Vendors Sales Analysis

Project Title: Vendor Analytics for Supply Chain Optimization

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Objective: Transforming vendor data into actionable supply chain insights.

Git Hub: *Access from here*

EXECUTIVE SUMMARY

This project analyzes vendor performance to uncover profitability gaps, purchasing concentration risks, and unsold inventory challenges in the supply chain. Using exploratory data analysis and interactive dashboards, it identifies top-performing vendors, validates bulk purchasing advantages, and delivers recommendations to enhance procurement efficiency while reducing supply chain risks.

Business Challenge:

Organisations often face:

- Loss-making transactions due to negative gross profit.
- Over-dependence on top 10 vendors (~66% of purchases).
- $2.71M tied up in unsold inventory.
- Inefficient pricing and bulk purchasing strategies.

These challenges reduce profitability, strain cash flow, and increase supply chain vulnerability.

Project Objective:

- Identify vendor performance differences across profitability and sales contribution.
- Detect risks of dependency on a small set of vendors.
- Evaluate bulk purchasing impact on unit cost savings.
- Provide actionable recommendations for procurement, pricing, and inventory optimization.

INTRODUCTION

Vendors form a critical component of the supply chain, directly influencing cost efficiency, profitability, and risk resilience. This project applies vendor data analysis to uncover key insights into purchasing, sales, and margin performance, enabling organizations to take data-driven supply chain decisions.

DATA-FOUNDATION: PREPARATION & STRATEGY

Data Cleaning: Removed transactions with Gross Profit ≤ 0, Profit Margin ≤ 0, and Total Sales Quantity = 0 to ensure reliability.

EXPLORATORY DATA ANALYSIS INSIGHTS

Summary Statistics:

|	count	mean	std	min	25%	50%	75%	max
VendorNumber	10692.0	10650.649458	18753.519148	2.000000	3951.000000	7153.000000	9552.000000	2.013590e+05
Brand	10692.0	18039.228769	12662.187074	58.000000	5793.500000	18761.500000	25514.250000	9.063100e+04
PurchasePrice	10692.0	24.385303	109.269375	0.360000	6.840000	10.455000	19.482500	5.681810e+03
ActualPrice	10692.0	35.643671	148.246016	0.490000	10.990000	15.990000	28.990000	7.499990e+03
Volume	10692.0	847.360550	664.309212	50.000000	750.000000	750.000000	750.000000	2.000000e+04
TotalPurchaseQuantity	10692.0	3140.886831	11095.086769	1.000000	36.000000	262.000000	1975.750000	3.376600e+05
TotalPuhchaseDollars	10692.0	30106.693372	123067.799627	0.710000	453.457500	3655.465000	20738.245000	3.811252e+06
TotalSalesQuantity	10514.0	3129.583317	11037.801407	1.000000	36.000000	280.000000	1985.000000	3.349390e+05
TotalSalesDollars	10514.0	42954.173834	168977.755843	1.980000	809.820000	5599.700000	29524.250000	5.101920e+06
TotalExciseTax	10514.0	1804.263569	11065.659557	0.060000	5.382500	50.425000	436.730000	3.682428e+05
freightCost	10692.0	61433.763214	60938.458032	0.090000	14069.870000	50293.620000	79528.990000	2.570321e+05
GrossProfit	10514.0	12364.618776	46576.616345	-52002.780000	66.975000	1496.490000	8970.040000	1.290668e+06
ProfitMargin	10514.0	-15.885227	447.289882	-23730.638953	15.353839	30.778375	40.210967	9.971666e+01
StockTurnover	10514.0	1.735689	6.067081	0.002817	0.829761	0.983431	1.042183	2.745000e+02
SalesToPurchaseRatio	10514.0	2.546789	8.524047	0.004196	1.181388	1.444635	1.672548	3.529286e+02

Negative and zero values:

1. GrossProfit:- is -ve, which indicates heavy losses, meaning some products and transactions may be selling at a loss or selling at a price which is lower than the purchase price.

2. ProfitMargin:- highly -ve means the revenue is zero or might be lower than the cost price.

3. TotalSalesQuantity and TotalSalesDollar:- Minimum value is zero(which is later set to 1), meaning the product has been purchased but never sold. They might be behaving like a tortoise, or there might be an obsolete stock.

Outliers Indicated by High Standard Deviation:

1. Purchase and Actual Price:- Their max value(5681.810000, 7499.990000) is significantly higher than the mean values(24.385303, 35.643671), indicating potential premium products., means usme bht se outliers present hai!

2. FreightCost:- huge variation (0.09 to 257032.070000), suggests logistics inefficiencies or bulk shipments.

3. Stock Turnover:- Ranges from 0 to 247.5, suggesting some products are selling rapidly while others remain unsold for a long period of time. A value > 1 indicates that sales for a product exceed the purchased quantity due to older stock fulfilling orders.
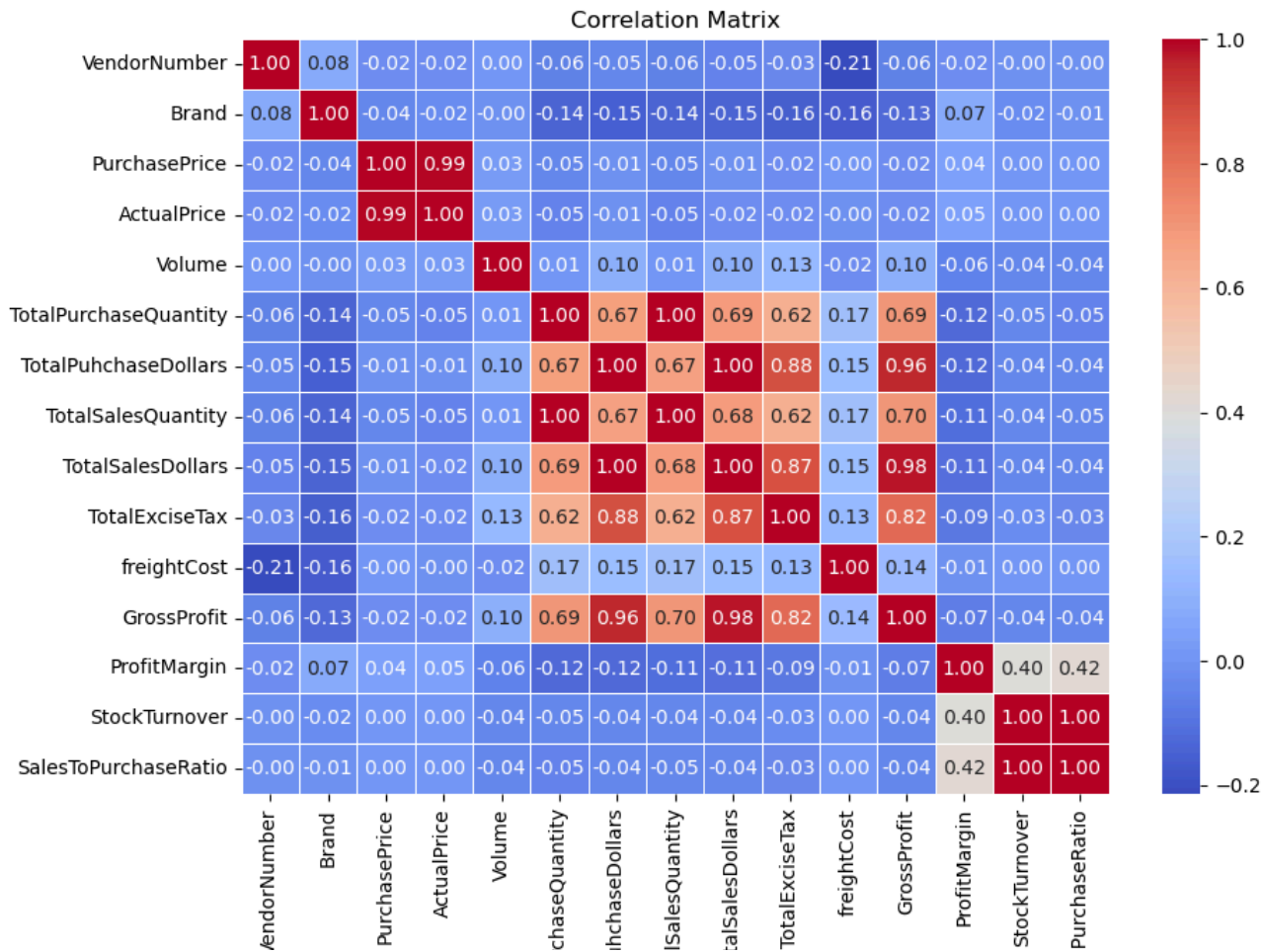
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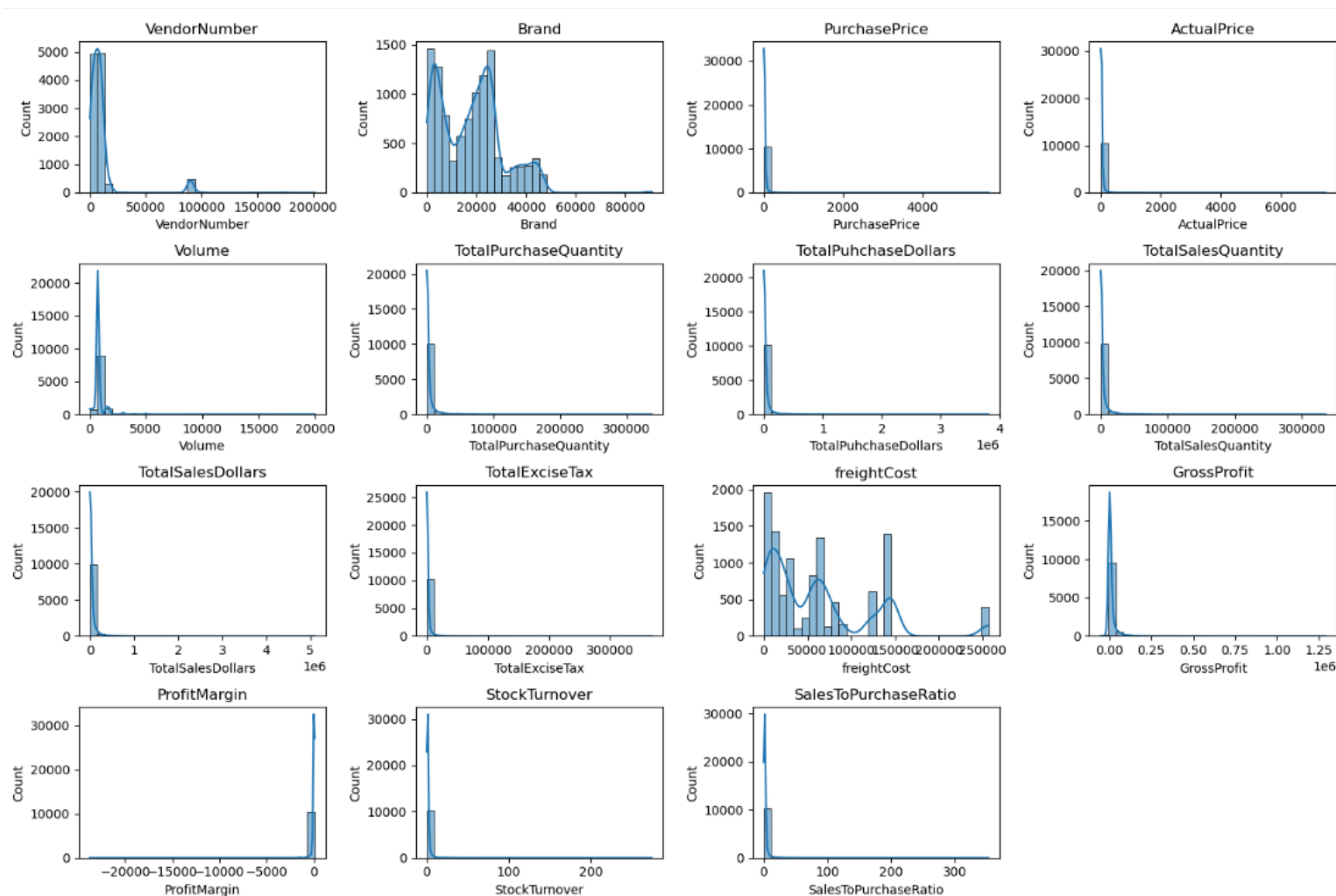
To enhance the reliability of the insights, we removed the inconsistent data points where:

- **Gross Profit**<=0 (to exclude transactions leading to losses)
- **Profit Margin** <=0 (to ensure analysis focuses on profitable transactions)

- **Total Sales Quantity = 0** (to eliminate inventory that was never sold)

Correlation Matrix

Correlation Insights:

1. **Purchase Price vs Total Sales Dollars and Gross Profit:** Purchase Price has a weak correlation with Total Sales Dollars (-0.01) and with Gross Profit (-0.02), suggesting that price variations do not significantly impact sales revenue or profit.

2. **Total Purchase Quantity vs Total Sales Quantity:** Strong correlation between total purchase quantity and total sales quantity (0.999), confirming efficient inventory turnover.

3. **Stock Turnover vs Gross Profit and Profit Margin:** Stock Turnover has a negative correlation with Gross Profit (-0.03), indicating that faster turnover does not necessarily result in higher Gross Profit.

Research Questions and Key Findings
1. **Brands for promotional and Pricing Adjustments:**

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Brands with low sales and high Profit Margins:
                        Description  TotalSalesDollars  ProfitMargin
6199        Santa Rita Organic Svgn Bl               9.99     66.466466
2369                Debauchery Pnt Nr              11.58     65.975820
2070        Concannon Glen Ellen Wh Zin            15.95     83.448276
2188                Crown Royal Apple             27.86     89.806174
6237        Sauza Sprklg Wild Berry Marg           27.96     82.153076
 ...                        ...                     ...            ...
5074        Nanbu Bijin Southern Beauty           535.68     76.747312
2271                Dad's Hat Rye Whiskey          538.89     81.851584
  57          A Bichot Clos Marechaudes           539.94     67.740860
6245        Sbragia Home Ranch Merlot             549.75     66.444748
3326        Goulee Cos d'Estournel 10             558.87     69.434752

198 rows × 3 columns
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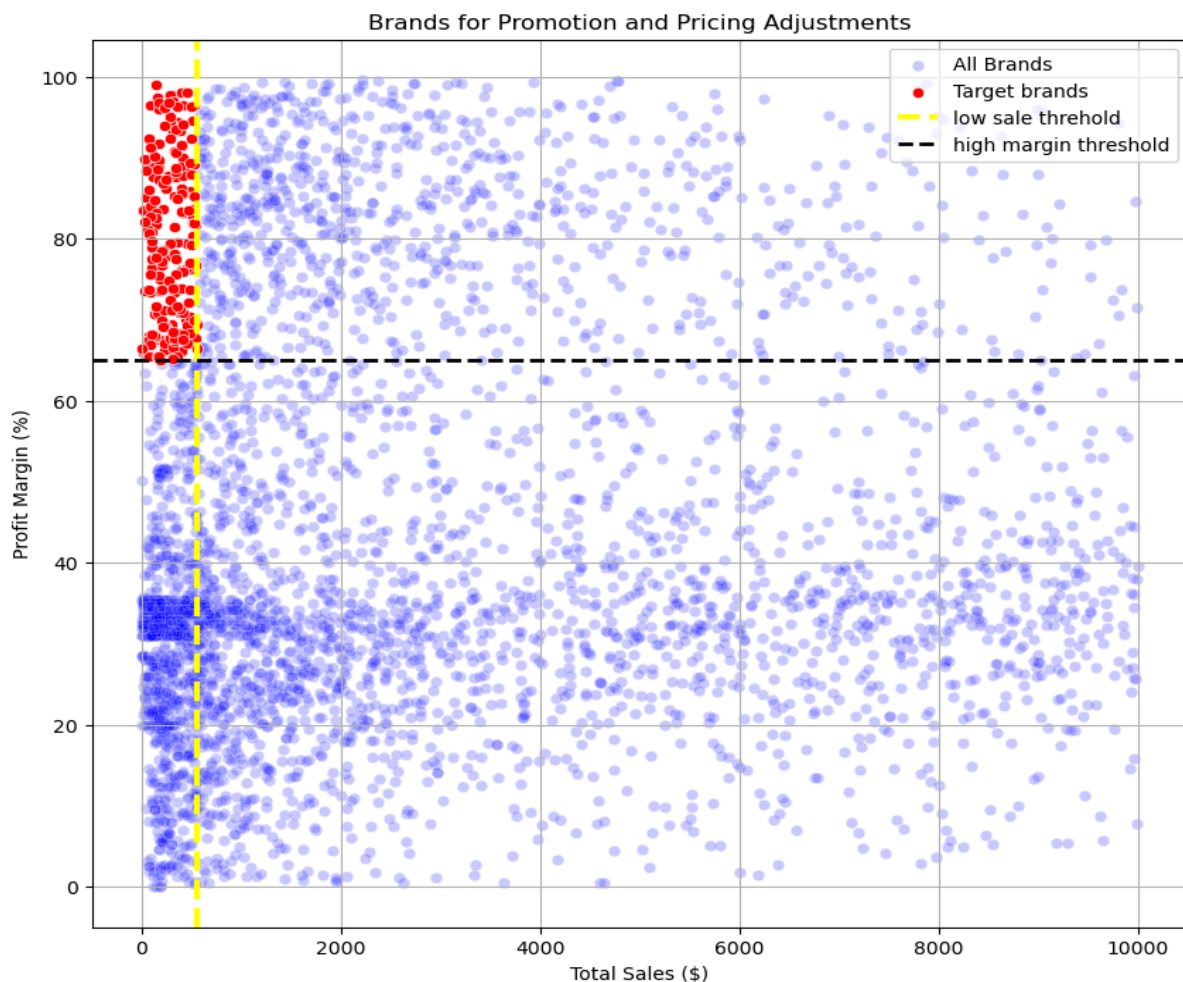
198 brands exhibit lower sales but higher profit margins, which could benefit from targeted marketing or price optimization to increase volume without compromising profitability.
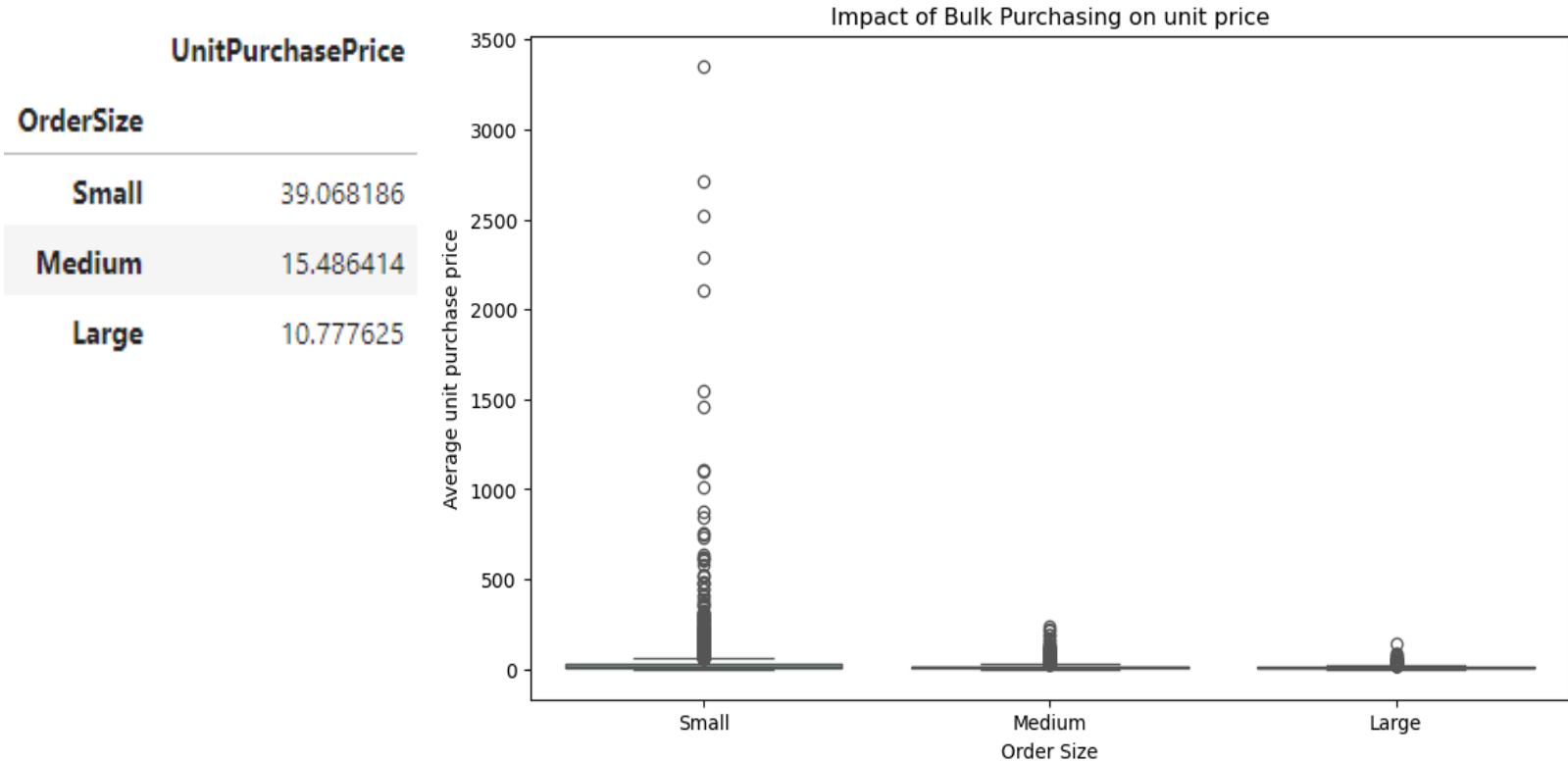
2. Top Vendor by Sales and Purchase Contribution:

Brands for Promotion and Pricing Adjustments

The top 10 vendors contribute 65.69% of total purchases, while the remaining vendors contribute only, while the remaining vendors contribute only 34.3%. This over-reliance on a few vendors may introduce risks such as supply chain disruptions, indicating a need for diversification.

Top 10 Vendor's Purchase Contribution(%)
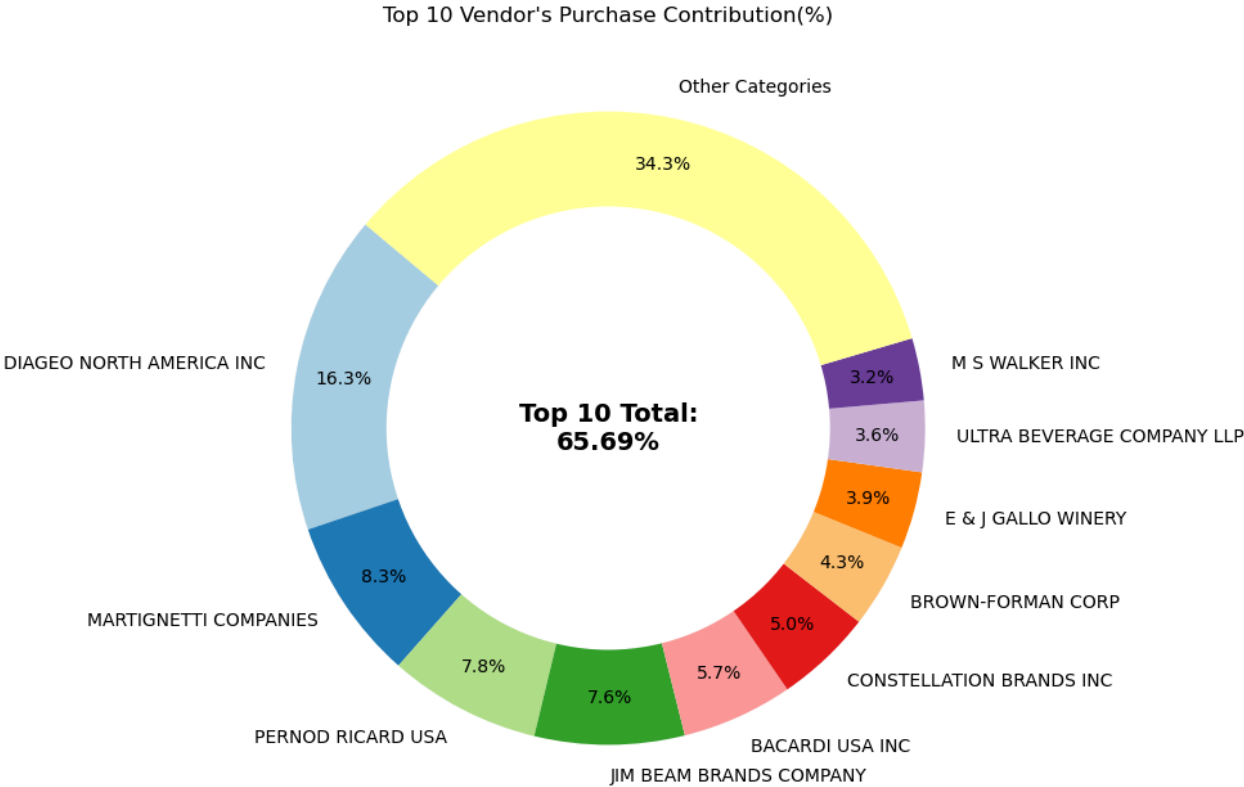
3. **Impact of Bulk Purchasing on Cost Savings:**

Vendors buying in large quantities receive a 72% lower unit cost ($10.78 per unit vs higher unit costs in smaller quantities).
Bulk pricing strategies encourage large orders, increasing total sales while maintaining profitability.

OrderSize	UnitPurchasePrice
Small	39.068186
Medium	15.486414
Large	10.777625

Impact of Bulk Purchasing on unit price

4. Impact of Bulk Purchasing on Cost Savings:

Total Unsold Inventory Capital: $2.71M. Slow-moving inventory increases storage costs, reduces cash flow efficiency, and affects overall profitability. Identifying vendors with low inventory turnover enables better stock management, minimizing financial strain.

VendorName	StockTurnover		VendorName	UnsoldInventoryValue
ALISA CARR BEVERAGES	0.615385	25	DIAGEO NORTH AMERICA INC	722.21K
HIGHLAND WINE MERCHANTS LLC	0.708333	46	JIM BEAM BRANDS COMPANY	554.67K
PARK STREET IMPORTS LLC	0.751306	68	PERNOD RICARD USA	470.63K
Circa Wines	0.755676	116	WILLIAM GRANT & SONS INC	401.96K
Dunn Wine Brokers	0.766022	30	E & J GALLO WINERY	228.28K
CENTEUR IMPORTS LLC	0.773953	79	SAZERAC CO INC	198.44K
SMOKY QUARTZ DISTILLERY LLC	0.783835	11	BROWN-FORMAN CORP	177.73K
TAMWORTH DISTILLING	0.797078	20	CONSTELLATION BRANDS INC	133.62K
THE IMPORTED GRAPE LLC	0.807569	61	MOET HENNESSY USA INC	126.48K
WALPOLE MTN VIEW WINERY	0.820548	77	REMY COINTREAU USA INC	118.60K

5. Profit-Margin Comparison: High vs Low-Performing Vendors:

Top vendors' Profit Margin (95% CI): (30.74%, 31.61%), Mean: 31.17%
Low Vendors' Profit Margin (95% CI): (40.67%, 41.81%), Mean: 41.24%
Low-Performing vendors maintain higher margins but struggle with sales volumes, indicating potential pricinginefficienciess or market reach issues.

Actionable Insights:
- Top performing vendors: Optimize profitability by adjusting pricing, reducing operational costs, or offering bdifferent undled promotions.
- Low-Performing vendors: Improve Marketing efforts, optimize marketing strategies, and enhance distribution networks.

Confidence Interval Comparison: Top vs Low Vendors (Profit Margin)

6. **Vendor Contribution to Total Purchases:**
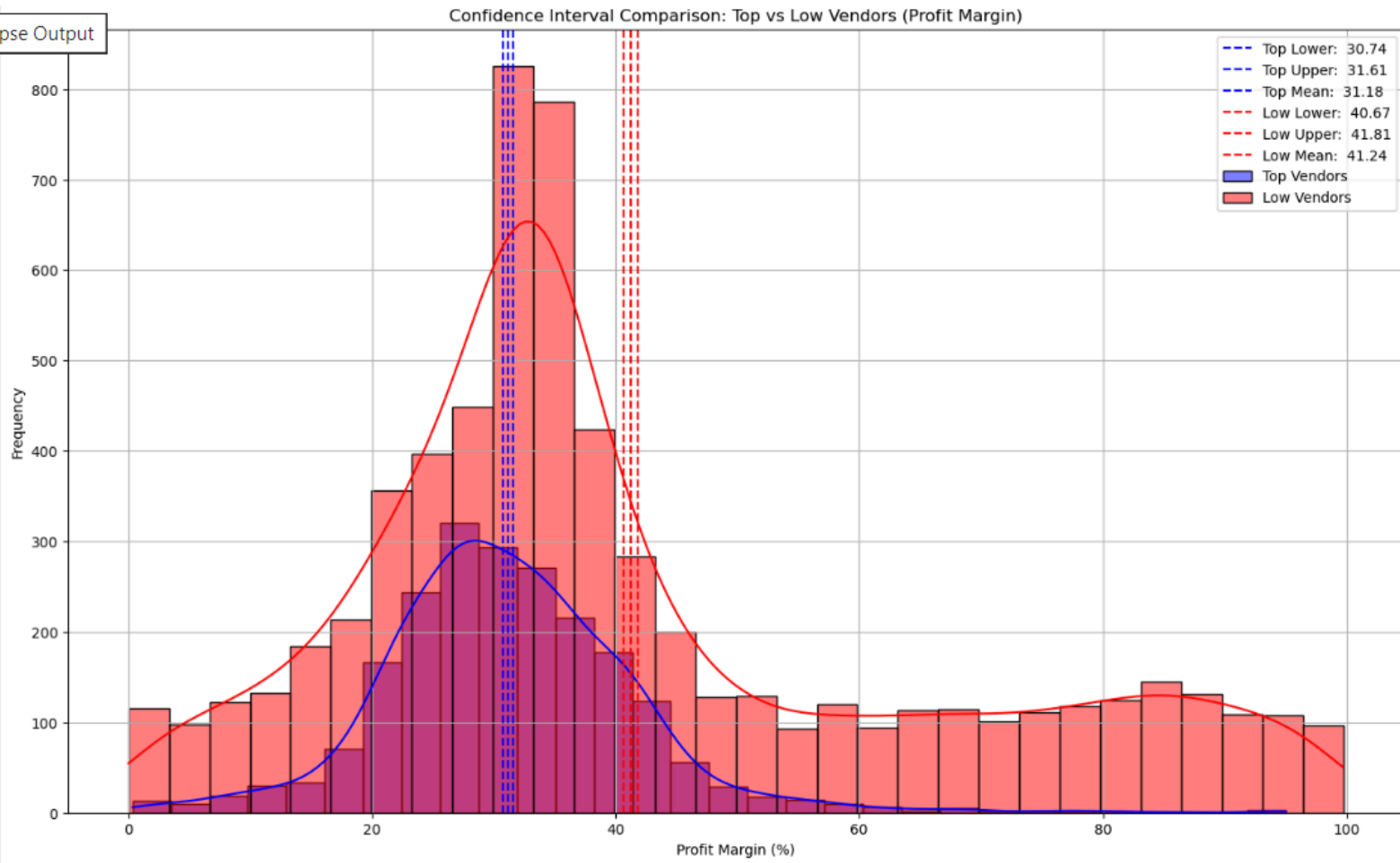
Pareto Chart: Vendor Contribution to Total Purchases
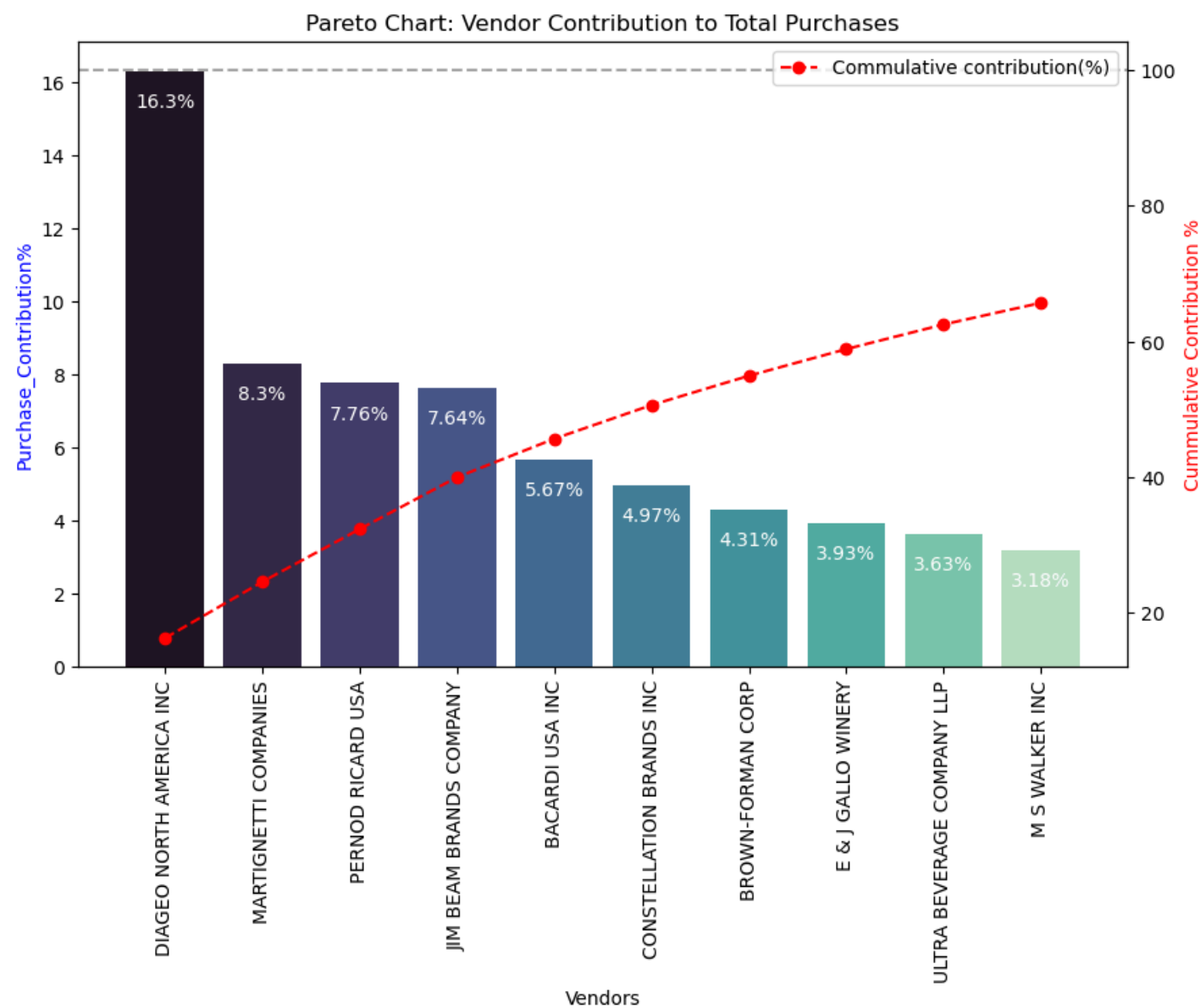
Insights:

- It confirms that a small number of vendors contribute disproportionately to total purchases, suggesting that focused management and strategic partnerships with these key suppliers are essential for procurement efficiencies and risk mitigation
- After the first several vendors, individual contribution drops below 6%, indicating that the remaining vendor base is much less impactful on overall purchasing, which may offer opportunities to consolidate or optimize the suppliers list.

7. Statistical Validation of Profit Margin Differences:

Hypothesis Testing:

Ho(Null Hypothesis): There is no significant difference in mean profit margins of top-performing and low-performing vendors.

H1(Alternative Hypothesis): The mean profit margins of top-performing and low-performing vendors are significantly different

Result: The null hypothesis is rejected, confirming that two groups operate under significantly different probability models.

Implication: High-margin vendors may benefit from better pricing strategies, while top-selling vendors could focus on cost efficiency.

POWER BI DASHBOARD SHOWCASE

Dashboard Overview
The interactive Power BI dashboard was designed to provide a visual view of vendor performance, profitability, and supply chain risks. It allows stakeholders to explore **vendor contribution, bulk purchasing impacts, profit margins, and inventory inefficiencies** in real time.
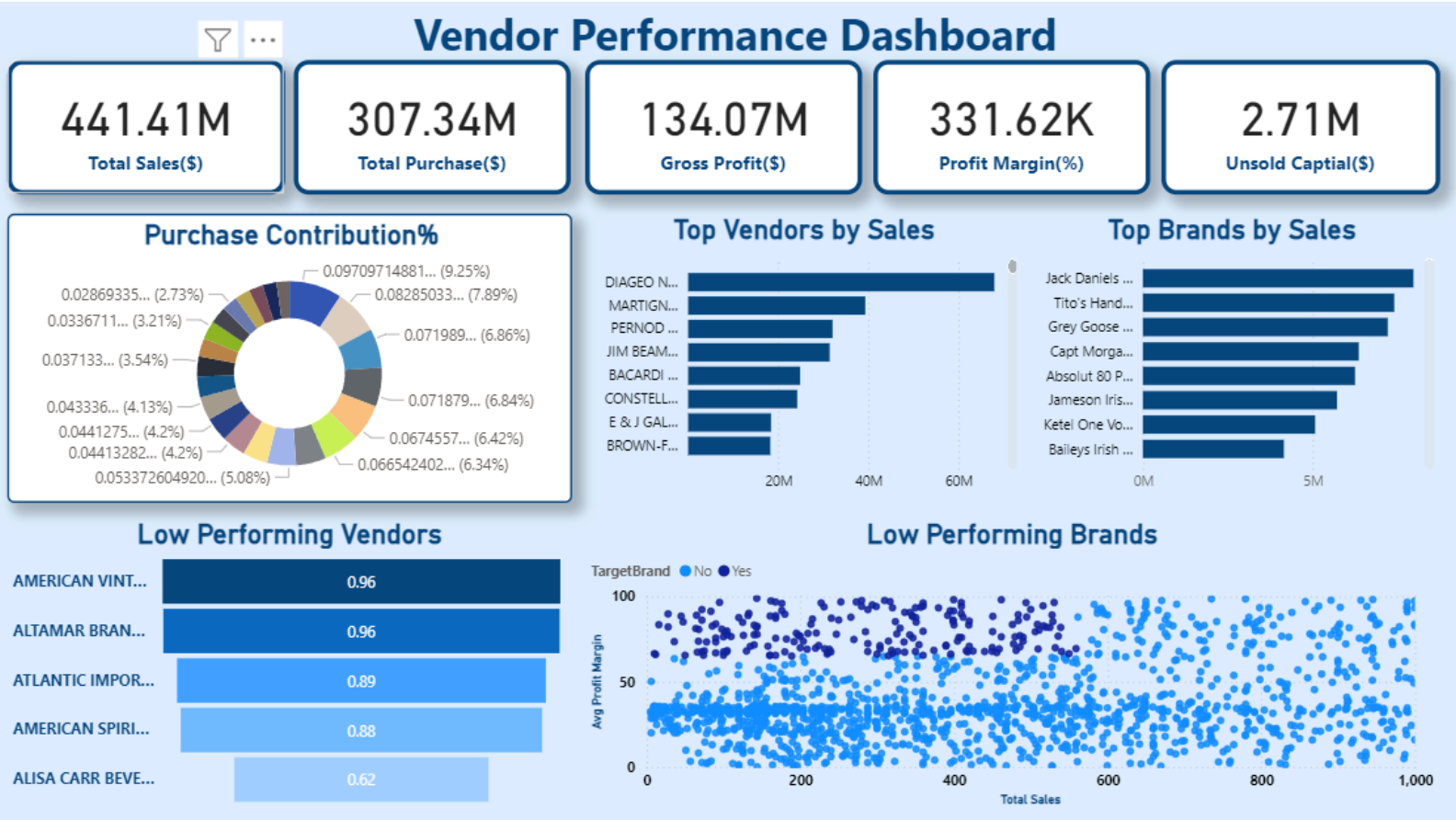
Key Value & Insights

- **Vendor Contribution Analysis**:
  - ➔ Visualization: *Bar/Pie Chart*
  - ➔ Insight: Top 10 vendors contribute ~66% of purchases, highlighting dependency risk.
- **Profit Margin Comparison:**
  - ➔ Visualization: *Clustered Bar Chart*
  - ➔ Insight: Low-performing vendors maintain higher profit margins (41%) but weaker sales volumes compared to top vendors (31%), indicating pricing inefficiencies.
- **Bulk Purchasing Impact:**
  - ➔ Visualization: *Line/Column Chart*
  - ➔ Insight: Large orders achieve ~72% cost savings per unit ($10.78 vs higher costs in smaller orders).
- **Inventory Insights:**
  - ➔ Visualization: *KPI Card / Donut Chart*
  - ➔ Insight: $2.71M is tied up in unsold stock, representing a major opportunity for inventory optimization.

FINAL RECOMMENDATIONS

- **Pricing Optimization**: Re-evaluate pricing for low-sales, high-margin brands to boost sales volume without sacrificing profitability.
- **Vendor Diversification**: Diversify vendor partnerships to reduce dependency on a few suppliers and mitigate supply chain risks.
- **Bulk Procurement Strategy:** Leverage bulk purchasing advantage to maintain competitive pricing while optimizing inventory management.
- **Inventory Optimization**: Optimize slow-moving inventory by adjusting purchase quantities ,launching clearance sales, or revising storage strategies.
- **Marketing & Distribution:** Enhance marketing and distribution strategies for low performing vendors to drive higher sales volume without compromising profit margins.

By implementing these recommendations, the company can achieve sustainable profitability, mitigate risks, and enhance overall operational efficiency.