Improving VSP's Product Assortment Strategy

Case: VSP Vision Eyewear Data Analysis

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95-851 Data Science for Product Managers

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Project Objectives

How to improve VSP Vision Product Assortment Strategy?

Find the best frame assortment to generate the highest sales.

VSP Vision owns **Visionworks**, a leading U.S. provider of eye care services, operates at the intersection of healthcare and retail. Backed by a network of Optometrists, technicians, and retail associates, Visionworks offers comprehensive eye exams and a wide selection of eyewear, including glasses, sunglasses, and contact lenses.

Customers can shop in-store or online. In-store displays are organized by frame shape, price, and gender, with dedicated brand marketing for labels like Nike and Calvin Klein.

Dataset & Analysis

Dataset Overview

The dataset we are working with is an **aggregated orders** with

store information *(e.g. location)* and **product information** *(e.g. frame shape, brand name, etc)*.
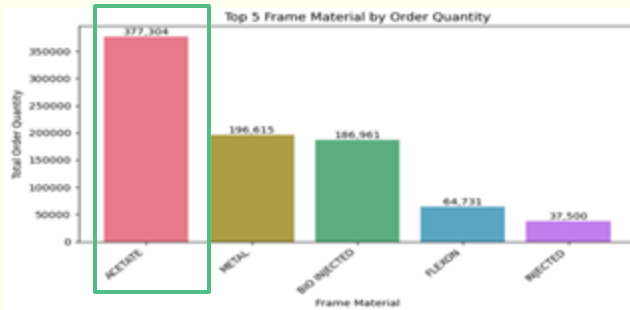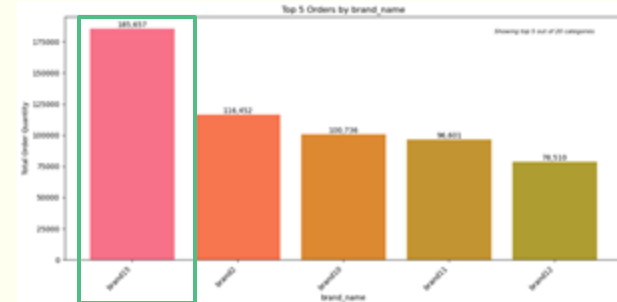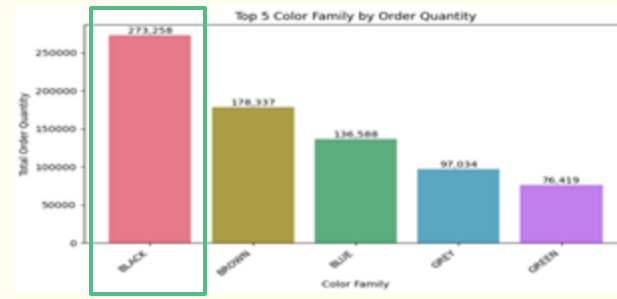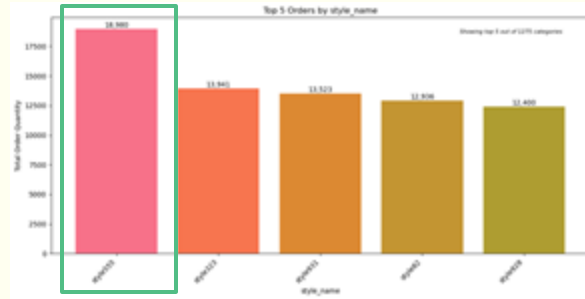
Our assumptions:

1. The orders are aggregated per product and location
2. It represents a snapshot of a specific time period
3. Gender information is assigned to frames and loosely reflects customer demographics

	0	1	2
style_name	style555	style555	style100
state	NC	NC	GA
city_district	GUILFORD	GUILFORD	GWINNETT
city	GREENSBORO	GREENSBORO	LAWRENCEVILLE
size	5116	5116	5316
color	1	4	259
temple_length	135	135	140
color_description	ONYX MATTE W/STAR PHOSPHO T	BLACK MATTE W/STAR PHOSPHO	HONEY TORTOISE
color_family	BLACK	BLACK	BROWN
hex_color	#000000	#000000	#BAA38A
lens size (a)	51.0	51.0	53.0
lens height (b)	0.0	0.0	45.5
Lens diameter (ed)	0.0	0.0	59.9
bridge size (dbl)	16.0	16.0	16.0
circumference	0.0	0.0	163.3
division_name	DESIGNER	DESIGNER	DESIGNER
frame_construction	FULL RIM	FULL RIM	FULL RIM
frame_shape_code	M	M	M
frame_shape	MODIFIED RECTANGLE	MODIFIED RECTANGLE	MODIFIED RECTANGLE
gender_code	C	C	F
gender	CHILD	CHILD	FEMALE
gross_weight	141.75	141.75	226.8
brand_name	brand10	brand10	brand2
front_material_name	BIO INJ-G820	BIO INJ-G820	ACETATE
temple_material_name	BIO INJ-G850	BIO INJ-G850	ACETATE
order_qty	2610	2428	2300

Popular Frames

Top 5 Orders by style_name

Top 5 Color Family by Order Quantity

Top 5 Orders by brand_name

Top 5 Frame Material by Order Quantity

The most popular frames by each features are:

By style name: Style 555

By color family: Black
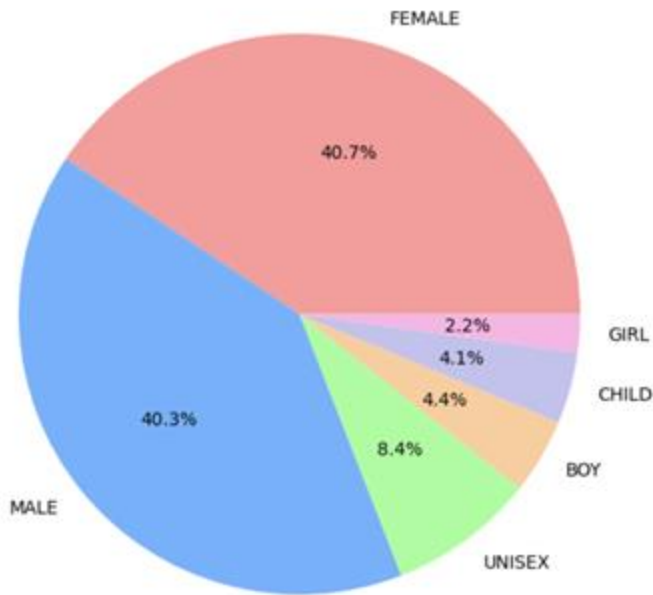
By brand name: Brand15

By Frame Material: Acetate

Demographic

- Female and Male customers dominates, account for the majority of eyewear sales (40.7% and 40.3% respectively).
- While unisex styles capture a segment of the market, they lag behind gender-specific options.

High orders in NC, prefer SPORTS & TECHNOLOGY

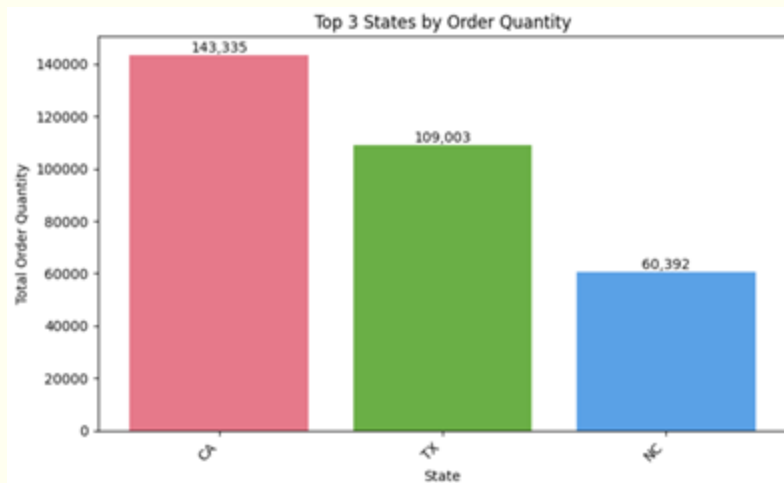Prefer more colorful frames and diverse frame shape (like cat eye, tea cup)

The most popular front & temple material is BIO_INJECTED

By States

Top 3 States by Order Quantity

CA
Top Styles: style931 > style323 > style601
Primary Demographic: Male
Color Preferences: Black > Brown > Blue
Shape Preferences: Modified Rectangle > Rectangle > Square
Brand Preferences: Brand15 > 2 > 11

TX
Top Styles: style555 > style274 > style323
Primary Demographic: Female
Color Preferences: Black > Brown > Blue
Shape Preferences: Modified Rectangle > Rectangle > Square
Brand Preferences: Brand10 > 15 > 11

NC
Top Styles: style555 > style544 > style545
Primary Demographic: Male
Color Preferences: Black > Blue > Brown
Shape Preferences: Modified Rectangle > Rectangle > Square
Brand Preferences: Brand10 > 15 > 11

Location

During our analysis, we discovered significant regional variation in feature preferences, particularly for brands. For example, brand10 shows strong popularity in North Carolina (34.8% of sales), yet has considerably lower market share in Oregon (3.5%) and Tennessee (4.9%).

So we see there are certain different customer preferences across states.

Brief methodology:
- We calculated the percentage of a certain item over the total orders on that particular state (e.g. top left is read as out of all orders in California, 18.8% are from brand 15).
- We produced a heatmap, and to make comparisons easier, the heatmap color is arbitrarily chosen to be blue-white-red at 0-20-40%.

* We also did this for several other features, e.g. material, color, frame shape.
** The image shown is cropped for readability

Optimize Frame Assortment based on Location Preferences

General Analysis

We performed clustering analysis at the state level and considered several features, such as frame colors and shapes, to identify the predominant preference clusters for each state. Based on these clusters, we can recommend optimized inventory assortments for each state to increase operational efficiency and maximize sales.

As an example, AE and AP (military bases) show distinctive preferences toward aviator-style frames ("top gun enthusiasts")

Brief methodology:
- Used weighted K-Means based on order quantity and taking only the feature of interest
- Evaluated using elbow method and silhouette scores
- Choose centroids of each resulting cluster, derive "characteristics" from the centroid values.
- The cluster archetypes here are named using Claude Sonnet 3.7 APIs to analyse the centroid characteristics and provide "names" for each clusters.

state	Cluster_color	Cluster_division	Cluster_frame_shape	Cluster_brand
AE	The Luxury Metallics	The Performance Purists	The Top Gun Enthusiasts	The Mainstream Mixers
AK	The Subtle Colorists	The Practical Traditionalists	The Classic Rectangulars	The Mainstream Mixers
AL	The Bold Expressionists	The Casual Fashionistas	The Classic Rectangulars	The Mainstream Mixers
AP	The Luxury Metallics	The Performance Purists	The Top Gun Enthusiasts	The Mainstream Mixers

```
'Cluster_2': {'regions': ['AE', 'AP'],
              'size': 2,
              'top_features': {'AVIATOR': 4.877524973725648,
                               'NAVIGATOR': 1.3985669402758336,
                               'RECTANGLE': 0.09778254830878531,
                               'ROUND': 1.0875942627874313,
```

* This analysis can be extended by considering all geographical levels (e.g. by city and district). We did try to do so, but we have yet to find a good enough cluster based on the elbow method and silhouette score.
** We also acknowledge there is still need further validation checks that need to be performed before applying this strategy in real settings

Frame Attributes

General Analysis

Top Frame Attributes Predicting Sales
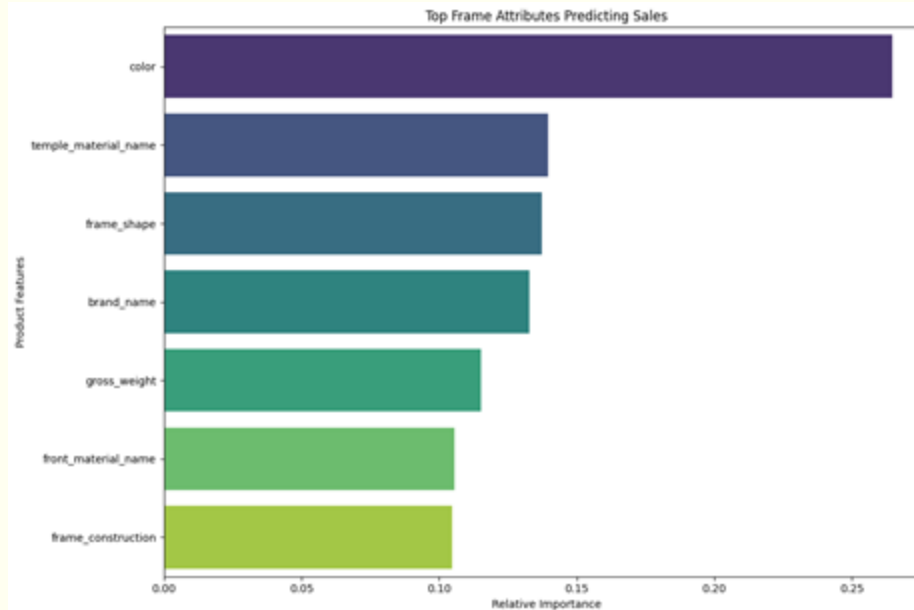
- ● Used Random Forest Algorithm to find the top feature attributes in predicting sales
  - ● Top 3 Feature Importances are: color, temple material name, frame shape
- ● Random Forest Algorithm: Used model's feature importances to quantify each frame attribute's impact on sales

Sales by Price

```
Price Category Distribution:
0    449458
2    131234
1     66922
Name: Price_Category, dtype: int64

Top Brand & Material for Each Price Category:
                brand_name front_material_name
Price_Category
0                  brand12             ACETATE
1                   brand8              FLEXON
2                  brand10         BIO INJECTED
```

*we are assuming the price based on the brand and frame material

Price Category	Order Quantity	Interpretation
0	449,458	Largest group, likely Mid-Range
2	131,234	Moderate-sized group, likely Budget
1	66,922	Smallest group, likely Premium

- Cluster 0 dominates the dataset. Most frames fall into a mid-range category.
- Cluster 1 has the fewest frames, which suggests a luxury segment with fewer, high-value purchases.
- Cluster 2 is moderate-sized, likely representing budget-friendly, high-turnover products.

Sales by Price

Distribution of Frames Across Price Categories

Most Common Brand per Price Category

Most Common Material per Price Category
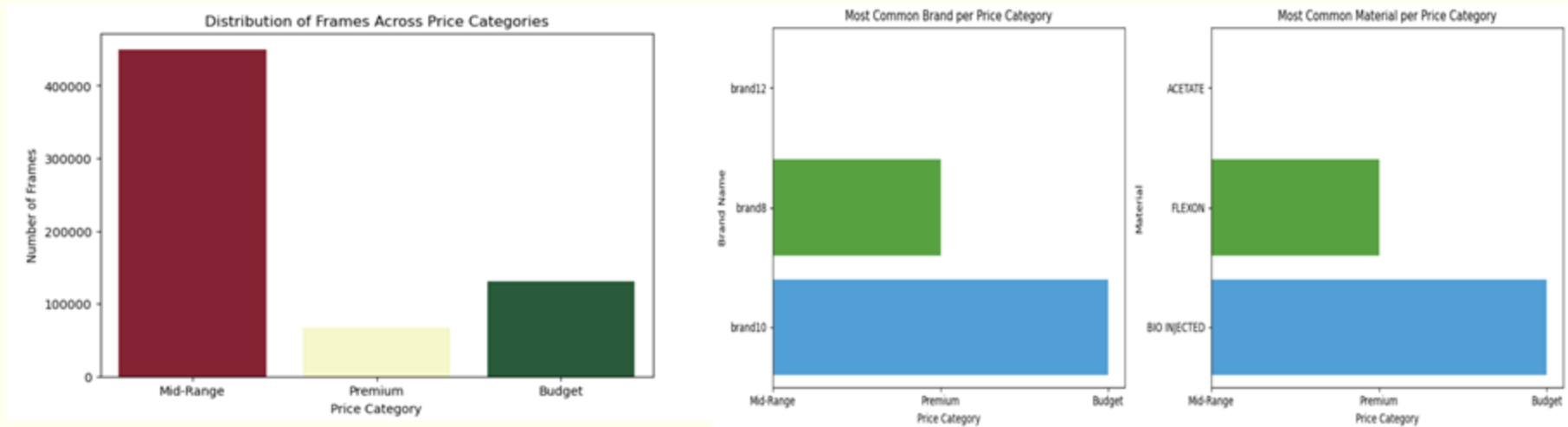
- **Mid-range frames dominate sales** : This category has the highest demand, making it the optimal price segment for maximizing revenue and market reach.
- **Premium frames are niche but high-value** : With the fewest frames sold, this segment targets luxury buyers who prioritize quality and innovation, such as Flexon material.
- **Budget frames see high turnover** : Cost-effective bio-injected materials drive affordability-focused purchases, ensuring steady demand in the lower price range.

Sales by Price

Cluster 0 (Mid-Range)

- Acetate frames & brand12 dominate this segment.
- Acetate is higher-quality than injected plastic but cheaper than titanium, making it a strong mid-range choice.
- Marketing strategy: Position as affordable premium, high-quality but accessible.

Cluster 1 (Premium)

- Flexon frames & brand8 dominate, which suggests high-end flexible metal frames.
- Flexon is typically used in high-performance eyewear (e.g., sports, professional).
- Marketing strategy: Focus on durability, technology, and premium branding.

Cluster 2 (Budget)

- Bio-injected frames & brand10 dominate, indicating an eco-friendly budget option.
- Bio-injected materials are often cheaper, lightweight, and mass-produced.
- Marketing strategy: Promote as sustainable, affordable eyewear for everyday use.

Recommendations

Recommendations

Optimize Inventory and stores by Gender:

- Our analysis reveals clear gender specific purchasing patterns.
- Adjust **gender focused marketing** based on top selling categories.
- Offer gender neutral designs to capture a broader audience. e.g. Modified rectangle was popular in both male and female categories.

Optimize Inventory and stores by States:

- Some states show significantly higher demand for eyewear, likely influenced by population density & demographics
- Top performing states can guide inventory allocation and regional marketing strategies.
- Focus on high demand states to ensure optimal availability of stocks.
- Consider regional promotions to boost sales in mid performing states.
- Prioritize the states customer preferences

Recommendations

- Expand **popular** styles and experiment with variations based analysis of popular features.
- Offer a one stop shopping experience :
  a. Offering preferred pricing to Visionworks insurance plan members
  b. Creating bundled offerings that connect insurance coverage with our premium frames
  c. A loyalty program could offer customers benefits like points for both eyewear purchases and vision services, strengthening long-term customer relationships

Recommendations

Pricing

we recommend a reverse pricing strategy that ensures competitive pricing.

Our sales analysis identifies key high performing frame clusters that drive significant volume. To sustain and grow sales, we should maintain competitive price points for these popular styles while ensuring alignment with market expectations and competitor offerings.

Brief ideas:

1. Maintain competitive pricing for high demand frames
2. Align pricing with supply costs & profit margins
3. Reinforce brand positioning through pricing
4. Implement data driven pricing adjustments

Recommendations

Pricing

Furthermore, based on the sales distribution across price categories, we propose the following strategies to optimize revenue and product assortment:

1. Strengthen the Mid-Range Segment (Core Revenue Driver)
- Since mid-range frames dominate sales, we should prioritize inventory allocation to this segment.
- Enhance marketing efforts around best-selling styles, materials, and brands in this category.
- Explore tiered pricing within the mid-range to capture both value-conscious and quality-seeking customers.

2. Expand Premium Segment Through Value-Driven Branding
- Although premium frames have lower sales volume, they serve a high-value, luxury-focused market.
- Position premium frames as specialty or exclusive products with innovative materials (e.g., Flexon) and advanced craftsmanship.
- Offer personalized shopping experiences, warranties, or premium service bundles to increase appeal.

3. Leverage Budget Frames for High-Turnover & Volume Sales
- Budget frames rely on cost-effective bio-injected materials and cater to price-sensitive consumers.
- Maintain steady inventory levels to meet the consistent demand in this category.
- Optimize pricing to balance affordability with profitability, ensuring attractive entry-level options while protecting margins.

Customer Review

★★★★★

Top 3 keywords

Unigrams: glasses, visionworks, great

Bigrams: customer service, went visionworks, vision works

Trigrams: great customer service, made feel comfortable, make sure satisfied

Positive reviews (5.0 ratings) emphasize "great customer service," "made feel comfortable," and "highly recommend Visionworks", indicating that excellent customer interactions significantly contribute to satisfaction.

Recommendations:
1. Standardize customer service training programs to ensure a consistent experience.
2. Implement a feedback system to identify and address service inconsistencies across different stores.
3. Recognize and reward locations with high customer satisfaction scores to encourage best practices.

Source: https://www.consumeraffairs.com/eyeglasses/visionworks.html

Analysis out of 606 reviews (Year 2010 - 2025)

Customer Review

Sentiment

★

Top 3 keywords
Unigrams: glasses, told, visionworks
Bigrams: eye exam, pair glasses, customer service
Trigrams: buy one get, one get one, get one free

The negative reviews (1.0 ratings) frequently mention phrases like "buy one get," "one get one," and "get one free", suggesting that customers may feel misled or confused about promotional offers. Also, reviews mention "eye exam" and "pair glasses" frequently, suggesting issues with the quality of exams or dissatisfaction with purchased eyewear.

Recommendations:
1. Clearly communicate promotional terms both in-store and online
2. Ensure advertising and signage explicitly detail conditions (e.g., eligibility, exclusions, expiration dates)
3. Train staff to explain offers consistently to prevent misunderstandings.
4. Improve the eye exam process by ensuring optometrists provide clear explanations of results and prescriptions.
5. Conduct quality checks on eyewear before delivery to customers to minimize complaints.

Source: https://www.consumeraffairs.com/eyeglasses/visionworks.html
Analysis out of 606 reviews (Year 2010 - 2025)

Next Steps

Next Steps

1. To achieve more robust and reliable results, VSP Vision could re-run the analysis and modelling with its more granular dataset. By incorporating finer details, we could enhance the accuracy/performance of our modelling, and by extension the insights.
2. Implement A/B testing of the recommended eyewear assortment.
3. Create a user friendly dashboard for store managers to visualize regional trends and receive personalized inventory recommendations
4. Explore further regarding the digital marketing strategy, understanding the effectiveness of the activity toward the sales performance.

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Q&A

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Thank You!