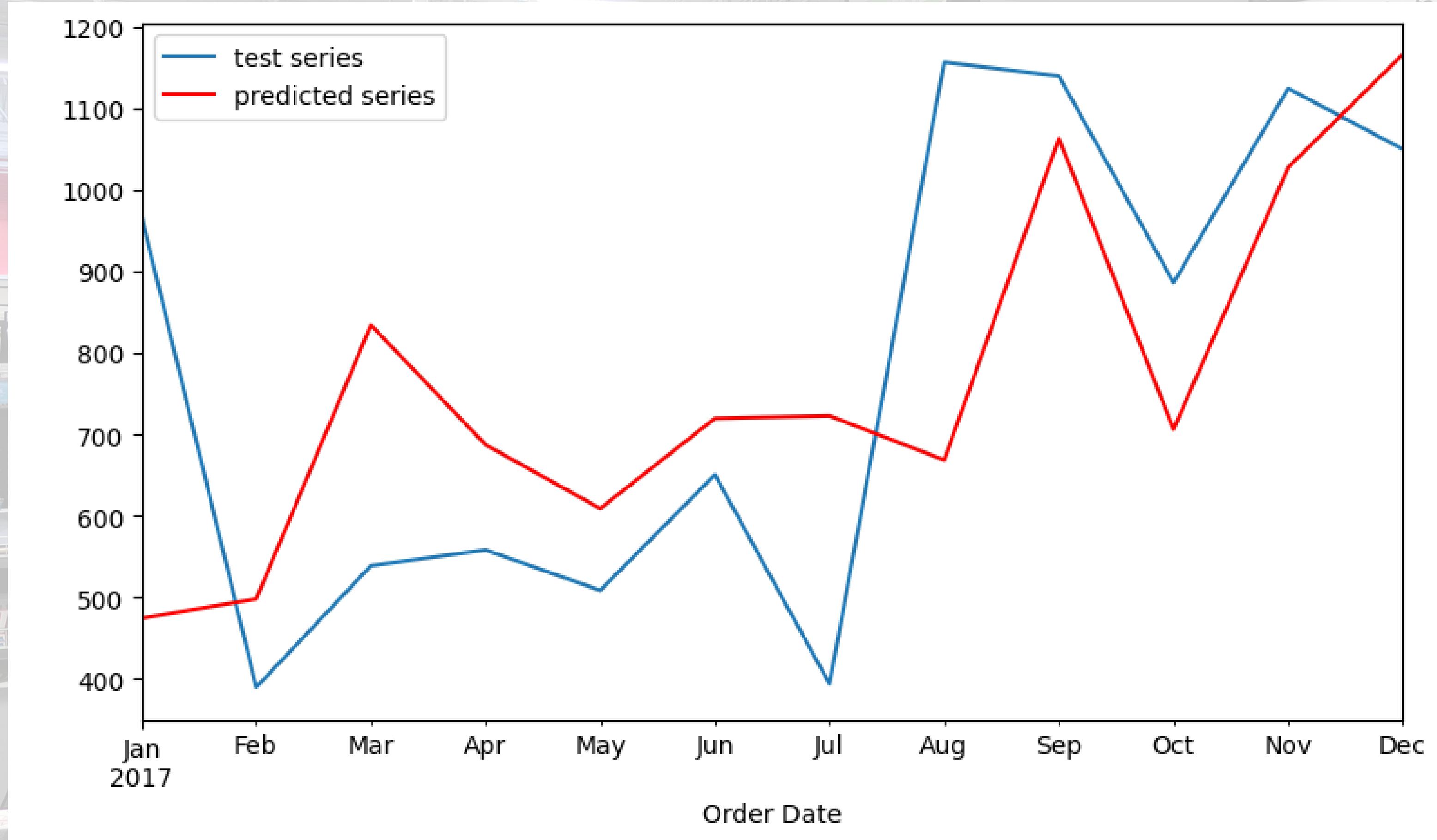


Furniture Sales Forecast for the next 5 years using Facebook Prophet

Facebook Prophet Forecast of Furniture Sales for the Next Five Years

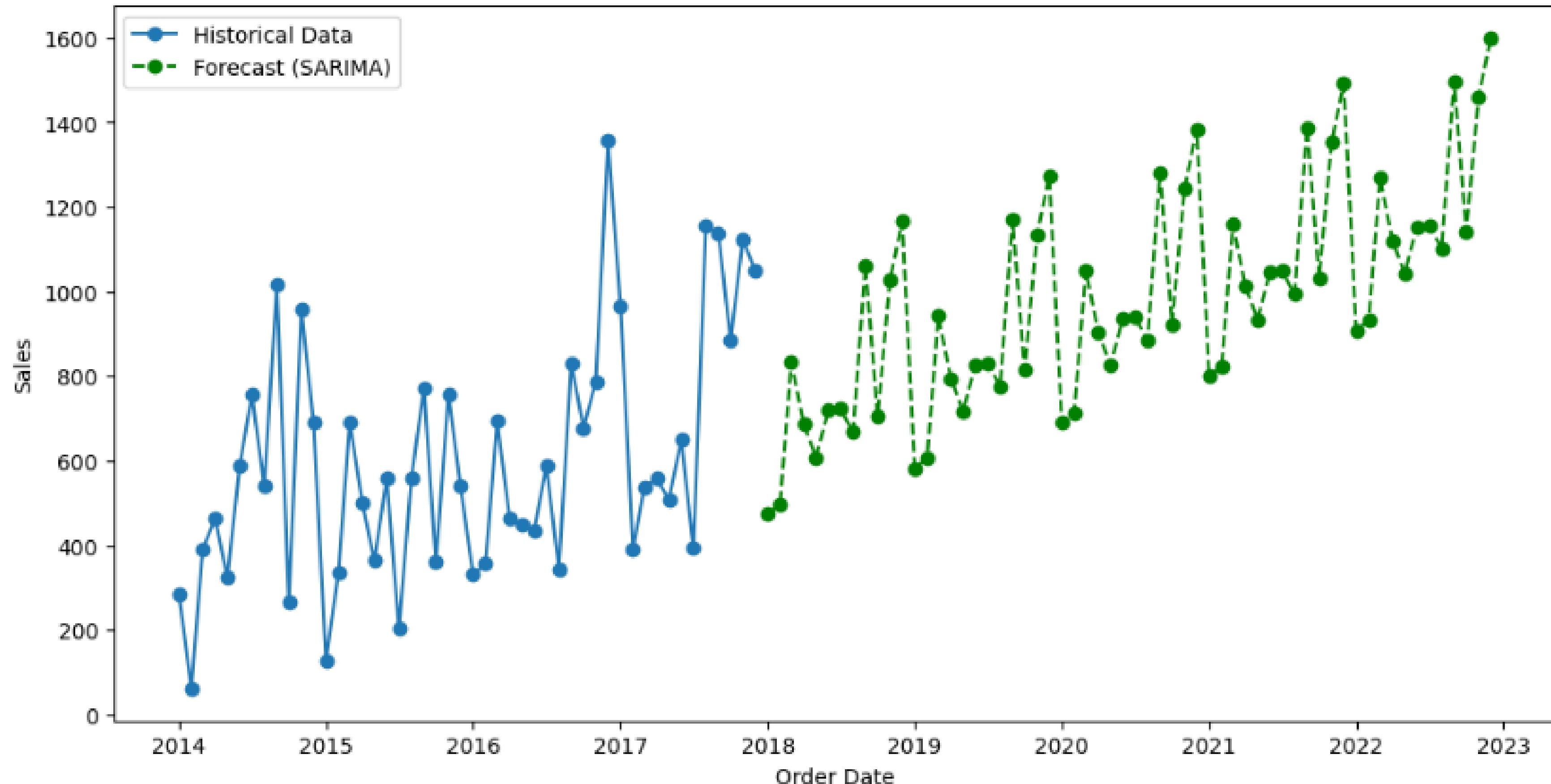


Office Supplies Forecast Sales using SARIMA



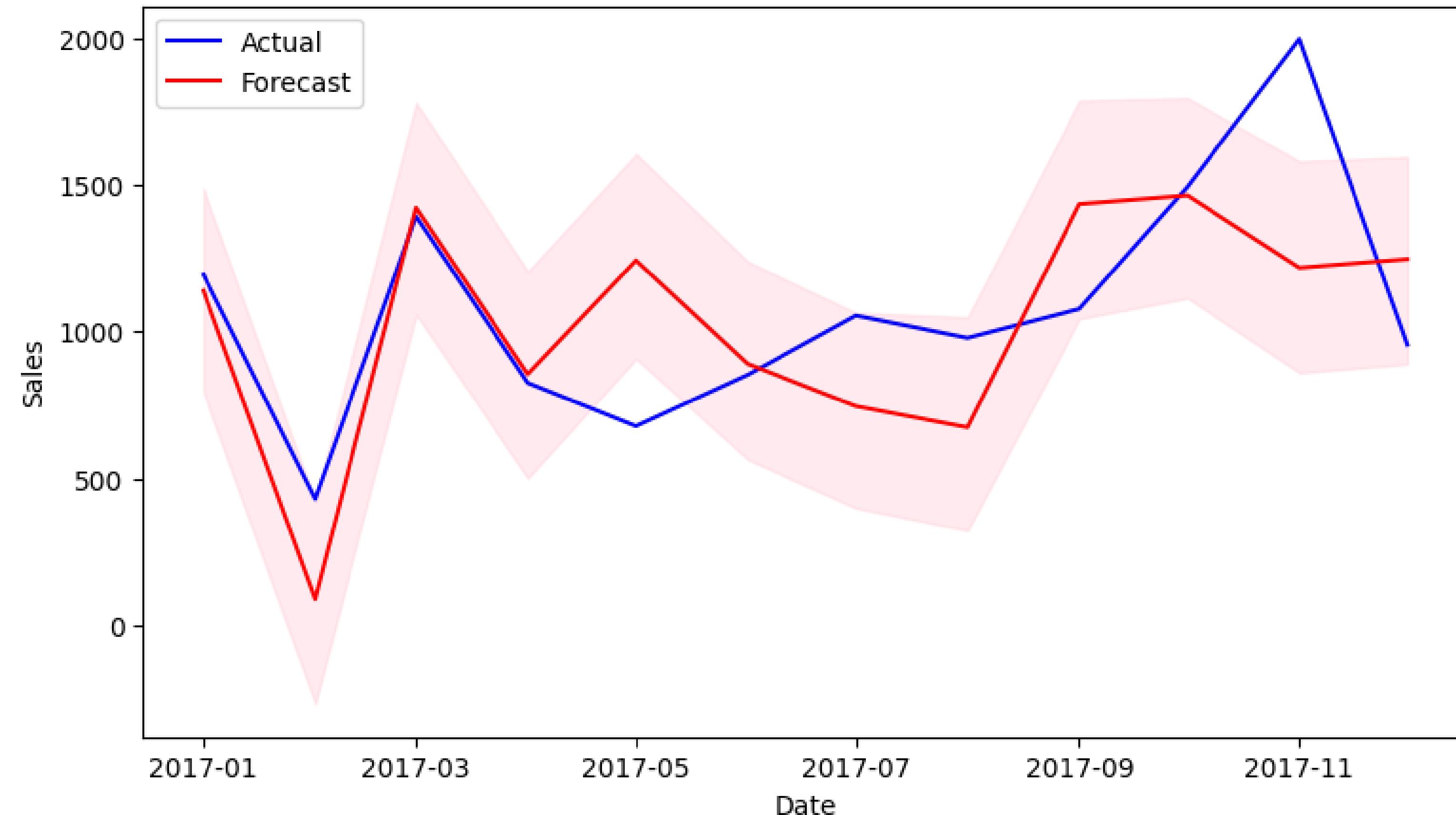
Office Supplies Sales Forecast for the next 5 years using SARIMA

SARIMA Forecast of Office Supplies Sales for the Next Five Years



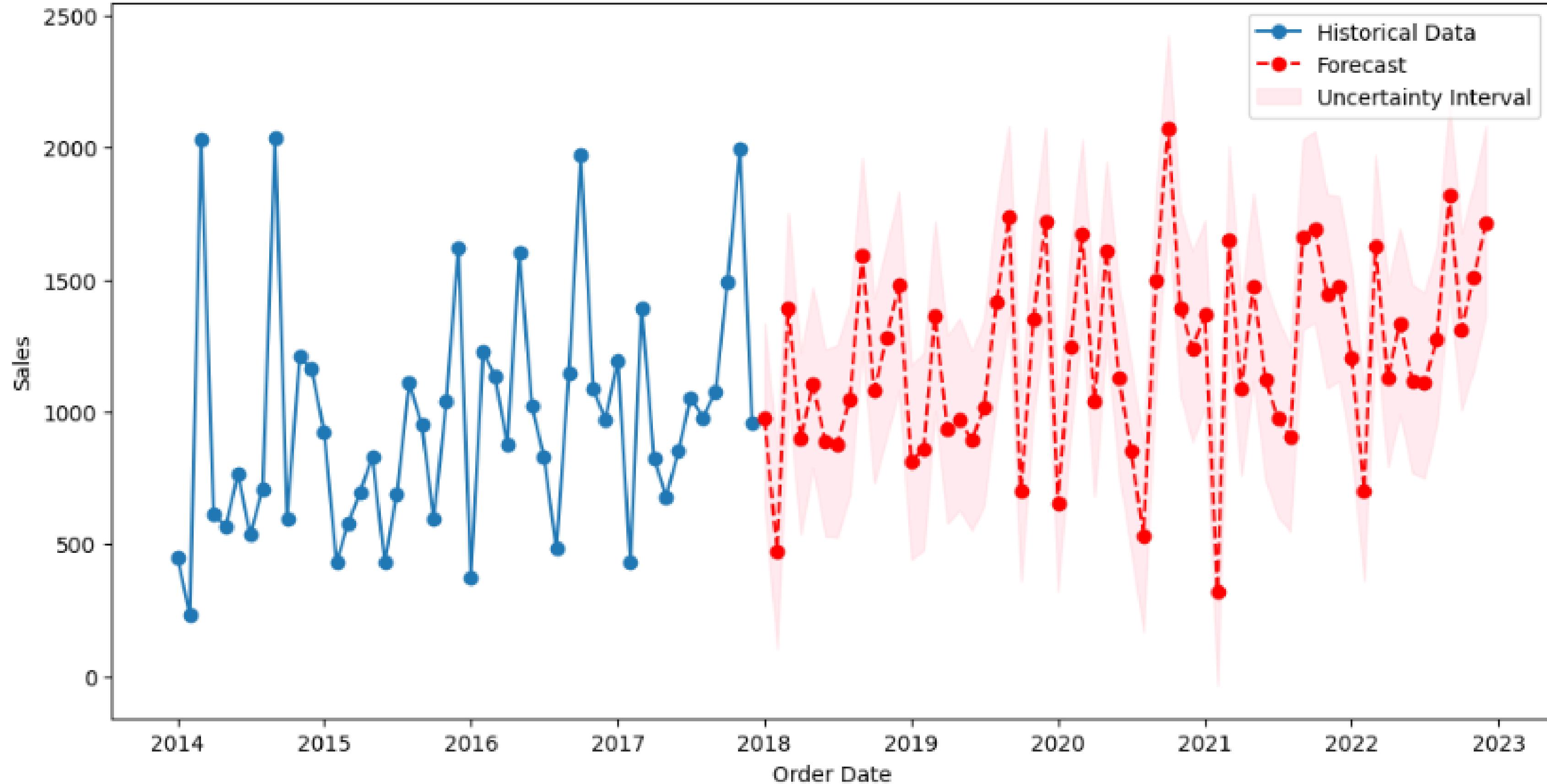
Technology Forecast Sales using Facebook Prophet

Facebook Prophet Forecast vs Actual Test Data



Technology Sales Forecast for the next 5 years using Facebook Prophet

Facebook Prophet Forecast of Technology Sales for the Next Five Years



SOLVING BUSINESS PROBLEM

- The project gave useful insights into sales, but optimizing inventory and maximizing sales face challenges due to complex consumer behavior and market dynamics.
- Efficient use of time series models can aid inventory management and performance, but constant strategy refinement is essential for unpredictable sales trends.

RECOMMENDATIONS

Inventory:

- Adjust stock based on seasons, minimizing carrying costs.

Marketing:

- Budget for promotions during low periods to boost sales.

Product Launch:

- Introduce new products strategically in peak periods.

Supplier Collaboration:

- Work closely with suppliers, negotiate discounts, and ensure smooth logistics during demand spikes.

OVERALL BUSINESS INSIGHTS

Financial Planning:

- Adjust budgets for peak and low seasons, focusing on cost reduction.

Operational Efficiency:

- Anticipate peak order needs by adjusting stock and logistics.

Staffing:

- Plan staffing for high seasons, optimize costs with leave rotations in low seasons.

Customer Experience:

- Ensure stock, excellent service by covering staffing needs, optimizing overall customer experience.

LIMITATIONS

Stationarity Assumption:

- Time series models assume stationarity, but real-world data may deviate, challenging accuracy.

Seasonal Variations:

- Unforeseen changes in consumer behavior, market trends, or external factors may impact sales differently, affecting forecast accuracy.

Changing Consumer Behavior:

- Shifts in purchasing patterns due to evolving consumer behavior may not be entirely captured by historical data, impacting model anticipation.

THANK YOU!

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Chairs

Lamps

Storage Carts

Storage Drawers

13

File Boxes

Plastic Storage

Business Forms

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Calculators

Digital Cameras

Shredders

Phones

15

All-in-One

Inkjet Printers

Laser Printers

Photo Printers

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Message P

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VALUE PACK

APC

Network Batteries

Miller

Power Strip

Surge Protector

UPS

UPS Power

