

Vendor Performance Analysis – Retail Inventory & Sales Optimization

Analysing vendor efficiency and profitability to support strategic purchasing and inventory decisions using SQL, Python and Power BI.

Business Problem:

Effective inventory and sales management are critical for optimizing profitability in the retail and wholesale industry. Companies must ensure they are not incurring losses due to inefficient pricing, poor inventory turnover, or over-dependence on specific vendors. The goal of this analysis is to:

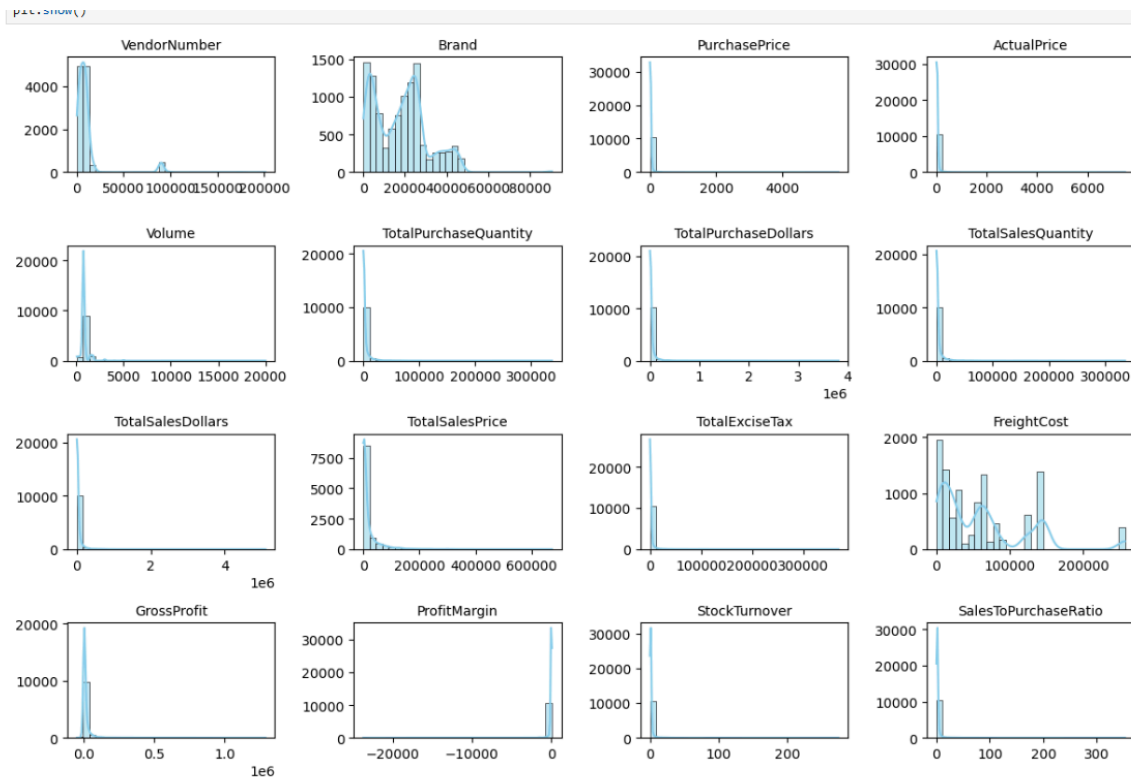
- Identify underperforming brands that require promotional or pricing adjustments.
- Determine top vendors contributing to total sales and gross profit.
- Analyze the impact of bulk purchasing on unit costs.
- Assess inventory turnover to reduce holding costs and improve efficiency.
- Investigate profitability variance between high-performing and low-performing vendors.

Exploratory Data Analysis Insights

Summary Statistics

[5]:

	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
TotalPurchaseDollars	10692.0	30106.693372	123067.799627	0.710000	453.457500	3655.465000	20738.245000	3.811252e+06
TotalSalesQuantity	10692.0	3077.482136	10952.851391	0.000000	33.000000	261.000000	1929.250000	3.349390e+05
TotalSalesDollars	10692.0	42239.074419	167655.265984	0.000000	729.220000	5298.045000	28396.915000	5.101920e+06
TotalSalesPrice	10692.0	18793.783627	44952.773386	0.000000	289.710000	2857.800000	16059.562500	6.728193e+05
TotalExciseTax	10692.0	1774.226259	10975.582240	0.000000	4.800000	46.570000	418.650000	3.682428e+05
FreightCost	10692.0	61433.763214	60938.458032	0.090000	14069.870000	50293.620000	79528.990000	2.570321e+05
GrossProfit	10692.0	12132.381048	46224.337964	-52002.780000	52.920000	1399.640000	8660.200000	1.290668e+06
ProfitMargin	10692.0	-15.620770	443.555329	-23730.638953	13.324515	30.405457	39.956135	9.971666e+01
StockTurnover	10692.0	1.706793	6.020460	0.000000	0.807229	0.981529	1.039342	2.745000e+02
SalesToPurchaseRatio	10692.0	2.504390	8.459067	0.000000	1.153729	1.436894	1.665449	3.529286e+02



Negative & Zero Values:

Gross Profit: Minimum of $-52,002.78$, indicating potential losses due to high costs or heavy discounts. This may result from selling products at lower prices than their purchase costs.

Profit Margin: Minimum of $-\infty$, suggesting cases where revenue is zero or even less than total cost, leading to extreme negative margins.

Total Sales Quantity & Sales Dollars: Some products show zero sales, meaning they were purchased but never sold. These represent slow-moving or obsolete stock, causing inventory inefficiencies.

Outliers Detected (High Standard Deviations):

Purchase & Actual Prices: Maximum values (5,681.81 and 7,499.99) are much higher than the means (24.39 and 35.64), indicating the presence of premium or specialized products.

Freight Cost: Ranges from 0.09 to 257,032.07, showing extreme variation that suggests logistics inefficiencies, bulk shipments, or inconsistent shipping costs across vendors.

Stock Turnover: Ranges from 0 to 274.5, suggesting some products sell rapidly while others remain unsold for long periods. A value greater than 1 indicates that sales exceeded the purchased quantity, possibly due to older stock being sold.

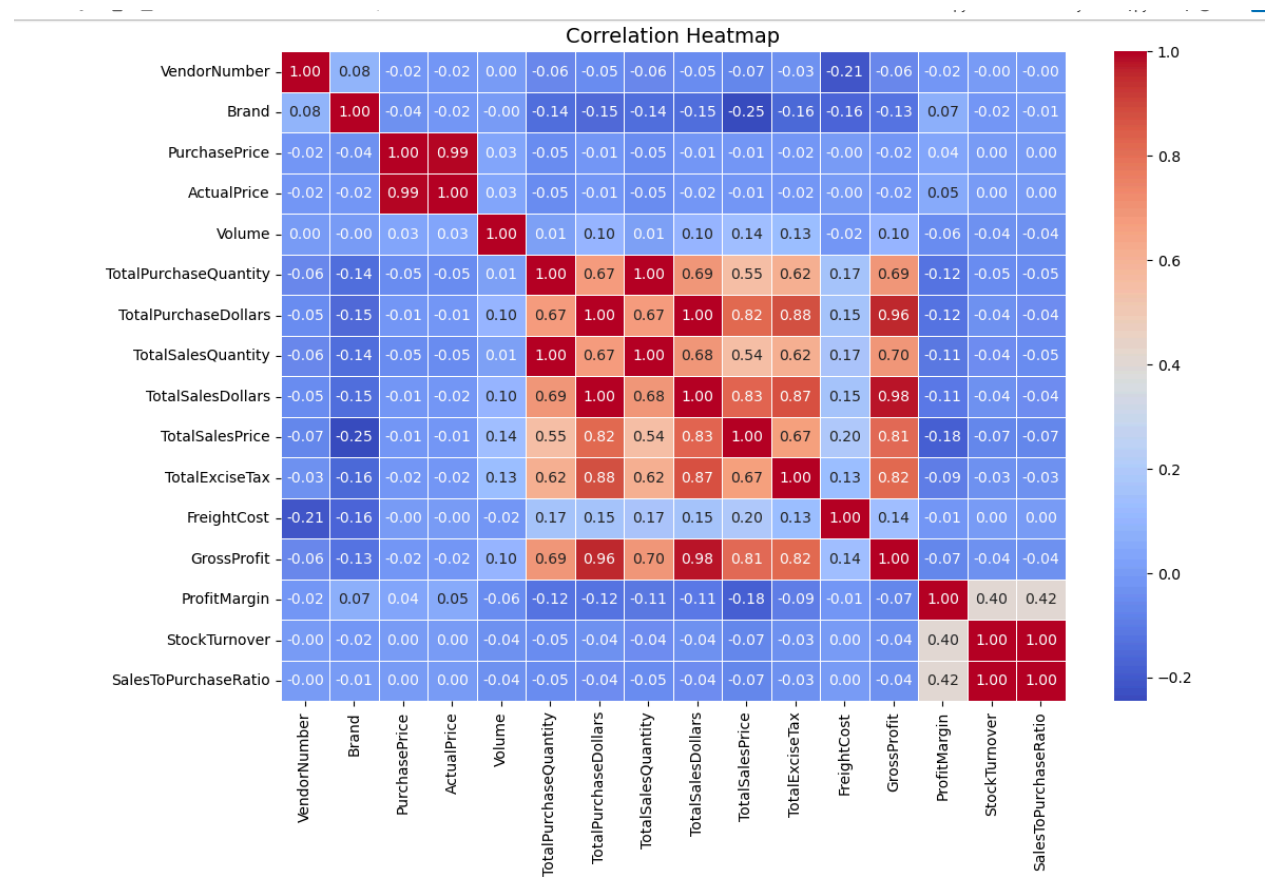
Data Filtering

To ensure the reliability of the insights, inconsistent data points were removed where:

- Gross Profit ≤ 0 (to exclude loss-making transactions).
- Profit Margin ≤ 0 (to focus on profitable transactions).

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

Correlation Insights



Purchase Price vs. Total Sales Dollars & Gross Profit: Weak correlation (-0.012 and -0.016), suggesting that price variations do not significantly affect total revenue or profit.

Total Purchase Quantity vs. Total Sales Quantity: Very strong correlation (0.999), confirming efficient inventory turnover.

Profit Margin vs. Total Sales Price: Negative correlation (−0.179), indicating that increasing sales prices may reduce margins, possibly due to competitive market pressures.

Stock Turnover vs. Gross Profit & Profit Margin: Weak negative correlation (−0.038 and −0.055), showing that faster turnover does not always translate to higher profitability.

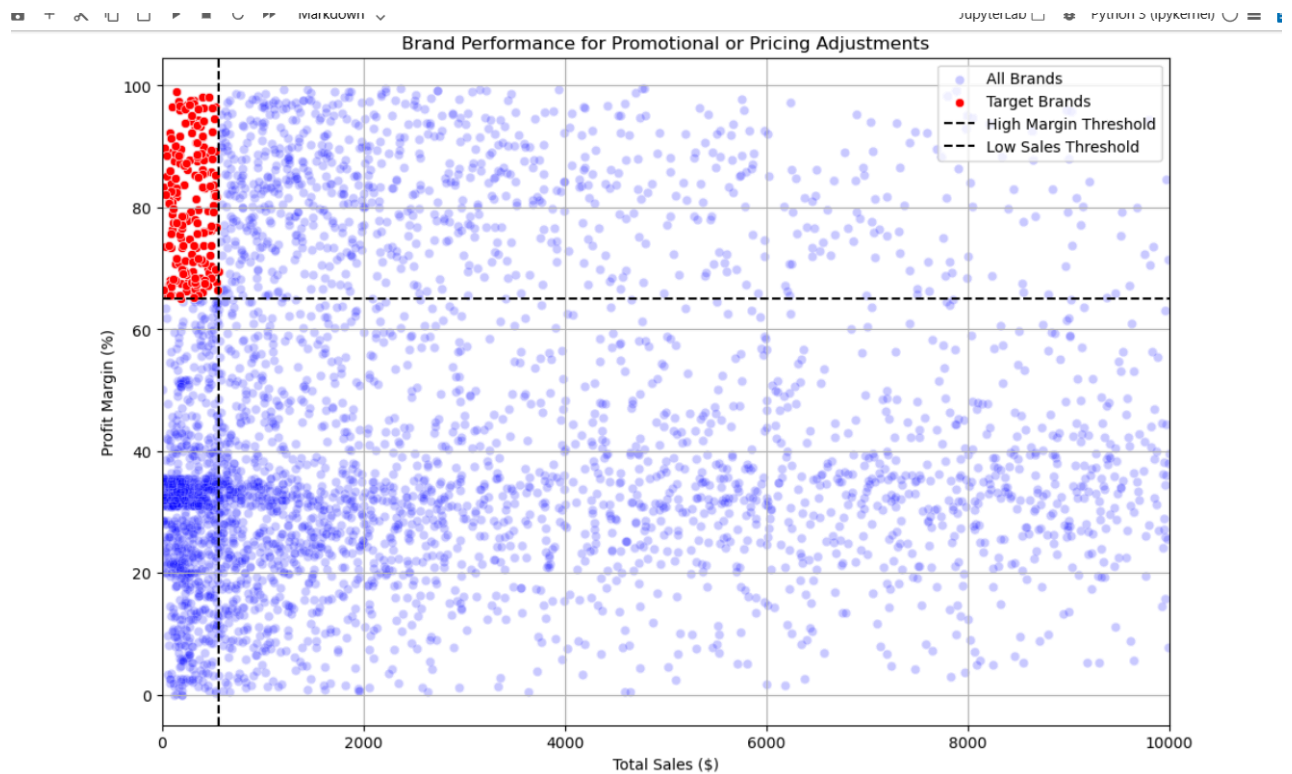
Research Questions & Key Findings

1. Brands Requiring Promotional or Pricing Adjustments

Brands with Low Sales but 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

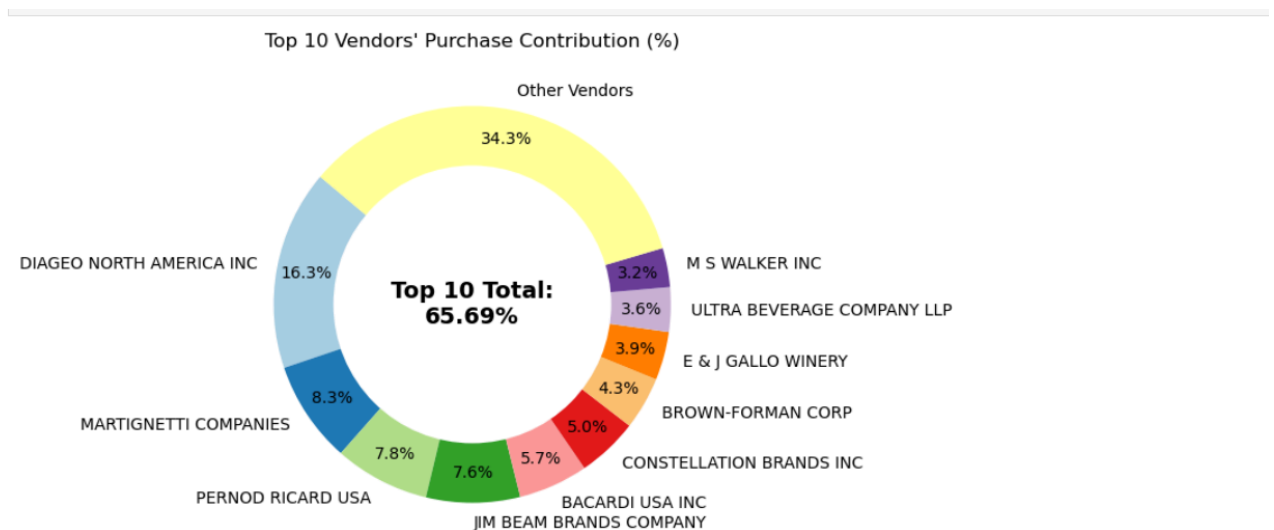
Finding:
198 brands exhibit lower sales but higher profit margins. These could benefit from targeted marketing, promotions, or optimized pricing to increase sales volume without compromising profitability.



2. Top Vendors by Sales & Purchase Contribution

The top 10 vendors contribute 65.69% of total purchases, while the remaining vendors account for only 34.31%.

This over-reliance on a few vendors increases the risk of supply chain disruptions, emphasizing the need for diversification in vendor partnerships.



3. Impact of Bulk Purchasing on Cost Savings

Vendors purchasing in large quantities receive a 72% lower unit cost (\$10.78 per unit) compared to smaller orders.

Bulk purchasing strategies help reduce unit costs, enhance margins, and encourage higher sales volumes while maintaining profitability.

[46]:

UnitPurchasePrice	
OrderSize	
Small	39.068186
Medium	15.486414
Large	10.777625

4. Identifying Vendors with Low Inventory Turnover

Total Unsold Inventory Capital: \$2.71 million

Slow-moving inventory increases storage costs, reduces cash flow efficiency, and negatively affects overall profitability.

Identifying vendors with low stock turnover enables better stock control and minimizes financial strain.

[50]:

StockTurnover	
VendorName	
ALISA CARR BEVERAGES	0.615385
HIGHLAND WINE MERCHANTS LLC	0.708333
PARK STREET IMPORTS LLC	0.751306
Circa Wines	0.755676
Dunn Wine Brokers	0.766022
CENTEUR IMPORTS LLC	0.773953
SMOKY QUARTZ DISTILLERY LLC	0.783835
TAMWORTH DISTILLING	0.797078
THE IMPORTED GRAPE LLC	0.807569
WALPOLE MTN VIEW WINERY	0.820548

[52]:

	VendorName	UnsoldInventoryValue
25	DIAGEO NORTH AMERICA INC	722.21K
46	JIM BEAM BRANDS COMPANY	554.67K
68	PERNOD RICARD USA	470.63K
116	WILLIAM GRANT & SONS INC	401.96K
30	E & J GALLO WINERY	228.28K
79	SAZERAC CO INC	198.44K
11	BROWN-FORMAN CORP	177.73K
20	CONSTELLATION BRANDS INC	133.62K
61	MOET HENNESSY USA INC	126.48K
77	REMY COINTREAU USA INC	118.60K

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

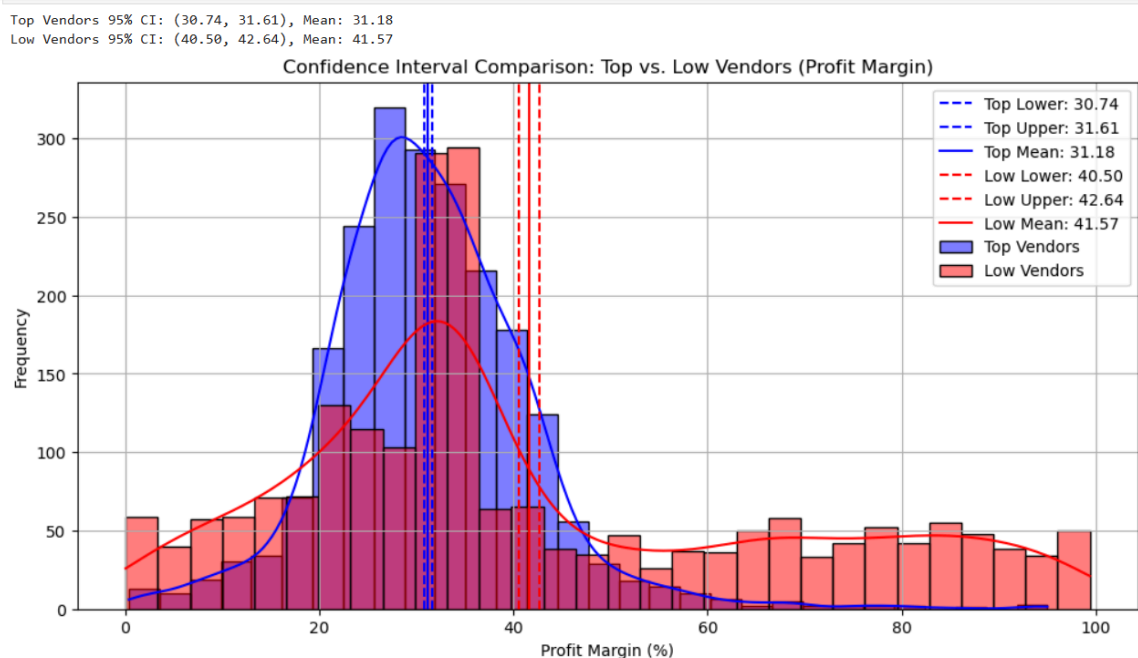
Top Vendors' Profit Margin (95% CI): (30.74%, 31.61%), Mean: 31.17%

Low-Performing Vendors' Profit Margin (95% CI): (40.48%, 42.62%), Mean: 41.55%

Low-performing vendors maintain higher margins but face lower sales volumes, indicating potential pricing inefficiencies or limited market reach.

Actionable Insights:

- Top-Performing Vendors: Optimize profitability through pricing adjustments, reduced operational costs, or offering bundled promotions.
- High-Margin Vendors: Focus on improving market reach and sales volume without compromising their strong margins.
- Low-performing vendors: Improve marketing efforts, optimize price strategies, and enhance distribution networks.



6. Statistical Validation of Profit Margin Differences

Hypothesis Testing:

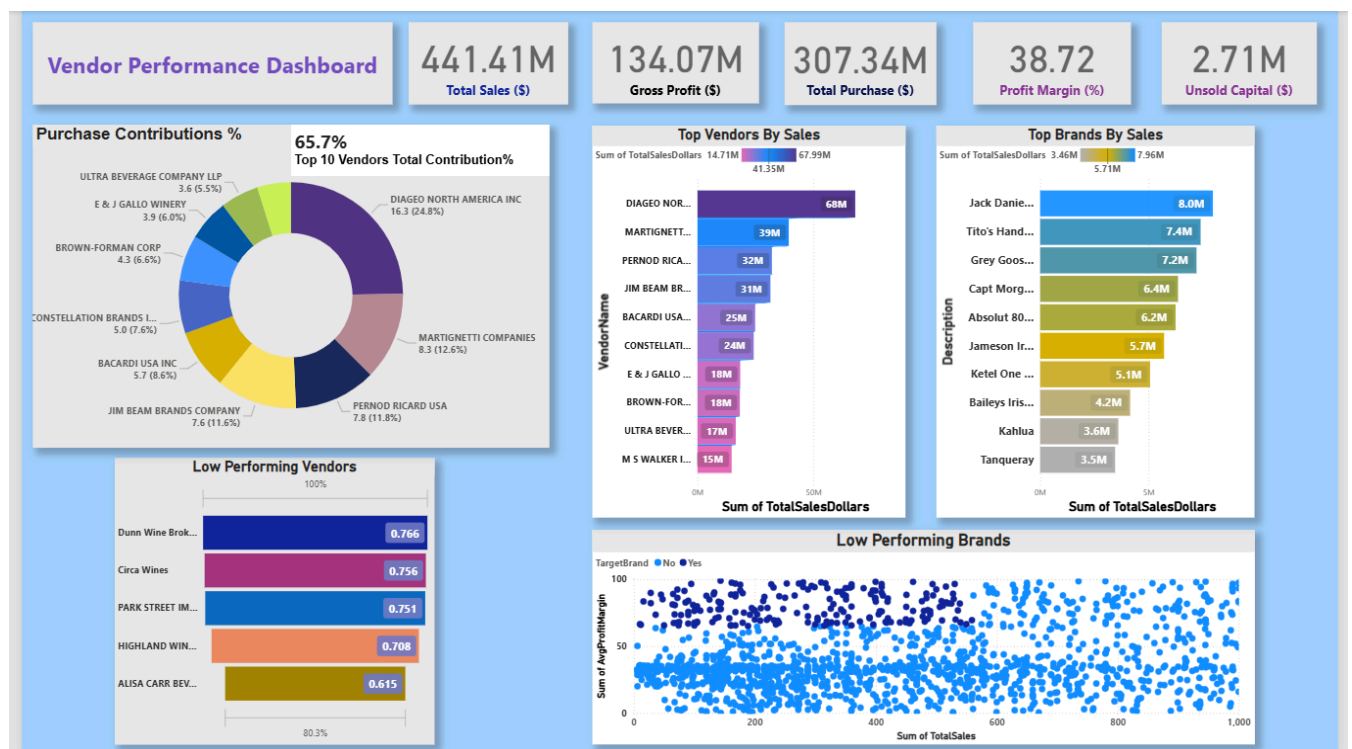
H_0 (Null Hypothesis): There is no significant difference in profit margins between top-performing and low-performing vendors.

H_1 (Alternative Hypothesis): There is a significant difference in profit margins between the two vendor groups.

Result: The null hypothesis is rejected, indicating that the two vendor groups exhibit statistically distinct profitability patterns.

Implication: High-margin vendors may benefit from effective pricing and premium product strategies, whereas top-selling vendors could improve profitability by enhancing cost efficiency and optimizing operational expenses.

Dashboard Insights:



The Vendor Performance Dashboard, created using Power BI, offers a unified view of vendor efficiency, sales, purchases, and profitability. It integrates KPIs and visual insights to evaluate procurement performance, financial outcomes, and brand growth, supporting accurate and data-driven business decisions.

2. Key Performance Indicators (KPIs)

KPI	Description	Key Insight
Total Sales (\$441.41M)	Overall revenue from all vendors.	Indicates strong sales performance.
Gross Profit (\$134.07M)	Sales minus purchase cost.	Reflects healthy profitability.
Total Purchase (\$307.34M)	Total vendor procurement value.	Shows large-scale vendor investment.
Profit Margin (38.72%)	Gross profit as % of sales.	Demonstrates efficient cost management.
Unsold Capital (\$2.71M)	Value of unsold inventory.	Manageable figure, showing good turnover.

3. Visual Insights

Purchase Contribution (Donut Chart):

Top 10 vendors, including Ultra Beverage Co., Diageo North America Inc., and Pernod Ricard USA, account for 65.7% of total purchases, indicating reliance on key suppliers—advantageous for negotiation but requiring diversification.

Top Vendors by Sales (Bar Chart):

Diageo North America Inc. leads (~\$68M), followed by Martignetti Companies and Paramount Global, helping identify high-value vendor relationships.

Top Brands by Sales (Bar Chart):

Best-performing brands include Jack Daniel's (8.0M), Tito's Handmade Vodka (7.4M), and Grey Goose (7.2M). Premium brands dominate sales, while others (e.g., Kahlua, Tanqueray) need promotional focus.

Low Performing Vendors (Bar Chart):

Vendors such as Dunn Wine Brokers, Circa Wines, and Park Street Imports show lower contribution ratios (0.61–0.78), suggesting review of contracts and supply strategies.

Low Performing Brands (Scatter Plot):

Highlights brands falling below sales targets, helping management prioritize improvement strategies and marketing efforts.

4. Key Insights

- **Strong Financials:** Solid sales and profit margins (~39%) show overall healthy operations.
- **Vendor Concentration:** Majority of purchases depend on top vendors—beneficial but poses supply risk.
- **Improvement Areas:** Certain brands and vendors underperform, needing focused action.
- **Effective Decision Tool:** Converts complex data into clear, actionable intelligence for managers.

Scope for Improvement:

1. Re-evaluate pricing for low-sales, high-margin brands to boost sales volume while maintaining profitability.
2. Diversify vendor partnerships to reduce dependency on a few suppliers and mitigate supply chain risks.
3. Leverage bulk purchasing to maintain competitive pricing and enhance cost efficiency.

4. Optimize slow-moving inventory through clearance sales, adjusted purchase quantities, or improved storage strategies.

5. Enhance marketing and distribution for low-performing vendors to increase sales volume without eroding profit margins.

By implementing these recommendations, the organization can achieve sustainable profitability, reduce operational risks, and enhance overall efficiency across sales, improve vendor collaboration and inventory management processes.