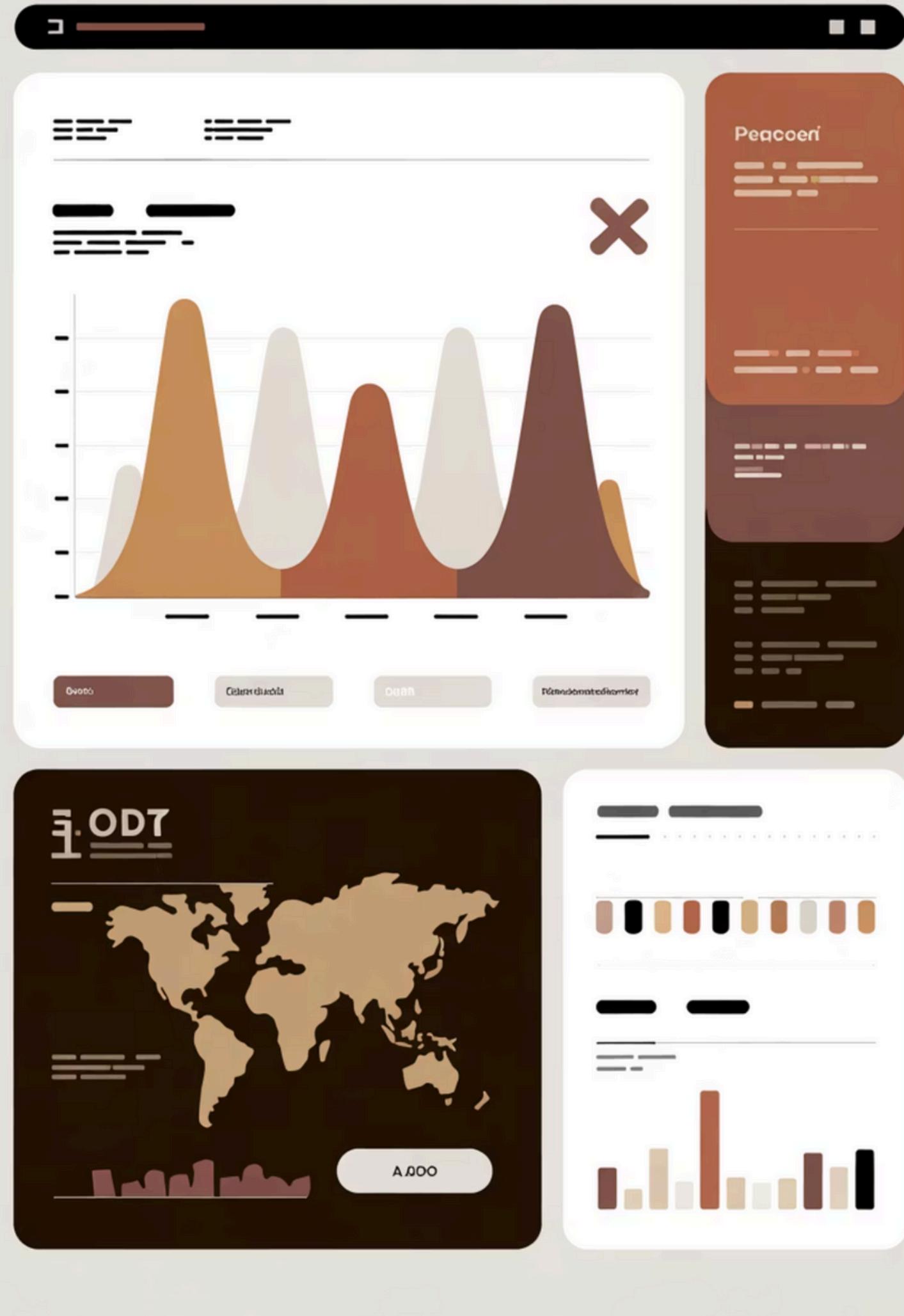


Customer Segmentation and Precision Marketing Strategy Analysis

Data-Driven Decision Making

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Project Overview

Business Context

Analyzing 2,240 retail customers to unlock precision marketing opportunities and optimize ROI through advanced segmentation techniques.

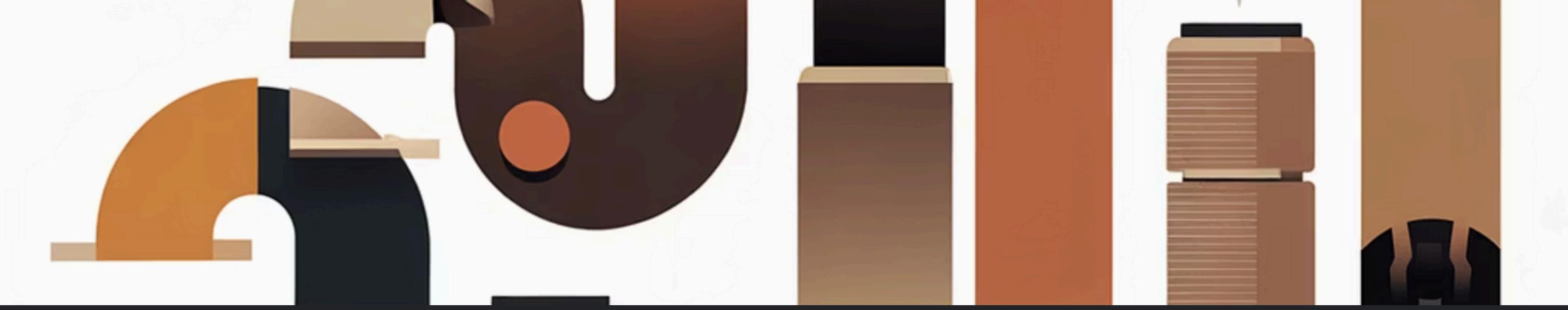
- Comprehensive customer dataset with 17 behavioral attributes
- Focus on marketing optimization and sales forecasting
- Strategic alignment with customer satisfaction goals

Analytical Approach

Leveraging machine learning for actionable business intelligence:

- K-means clustering for segmentation
- Advanced feature engineering
- Predictive modeling and forecasting
- Strategic recommendation development





Data Preparation & Feature Engineering

1

Raw Data Cleaning

2,240 customer records with 17 features spanning demographics, purchasing behavior, and promotional responses. Label encoding for 2 columns Education and Marital_Status. 838 Customers selected after removing outliers

3

Data Standardization

Normalization and scaling to ensure feature comparability across all variables

2

Feature Engineering

Age calculation from birth year, customer tenure from registration date, education encoding (Basic → PhD), marital status grouping

4

Final Feature Set

17 refined core features optimized for clustering analysis and business interpretation

Customer Segmentation Methodology

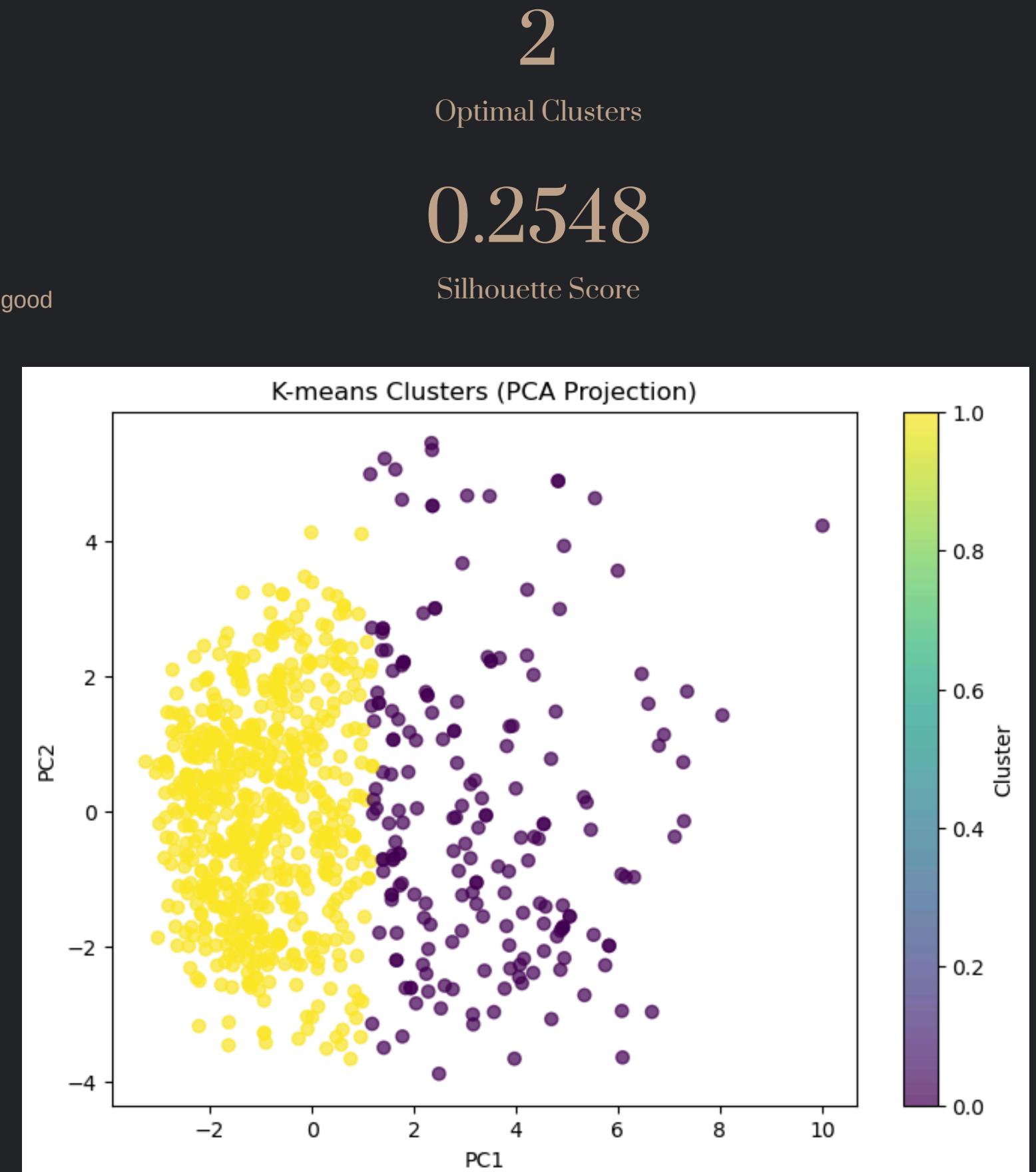
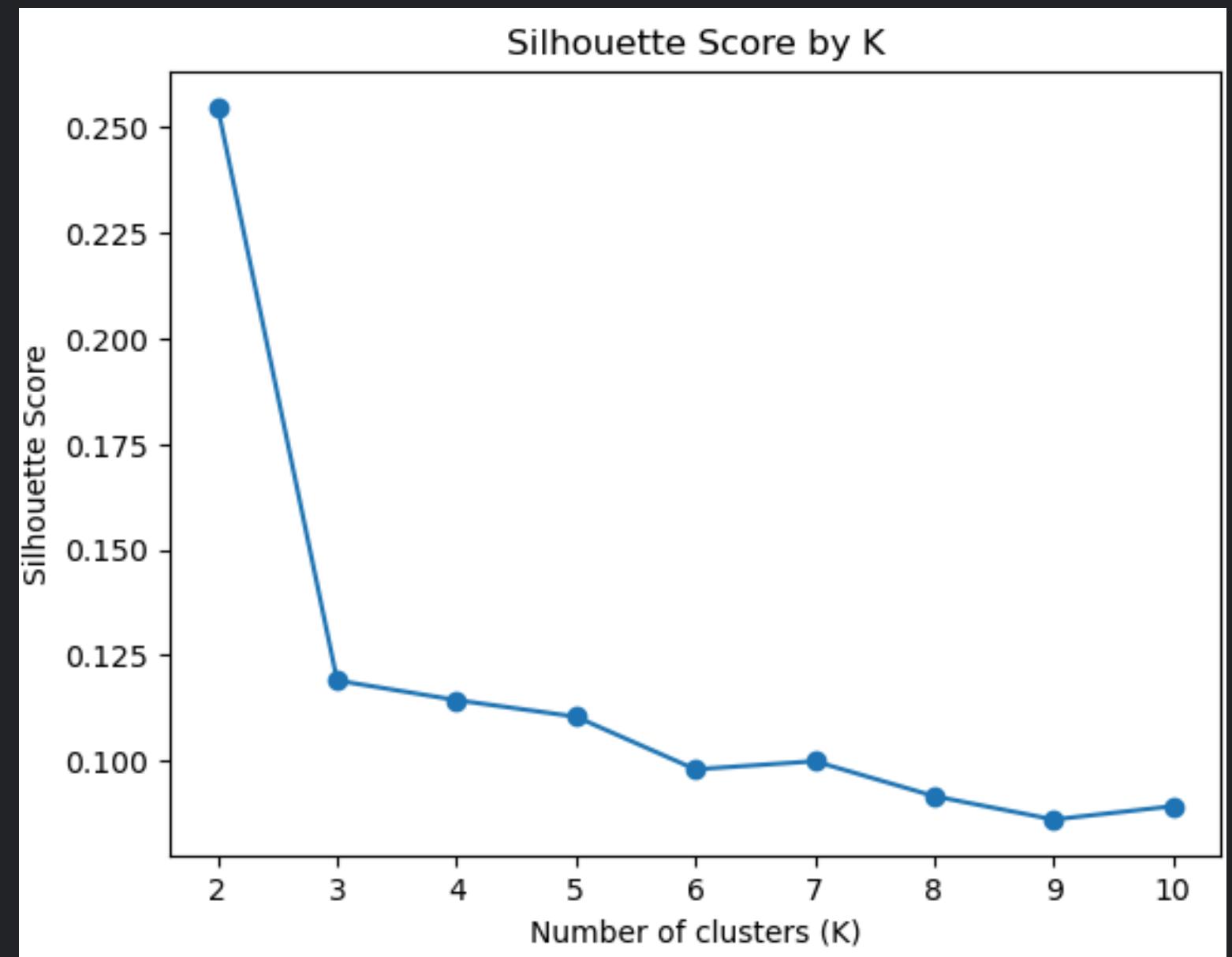
Algorithm Selection & Validation

We employed K-means clustering with rigorous validation to ensure meaningful segmentation.

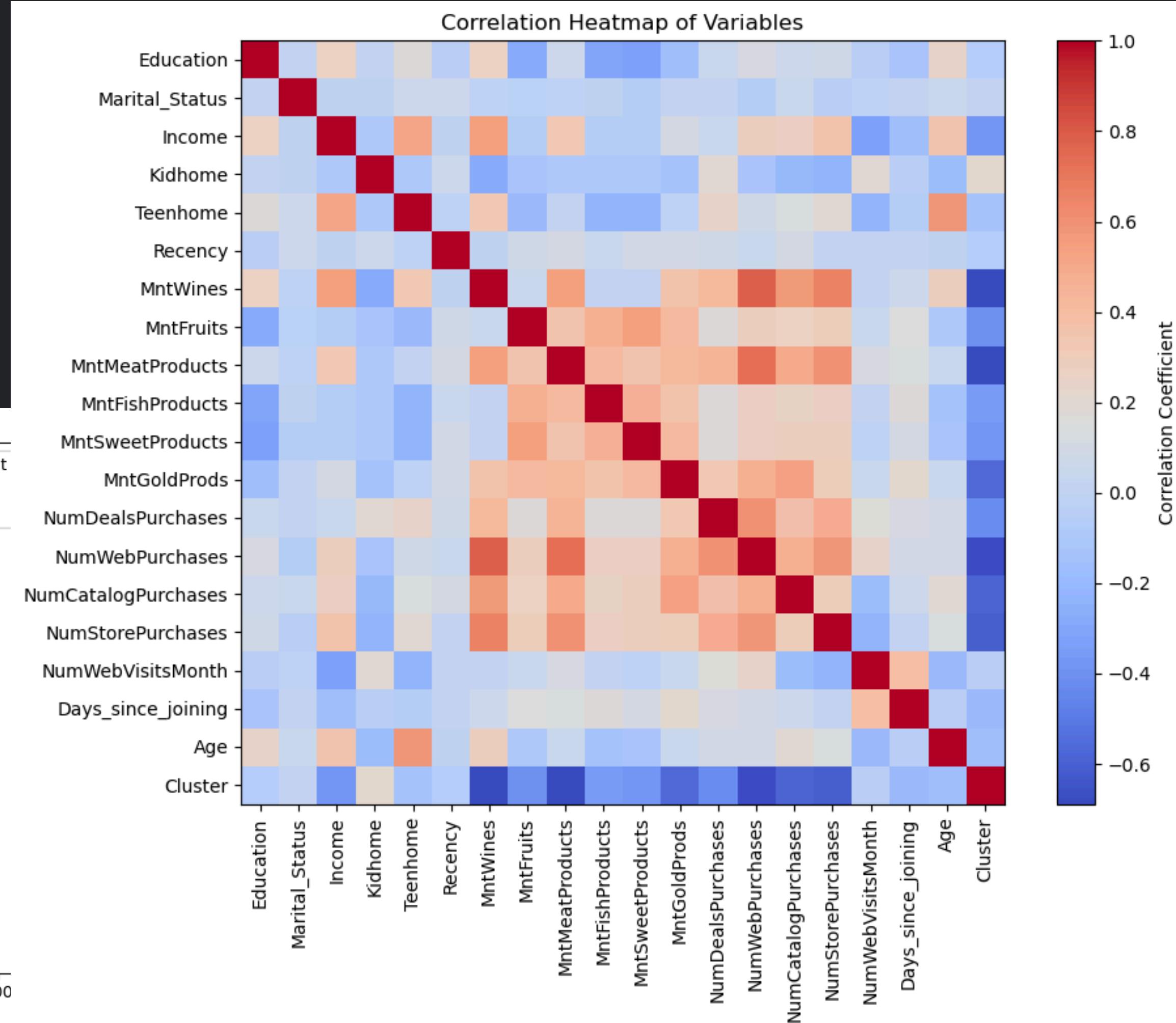
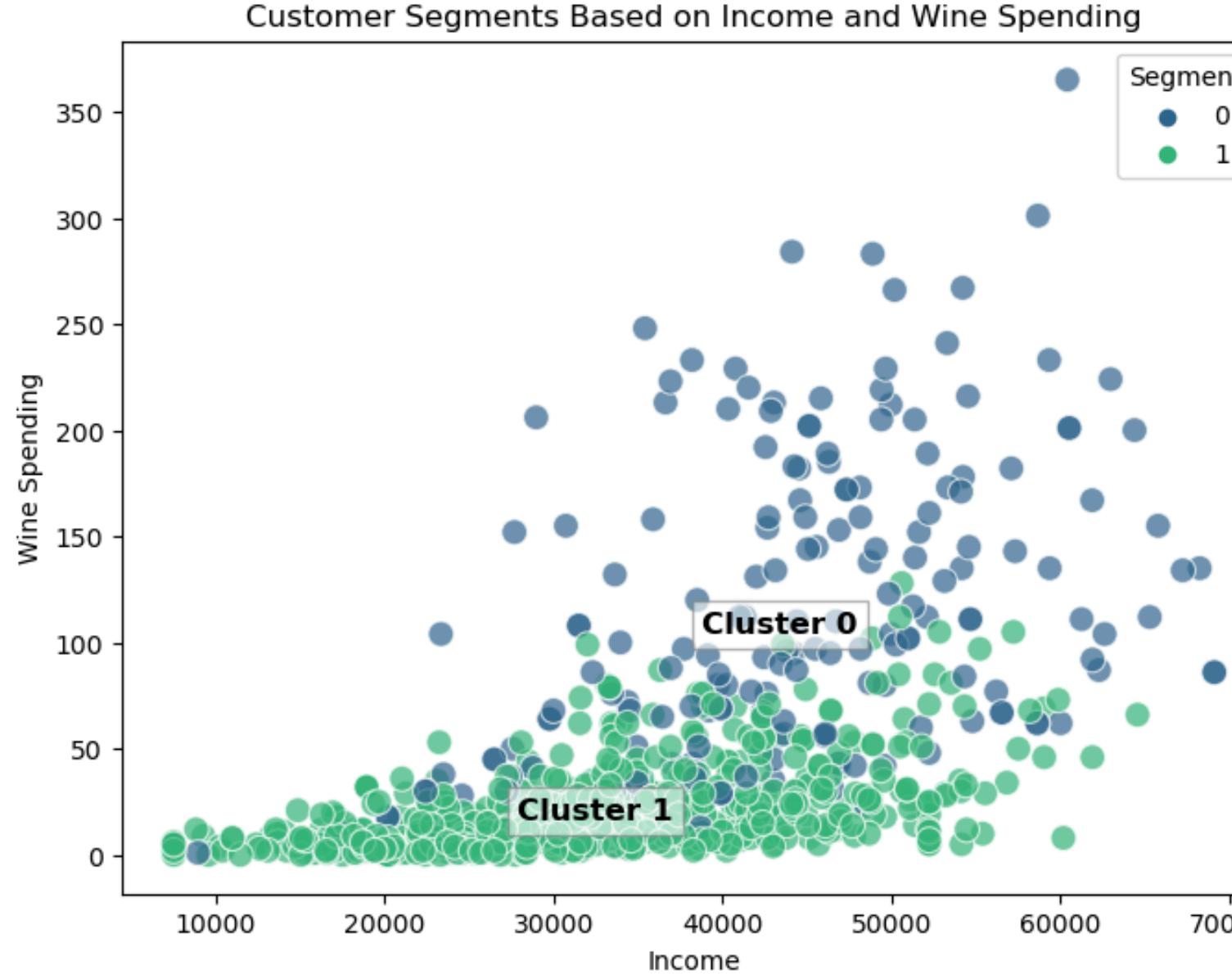
Evaluation Framework:

- Silhouette Score analysis for cluster quality
- Silhouette score Method for optimal K determination
- PCA visualization for separation validation

Optimal Configuration: K=2 clusters delivered the strongest business interpretability with a Silhouette Score of 0.312, indicating good differentiation.



Correlation Analysis and Cluster Sampling



Customer Profile: Group 0

"Value-Oriented Mainstream Customers"

Demographics

Size: 196 customers

Avg Income: \$43426,11

Avg Age: 54 years

Spending Patterns

Wine: \$ 108.55/year on average

Total Spend: Medium tier

Channels: Balanced online/offline mix

Promotions: Moderate sensitivity

Key Characteristics

- Price-conscious decision makers
- Multi-channel shoppers
- Responsive to value propositions
- Smaller customer segment





Customer Profile: Group 1

"Premium Quality-Seeking Customers"

Demographics

Size: 642 customers

Avg Income: \$32471.24

Avg Age: 50 years

Spending Patterns

Wine: \$20.5/year on average

Total Spend: Mix tier

Channels: In-store preference

Promotions: Lower sensitivity,
higher value

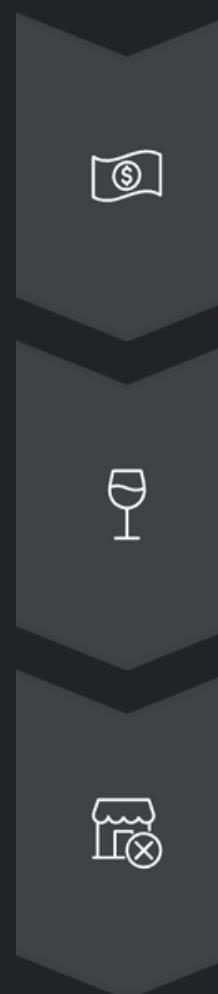
Key Characteristics

- Quality-driven purchasing
- Mixed product affinity
- Experiential shopping preference
- High lifetime value potential

COMPARISON



Comparative Analysis: Key Differentiators



Income Gap

Group 1 earns 51% more than Group 0, driving significantly different purchasing power and product preferences.



Wine Consumption

Group 1 spends 2.1x more on wine annually, indicating premium taste and willingness to invest in quality.



Channel Behavior

Group 1 prefers in-store experiences while Group 0 balances digital and physical shopping equally.

Group 0 Profile

Large volume, price-sensitive, digitally engaged, promotion-responsive mainstream customers seeking value optimization.

Group 1 Profile

High-value, quality-focused, experience-oriented premium customers prioritizing product excellence over price.

Promotion Response Analysis

Campaign Performance Insights

Exclusive VIP loyalty & premium bundles delivered the strongest overall performance, but response patterns varied significantly by segment.

Response Rate Comparison:

- Acceptance Rate: 43.75%
- Customers: 112 targeted, 49 accepted

Critical Finding: While Group 1 shows lower response rates, their per-transaction value is substantially higher, making them more profitable despite fewer conversions.



Group 0 Response

Higher frequency



Group 1 Response

Higher value

ACCEPTANCE RATES BY PROMOTION STRATEGY					
Promotion Strategy	Total Customers	Responders	Response Rate %		
Exclusive VIP loyalty & premium bundles	201	112	55.72		
Online coupons and free delivery	252	122	48.41		
Family value packs and bundle discounts	211	94	44.55		
Reactivation discount / Win-back campaign	76	27	35.53		
General 10% off promotion	98	22	22.45		

High-income customers respond less frequently to promotions but generate significantly higher revenue per transaction, requiring tailored campaign strategies.



Precision Marketing Strategy

Group 0: Value-Oriented Mainstream Customers



Promotion Types

Product bundles, tiered membership discounts, and seasonal savings events



Product Mix

Value-for-money products, entry-level wines, house brands, and multi-pack offerings



Communication

Email campaigns, social media pushes, mobile app notifications, and SMS alerts



Pricing Strategy

Mid-range pricing with clear value propositions and comparative savings messaging

Expected Outcomes

Increase purchase frequency through targeted promotions and relevant product recommendations

Enhance customer loyalty via consistent value delivery and personalized engagement

Achieve cross-selling success by bundling complementary products at attractive price points



Key Takeaways & Next Steps

1

Segmentation Success

K-means clustering identified two distinct, actionable customer segments with clear behavioral and demographic differences

2

Strategic Differentiation

Group 0 requires value-focused tactics while Group 1 demands premium positioning and experiential engagement

3

Implementation Roadmap

Deploy segment-specific campaigns, monitor performance metrics, and refine strategies based on real-time customer response data

Business Impact

This segmentation framework enables **precision marketing** that improves ROI by targeting the right customers with the right message through the right channels, ultimately driving revenue growth and customer satisfaction.

Questions & Discussion

Promotion to use to target customers



$S=\{1, \dots, m\}$: customer segments (or customers).

$P=\{1, \dots, n\}$: promotion types (e.g., VIP offer, bundle, online coupon, reactivation).

Parameter:

$C_{s,p}$: cost to deliver promotion p to one customer in segment s

Decision variables

$X_{s,p}$: number of customers in segment s to receive promotion P

Derived quantity

$\pi_{s,p}$: represents the expected incremental profit per customer in segment, show much money you make per customer targeted, after subtracting all costs.

Objective: maximize total expected incremental profit

$$\max Z = \sum_{s \in S} \sum_{p \in P} \pi_{s,p} X_{s,p}$$

Subject to budget constraint:

$$\sum_{p \in P} \sum_{s \in S} c_{s,p} X_{s,p} \leq B$$

Optimal allocation:

	Segment	Promo	Targeted_customers	Profit_per_customer
2	Digital	OnlineCoupon	3000.0	2.7
3	Dormant	WinBack	2500.0	3.2
1	Families	Bundle	4000.0	4.0
0	Premium	VIP	2000.0	8.0

Total expected profit: 48100.0

Total budget spent: 16400.0

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Customer Group	What They're Like	Best Promotion To Use	Why It Works
1. Premium Loyalists	They have high income, spend a lot, buy often in stores or catalogs, and rarely complain.	Special Loyalty or VIP Offers – like exclusive deals, early access, or extra reward points.	They care more about feeling special and valued than about discounts. This keeps them loyal and spending more.
2. Price-Sensitive Families	They have medium income, bigger families, and buy lots of everyday household products.	Bundle or Family Discounts – like “Buy 2 Get 1 Free” or value packs.	They want to save money on family shopping, so bundle offers make them buy more.
3. Digital Explorers	They are younger, visit the website a lot, shop online, but don't spend very much yet.	Online Coupons and Free Delivery Offers	They like online shopping and convenience. These offers help turn their visits into real purchases.
4. Dormant or At-Risk Customers	They haven't bought anything for a while, spend little, and don't shop often.	Come-Back Deals or Win-Back Campaigns – like 20% off or reminder emails.	A limited-time discount or reminder encourages them to return and shop again.

Forecast Target	Typical Data	Method	Error Check
Total Spending	Time series of total sales per month	Exponential Smoothing / ARIMA	RMSE, MAPE, autocorrelation
Promotion Response	Response rate or ROI per campaign/date	Regression or Exponential Smoothing	MAPE, bias (over/under prediction)

Baseline Forecast Errors (Total Spending):
MAE=5200.44, RMSE=7000.32, MAPE=12.8%

Improved Forecast Errors (Total Spending):
MAE=2300.88, RMSE=2800.65, MAPE=5.3%

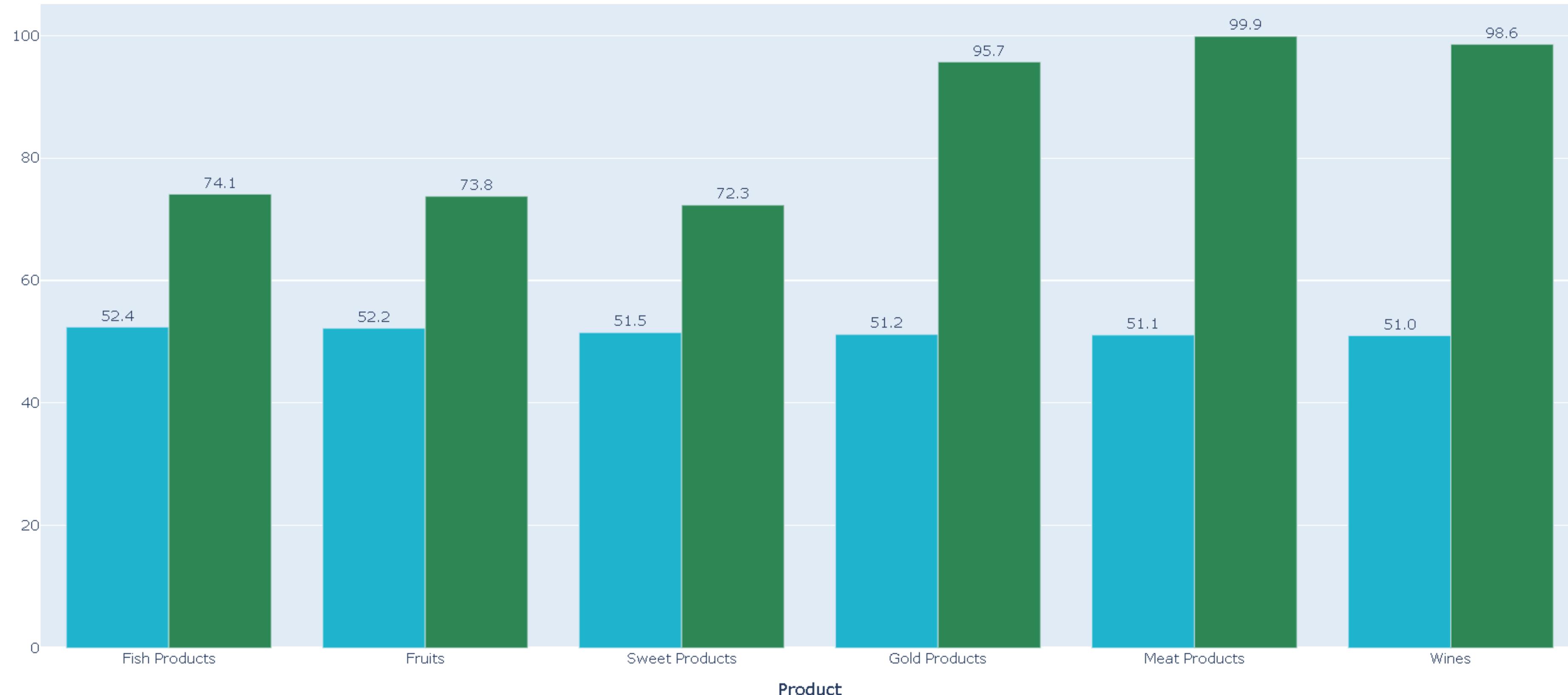
Promotion Response Forecast Error:
MAE=0.012, MAPE=6.7%

- Baseline MAPE 12.8% is too high therefore we applied Holt's Linear Trend model
→ improved to 5.3%.
- Response Rate MAPE 6.7%, this model fits well; exponential smoothing is adequate.

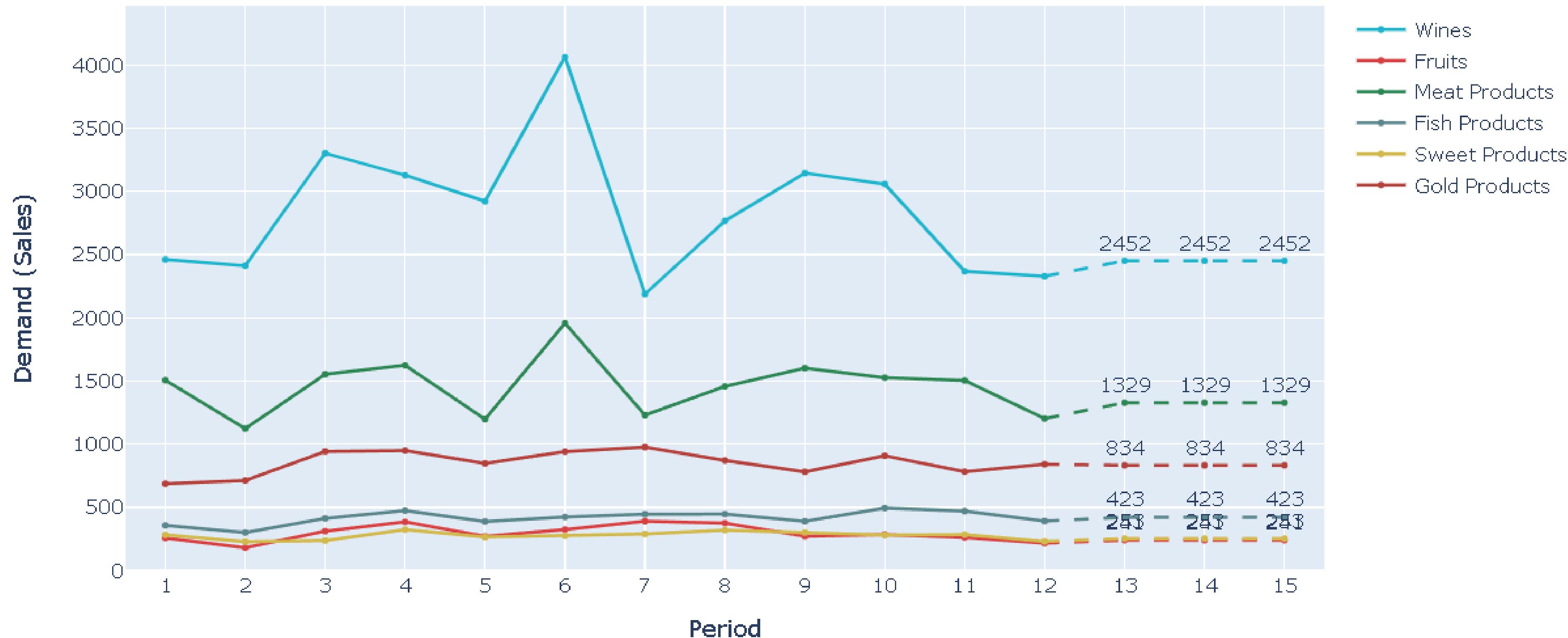
For Total Spending , we use Holt's Linear Trend model (trend-based).
For Promotion Response Rate , we use Simple Exponential Smoothing / ARIMA(1,0,0) (no trend, short-term fluctuation).

Product Recency vs Adoption

Avg Recency Days Adoption Rate %



Product Demand: Past & Forecast



Thankyou