

Executive Summary

Introduction

This project performs a Data-Driven Business Analysis on the ERP Beverage Dataset to identify key trends, insights, and potential business optimizations.

Goals and Objectives

- Identify key market trends, customer behaviors, and operational inefficiencies to support strategic decision-making.
 - Enhance revenue growth by strengthening market presence in top-performing and emerging regions.
 - Optimize pricing, inventory, and product strategies to maximize profitability and efficiency.
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Data Sources and Overview

1. **CustomerMaster** (500 rows, 5 columns): CustomerID(PK), CustomerName, CustomerCity, CustomerCountry, PaymentTerms
 2. **InventoryBalances** (15,000 rows, 6 columns): InventoryID(PK), WarehouseID, ProductID, OnHand, OnOrder, LastUpdated
 3. **ProductMaster** (25 rows, 5 columns): ProductID(PK), ProductName, ProductCategory, UnitOfMeasure, BasePrice
 4. **ProductionLineMaster** (10 rows, 4 columns): LineName, FacilityLocation, MaxCapacity
 5. **ProductionOrders** (5,000 rows, 7 columns): ProductionOrderID(PK), ProductionLineID, ProductID, ProductionDate, BatchSize, UnitCost, TotalProductionCost
 6. **SalesOrders** (25,000 rows, 7 columns): SalesOrderID(PK), OrderDate, CustomerID, ProductID, Quantity, UnitPrice, TotalAmount
 7. **SupplierMaster** (100 rows, 5 columns): SupplierID(PK), SupplierName, SupplierCity, SupplierCountry, PaymentTerms
 8. **WarehouseMaster** (15 rows, 4 columns): WarehouseID(PK), WarehouseName, Location, Capacity
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Data Preparation and Procedure

Tools Used:

1. **Python**: Data Loading, Data Extraction, Data Wrangling, Model Deployment
2. **Looker Studio**: Data Transformation, Data Visualization
3. **Google Big Query**: Data Extraction, Data Transformation
4. **Tableau**: Automatic Forecasting
5. **Libraries**: Pandas, Numpy, Scikit-Learn, Plotly, Matplotlib

- Load dataset into **Jupyter Notebook**. Clean null values and duplicates.
- **Merge tables into three key sets**: Sales: Orders + Customers + Products , Inventory: Balances + Products + Warehouses, Production: Orders + Lines + Products
- Export merged tables as **CSV**. Upload to **Google BigQuery**.
- Visualize data in **Looker Studio**.

Preliminary EDA



Sales

- Quantity Sold: Mean = 2.5K, Median = 2.5K, Range = 100 – 5K, Std = 1.4K. **Uniform Distribution**.
- Total Amount (\$): Mean = \$8.4K, Median = \$6.9K, Range = \$10 – \$32.7K, Std = \$6.4K. **215 outliers. Right-skewed (most orders have lower values and occur more frequently)**.

Production Order

- Batch Size: Mean = 5.3K, Median = 5.3K, Range = 500 – 10K, Std = 2.8K. No outliers. **Uniform Distribution**.
- Total Production Cost (\$): Mean = \$6.9K, Median = \$5.4K, Range = \$79 – \$25K, Std = \$5.5K. 38 outliers. **Right-skewed (majority of values fall within the lower cost range)**.

Warehouse

- Capacity (Units Stored): Mean = 49.5K, Median = 46.4K, Range = 19.8K – 85.3K, Std = 22.3K.
- Max Capacity: Mean = 11.7K, Median = 8.9K, Range = 5.6K – 20K, Std = 6K.

Inventory

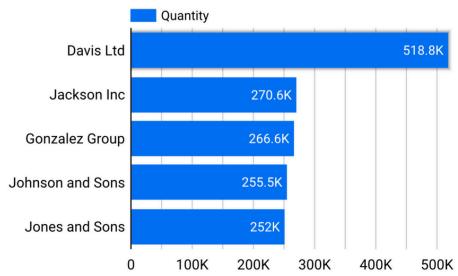
- On-Hand Inventory: Mean = 10K, Median = 10K, Range = 2 – 20K, Std = 5.8K. **Uniform Distribution**.
- On-Order Inventory: Mean = 2.5K, Median = 2.5K, Range = 0 – 5K, Std = 1.4K. **Uniform Distribution**.
- The outliers, representing high-volume purchases, are retained as they provide valuable insights into key customer segments and significant revenue contributions.**

Descriptive and Diagnostic Analysis

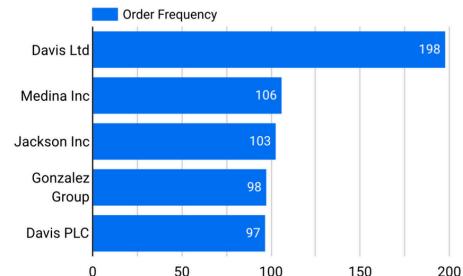
Top 5 Customers by Total Sales

Customer Name	Total Amount
1. Davis Ltd	1,716,102.39
2. Hill PLC	886,240.31
3. Gonzalez Group	875,519.08
4. Jackson Inc	865,310.47
5. Jones and Sons	847,993.06

Top 5 Customers by Quantity



Top 5 Customers by Order Frequency



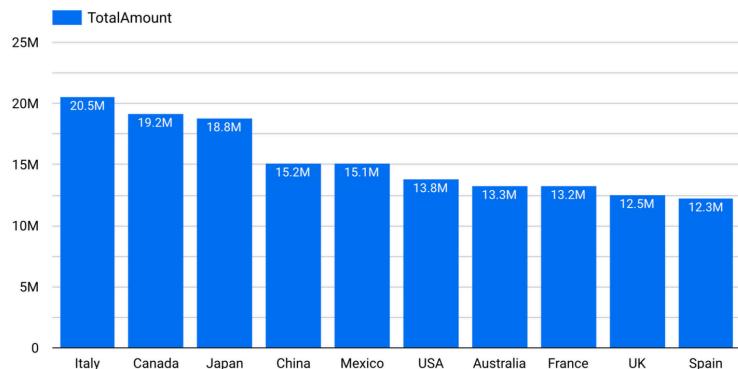
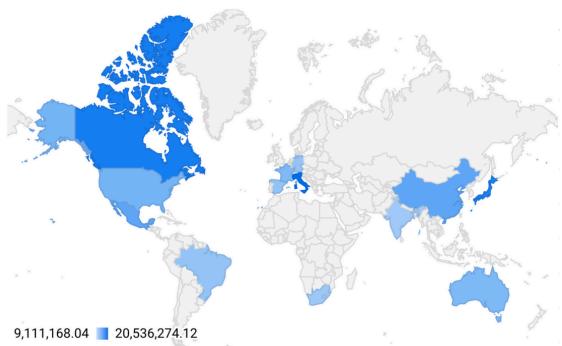
Top Revenue Contributor: Davis Ltd leads with \$1.72M, followed by Hill PLC and Gonzalez Group.

Largest Order Volumes: Davis Ltd leads in quantity sold (518K units), followed by Jackson Inc and Gonzalez Group.

Most Frequent Orders: Davis Ltd also tops order frequency (198 orders), with Medina Inc and Jackson Inc trailing.

- Davis Ltd** is the top customer across all metrics—focus on retention and upselling.
- Jackson Inc and Gonzalez Group** are strong across multiple areas—deepen engagement.
- Medina Inc** has high order frequency but lower revenue—opportunity for higher-value sales.

Customers Country by Sales



Top 5 Customer Cities By Revenue

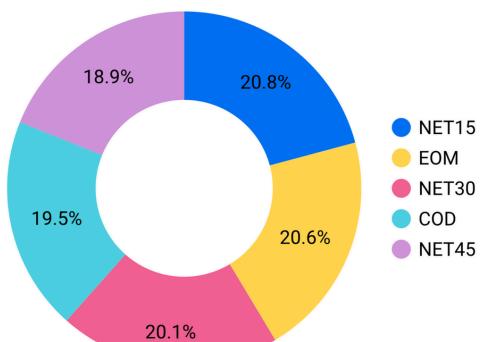
CustomerCountry	CustomerCity	Quantity	TotalAmount
1. USA	East Heather	326.6K	1M
2. UK	West Angela	189.2K	667K
3. France	North James	174.4K	615K
4. Australia	Lake Lisa	184.3K	612K
5. France	North Arthur	168.8K	608K

- **Top Markets:** Italy, Canada, and Japan drive the highest revenue, with Italy leading at \$20.5M.
- **Emerging Opportunities:** China, Mexico, and the USA follow closely, signaling strong market potential.
- **High-Performing Cities:** East Heather (USA), West Angela (UK), and North James (France) generate the most revenue.

- **Maintain revenue growth** for Italy, Canada, and Japan.
- **Strengthen market strategies** in China, Mexico, and the USA to capitalize on growth potential.

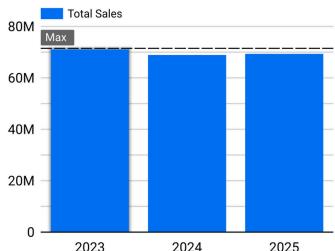
Country	Product Category / Quantity					
	Coffee	Carbonated Soft Drink	Juice	Energy Drink	Tea	Water
Italy	1.3M	1.3M	1.2M	937.9K	1M	441.6K
Canada	1.2M	1.2M	1.1M	941.2K	923.2K	521.2K
Japan	1.1M	1.1M	1.2M	894.3K	856.7K	520.9K
Mexico	904.9K	878K	903.3K	729.6K	750.3K	405.5K
China	952.9K	880.2K	918K	720.6K	692.4K	403.9K
USA	868.3K	905.8K	820.7K	679.7K	604.1K	367.2K
Australia	851.7K	825K	723.2K	708.9K	673.6K	279.8K
France	822.9K	868.1K	841.7K	571.1K	643.8K	282K
Brazil	720.5K	831.5K	717.3K	598.3K	563.7K	325.8K
Spain	818.7K	788.3K	705.1K	579.9K	552.8K	294.1K
UK	714.3K	757K	805.2K	648.6K	501.6K	300.1K
Germany	791.4K	672.4K	759.3K	618.6K	524.3K	294.6K
South Africa	640.4K	702.9K	766.6K	571.6K	606.8K	242.2K
India	737.7K	699.2K	617.5K	590.5K	529.2K	324.4K
Singapore	564.8K	511.2K	571.1K	427.8K	435.1K	197.5K

Payment Terms Distribution by Sales

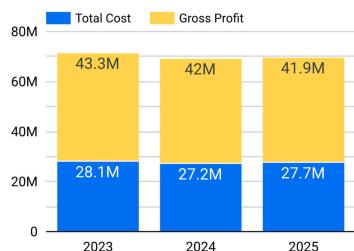


- **Payment Terms are fairly evenly distributed:** NET15 and EOM are the most common, followed by NET30 and COD, with NET45 slightly lower.
- **Juice** is the top-selling product in most countries especially in Italy, Canada and Japan ; leading countries in sales.
- **Water** has consistently low sales across many regions.
- **Juice & Carbonated Soft Drinks:** Target hot regions like Mexico, Brazil, India, South Africa, and Australia for refreshing.
- **Focus on premium coffee and traditional teas** in Europe, Asia, and parts of Africa (Italy, France, Japan, China, India).
- **Health & Wellness Focused:** Juice and water products for health-driven markets (UK, South Africa, Singapore).

Yearly Sales (2023 - 2025)



COGS and Gross Profit



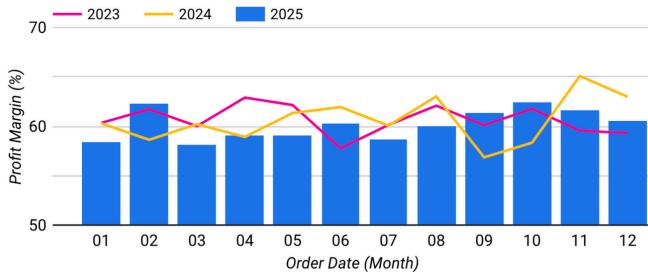
Total Sales dropped by 3.2% in 2024 but showed a slight recovery of 0.6% in 2025, but 2023 remains as highest sales.

Total Cost decreased in 2024 but slightly increased in 2025, suggesting cost optimization and production efficiency.

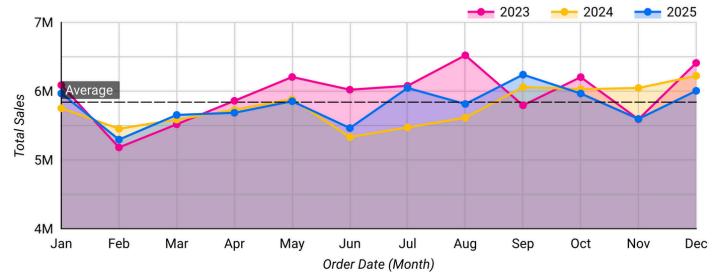
Gross Profit is stable at around ~60% but has been decreasing.

With slowing revenue growth and stable margins, the business is in its mature stage, **expansion and optimization** will be solutions for long-term growth.

Monthly Profit Margin Trend (2023-2025)



Sales Trend (2023 - 2025)



Total revenue shows cyclical trends, with noticeable **peaks** (May, Sep, Oct, Dec) and **dips** (Feb, Jun, Nov).

In 2023, Sales reached its highest in Summer (May-Aug) but significantly decline in 2025.

Winter (Nov-Dec) shows **improved profit margins**, likely due to **holiday season** planning and successful premium pricing. Summer (May-Aug) consistently show high total sales, but profit margin slightly low suggest **high costs or pricing**.

- **February** shows the weakest sales with a high profit margin.
- Reduce aggressive discounting in months where profit margins are low. (**Jan, May, Aug, Sep**)
- Offer volume-based discounts or bundled deals to encourage lower sales months. (**Feb, Jun, Jul, Nov**)
- Introduce seasonal promotions, such as winter warm beverages (coffee, tea) and summer (**Juice, Soft Drinks, Energy Drinks**)

Monthly Sales Volume (2023-2025)

Month	Quantity ▾	Month	Quantity ▾
December	5.6M	February	4.8M
October	5.6M	June	5.1M
May	5.5M	March	5.2M
September	5.5M	November	5.2M
January	5.5M	April	5.2M
August	5.4M	July	5.3M

Sales and Profit by Payment Terms



NET15 generates the highest Total Sales and Profit, followed by EOM and NET30. Longer payment terms (NET45) and Cash on Delivery (COD) result in lower revenue and profit.

- The highest order volumes occur in December (5.6M) and October (5.58M), likely due to holiday promotions, offering special promotions like end-of-year sales in Q4 to maximize revenue.
- Develop promotions for February to address low sales (4.83M).

Product Category (...)		Total Sales
<input checked="" type="checkbox"/> Juice		53.1M
ProductName	Sales ▾	Qty
Vote Term	12.0M	2.6M
Sense Fill	11.9M	2.6M
Purpose Enter	11.1M	2.5M
Watch Could	10.5M	2.5M
Discuss Them	7.6M	2.5M
Grand total	53.1M	12.6M

Product Category (...)		Total Sales
<input checked="" type="checkbox"/> Coffee		46.1M
ProductName	Sales ▾	Qty
Collection Wear	13.6M	2.6M
Success Get	10.1M	2.6M
Under Dog	9.5M	2.7M
Pick Image	6.7M	2.6M
Daughter Drop	6.1M	2.5M
Grand total	46.1M	13.0M

Product Category (...)		Total Sales
<input checked="" type="checkbox"/> Carbonated Soft Drink		28.9M
ProductName	Sales ▾	Qty
Culture Guess	12.7M	2.7M
Collection Religious	4.8M	2.7M
Cut Then	4.2M	2.6M
Attorney Cover	3.8M	2.4M
Think Decide	3.5M	2.6M
Grand total	28.9M	13.0M

Juice (Total Sales: 53.1M, Total Qty: 12.6M)

- **Highest sales:** Vote Term (12.0M)
- **Highest quantity:** Vote Term & Sense Fill (2.6M each)

"Maintain strong sales momentum with premium offerings."

Carbonated Soft Drink (Total Sales: 28.9M, Total Qty: 13.0M)

- **Highest sales:** Culture Guess (12.7M)
- **Highest quantity:** Culture Guess & Collection Religious (2.7M each)

"Boost revenue through volume-based discounts and bundling."

Coffee (Total Sales: 46.1M, Total Qty: 13.0M)

- **Highest sales:** Collection Wear (13.6M)
- **Highest quantity:** Under Dog (2.7M)

"Leverage high demand with strategic promotions and upselling."

Product Category (...)		Total Sales
<input checked="" type="checkbox"/> Energy Drink		37.7M
ProductName	Sales ▾	Qty
Born Near	11.9M	2.4M
Party Great	10.9M	2.6M
Gun Rate	9.3M	2.6M
New Occur	5.7M	2.6M
Grand total	37.7M	10.2M

Product Category (...)		Total Sales
<input checked="" type="checkbox"/> Tea		35M
ProductName	Sales ▾	Qty
Old Tell	11.5M	2.4M
Information Democrat	10.5M	2.4M
Sign Ability	7.0M	2.6M
Stand Property	6.0M	2.5M
Grand total	35.0M	9.9M

Product Category (...)		Total Sales
<input checked="" type="checkbox"/> Water		9.4M
ProductName	Sales ▾	Qty
Energy Teacher	5.0M	2.6M
Compare Ground	4.4M	2.6M
Grand total	9.4M	5.2M

Energy Drink (Total Sales: 37.7M, Qty: 10.2M)

- **Highest sales:** Born Near (11.9M)
- **Highest quantity:** Party Great & Gun Rate (2.6M each)

"Target niche markets with performance-driven branding."

Water (Total Sales: 9.4M, Total Qty: 5.2M)

- **Highest sales:** Energy Teacher (5.0M)
- **Highest quantity:** Energy Teacher & Compare Ground (2.6M each)

"Enhance market appeal with eco-friendly packaging and bulk deals."

Tea (Total Sales: 35.0M, Total Qty: 9.9M)

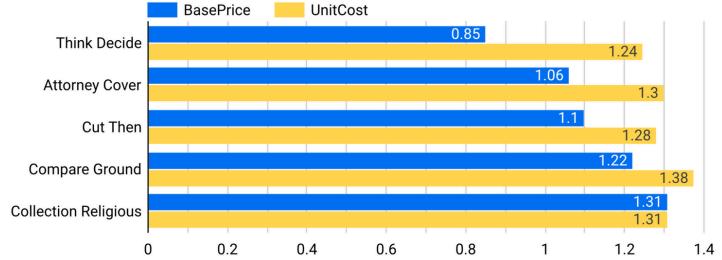
- **Highest sales:** Old Tell (11.5M)
- **Highest quantity:** Sign Ability (2.6M)

"Expand reach by promoting health benefits and specialty blends."

Low Profit Margin Products

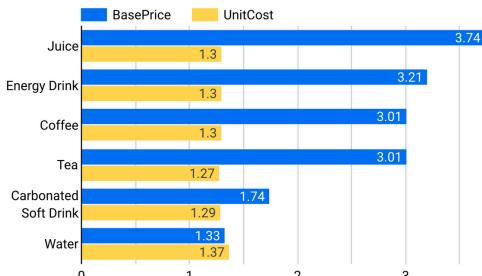
ProductName	ProductCategory	Profit Margin ▾
1. Think Decide	Carbonated Soft Drink	7.20
2. Attorney Cover	Carbonated Soft Drink	18.41
3. Compare Ground	Water	19.05
4. Cut Then	Carbonated Soft Drink	19.74
5. Collection Religious	Carbonated Soft Drink	26.75

Products with Avg Base Price less than Unit Cost

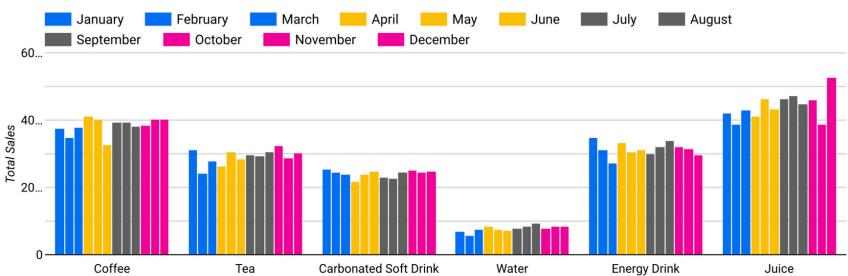


Most low-profit margin products belong to the Carbonated Soft Drink category, with "Think Decide" having the lowest margin at 7.2%. These products have a lower base price than their unit cost, leading to reduced profit margins. Reviewing and updating pricing strategies is essential to restore profitability.

Average Base Price and Unit Cost by Product Category

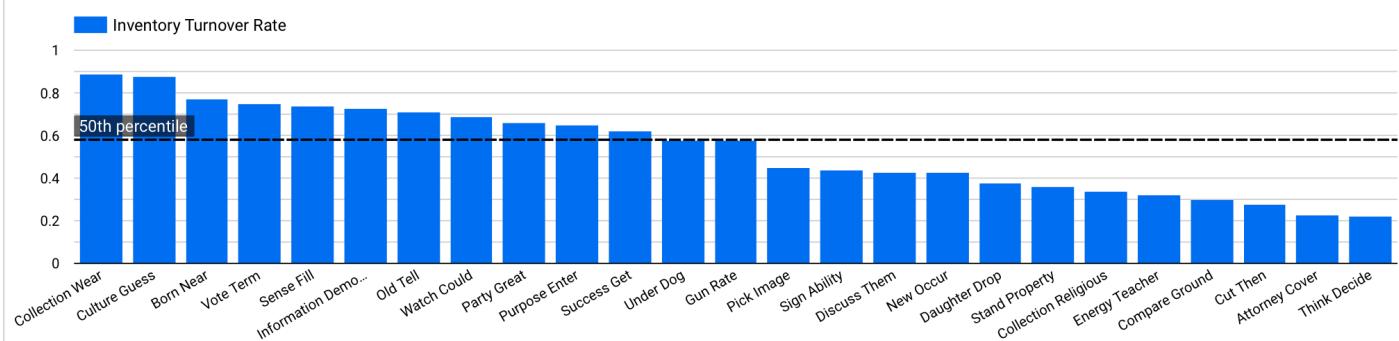


Product Category and Monthly Trends



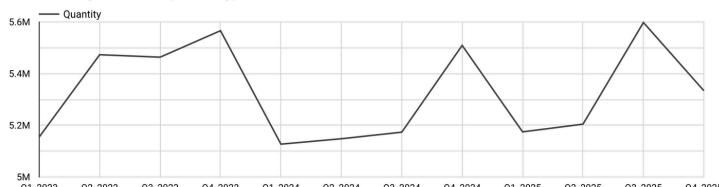
- Juice and Energy Drinks** show strong seasonal demand, peaking towards **the end of the year (November–December)**.
- Carbonated Soft Drinks** have stable but lower sales. To boost sales, carbonated soft drinks should be marketed in **Summer**.
- Tea and Coffee** maintain steady sales across months, showing little fluctuation. Suggested seasons are **winter and fall**.
- Water** has the **lowest sales volume and lacks strong seasonality**, making it a weak performer.

Inventory Turnover Rate by Product Name



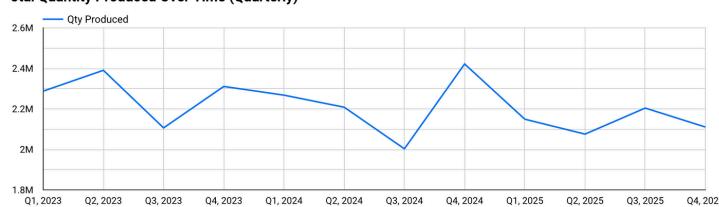
Collection Wear (0.89) and Culture Guess (0.88) are top performers, while products like **Think Decide (0.22)** and **Attorney Cover (0.23)** are significantly underperforming. To optimize inventory, focus on promoting high-turnover products, liquidating or discontinuing low-turnover items, and improving demand forecasting.

Sales Quantity Over Time (Quarterly)



There's a consistent gap between the quantity ordered (5 million+) and the quantity produced (2 million+), indicating that production is not fully meeting the demand.

Total Quantity Produced Over Time (Quarterly)



The relatively stable inventory levels (around 10,000 units) suggest that inventory is being used to compensate for the shortfall in production. However, this approach may not be sustainable long-term if production does not align with rising order demands.

Average Inventory OnHand Over Time (Quarterly)

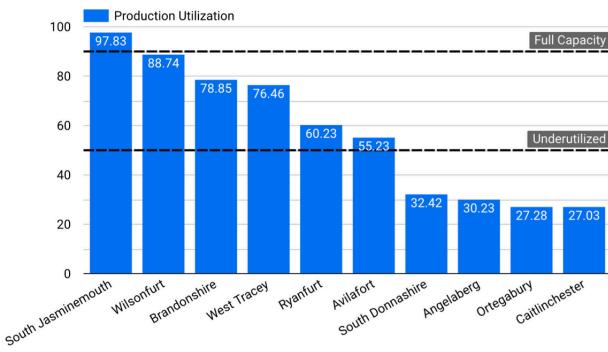


The lower production volumes observed in early 2025, especially in Q1, combined with higher order volumes, raise concerns about potential supply shortages.

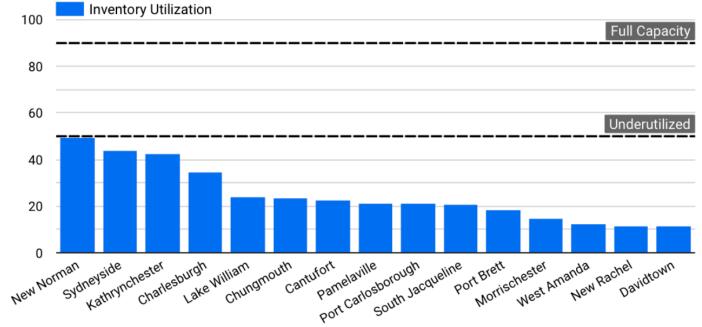
The data shows some seasonal fluctuations in order quantities, with higher orders in Q4, indicating potential seasonal demand peaks.

To ensure smoother operations, it is recommended to enhance production capabilities in Q1 2025 and plan for future demand spikes, particularly in Q4 and Q3.

Production Utilization by Facility Location



Inventory Utilization by Location

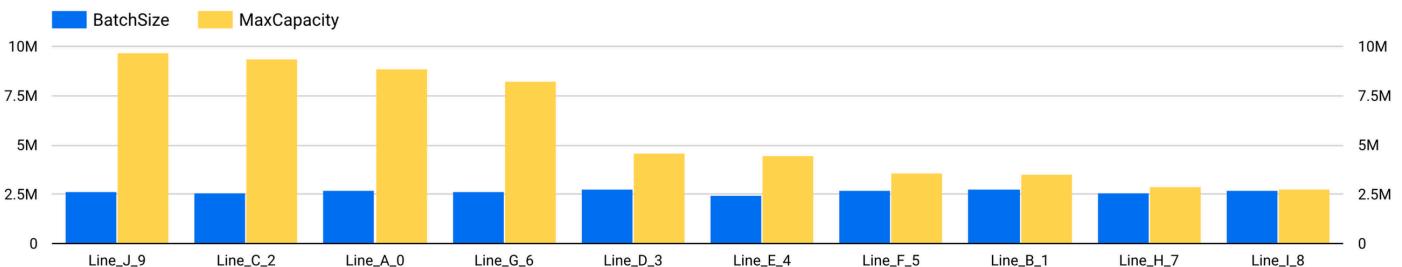


- None of the facilities are fully utilized, indicating significant inefficiencies in inventory management across all locations.
- All facilities are “underutilized” with utilization rates ranging from 49.36% (New Norman) to as low as 11.44% (Davidtown).

It is suggested to

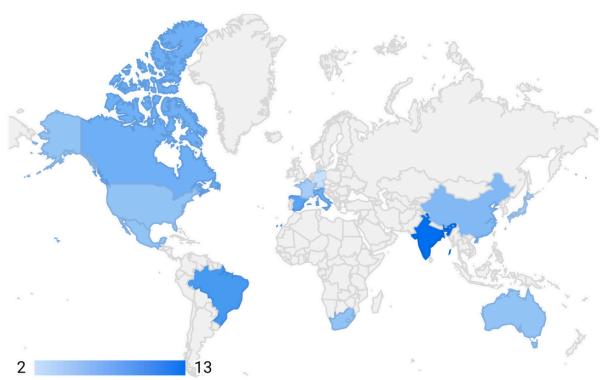
- Improve demand planning to align inventory levels with actual sales trends.
- Consider consolidating inventory from low-utilization facilities (e.g., Davidtown, New Rachel) into higher-performing locations to reduce costs.
- South Jasminemouth (97.83%) is the only facility operating at full utilization
- Wilsonfurt (88.74%), Brandonshire (78.85%), West Tracey (76.46%), Ryanfurt (60.23%), and Avilafort (55.23%) are moderately utilized. Optimize processes, increase marketing efforts, or reallocate resources to improve utilization.
- South Donnashire (32.42%), Angelaberg (30.23%), Ortegabury (27.28%), and Caitlinchester (27.03%) are significantly underutilized.
- Investigate root causes (e.g., low demand, inefficiencies) and consider consolidating operations or repurposing facilities to reduce costs.

Batch Size and Max Capacity Distribution by Production Line



- Line_J_9, Line_C_2, Line_A_0, and Line_G_6 have significantly higher max capacities but are operating at only 30-32% utilization.
- Line_L_8 and Line_H_7 are operating at 97.8% and 88.7% utilization, respectively, despite having much lower max capacities.
- Batch sizes are equally distributed across all production lines, regardless of their max capacity. This approach is inefficient, as it does not leverage the full potential of high-capacity lines and overburdens low-capacity ones.
- It is suggested to investigate why high-capacity lines like Line_A_0 and Line_G_6 are underutilized. Potential causes could include: Lack of demand for their output, Inefficient processes or equipment, Insufficient raw materials or labor.

Supplier Distribution Across Country



Supplier Distribution Across Country

SupplierCountry	Record Count
1. India	13
2. UK	11
3. Singapore	9
4. Brazil	9
5. Spain	8
6. Italy	7
7. Canada	7

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India (13 suppliers) and the UK (11 suppliers) being the largest sourcing hubs, followed by Singapore and Brazil (9 each). Key regions like Asia and Europe dominate, while major economies such as China, Germany, and the USA have fewer suppliers, suggesting either strategic diversification or untapped potential.

To optimize the supply chain, the company should strengthen relationships with top hubs, explore opportunities in underrepresented regions, and continue diversifying to mitigate risks.

Payment Terms / Number of Suppliers

SupplierCount...	COD	NET15	NET45	EOM	NET30
India	5	3	1	2	2
UK	3	3	3	1	1
Brazil	3	-	2	2	2
Singapore	3	3	2	1	-
Spain	2	3	-	3	-
Canada	3	-	3	-	1
Italy	1	3	2	-	1
China	-	1	1	2	2
Australia	1	-	2	1	1
Mexico	3	-	1	1	-
South Africa	1	1	-	1	2
USA	2	-	1	2	-
France	1	2	-	-	1
Japan	1	1	-	-	2
Germany	1	-	-	-	1

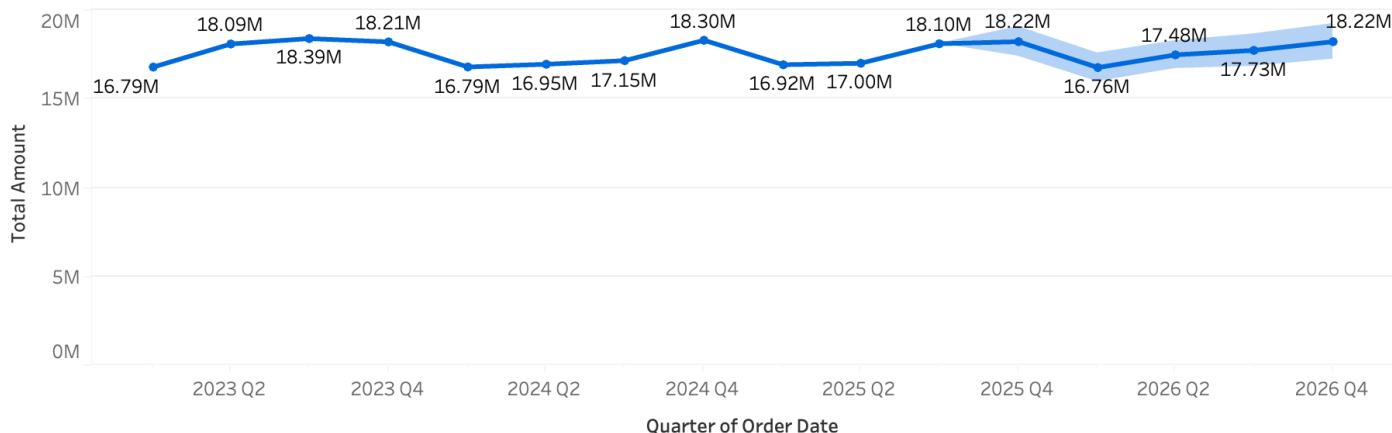
India has the highest number of suppliers favoring COD (5 suppliers), making it the leading market for immediate payments, followed by the UK, Brazil, Singapore, Canada and Mexico. Spain, Canada and Italy also have a notable number of suppliers favoring NET15 (3 each), making them strong options for short-term credit agreements. UK and Canada have suppliers offering NET45 terms, which could be beneficial for businesses seeking longer payment periods.

Countries like Canada, China, Australia, and the USA show a preference for EOM payments, making them suitable for structured payment agreements. Spain has the highest number of EOM-preferred suppliers (3), indicating flexibility for businesses that require end-of-month settlements.

For needing longer credit terms, Canada, Spain, and Italy are strong options due to their suppliers' openness to NET45 and EOM agreements. Businesses prioritizing immediate payments should focus on India, the UK, and Brazil, where COD suppliers are most prevalent. Additionally, supplier diversity should be explored in underrepresented markets such as Germany, France, and Japan, which have fewer suppliers but the potential for expansion.

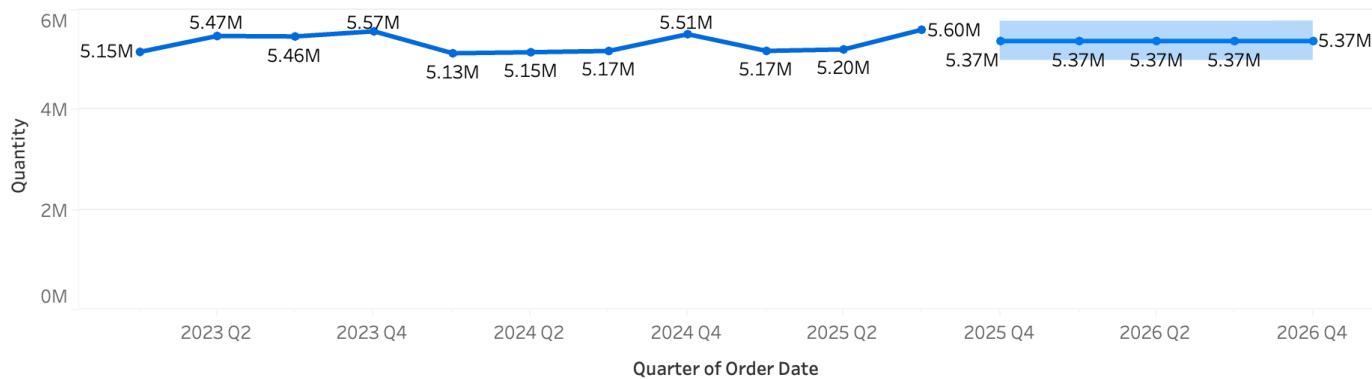
Predictive Analysis and Advanced Insights

Quarterly Sales Forecast (2026)



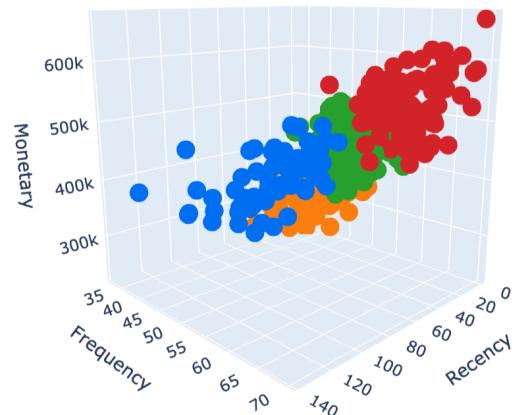
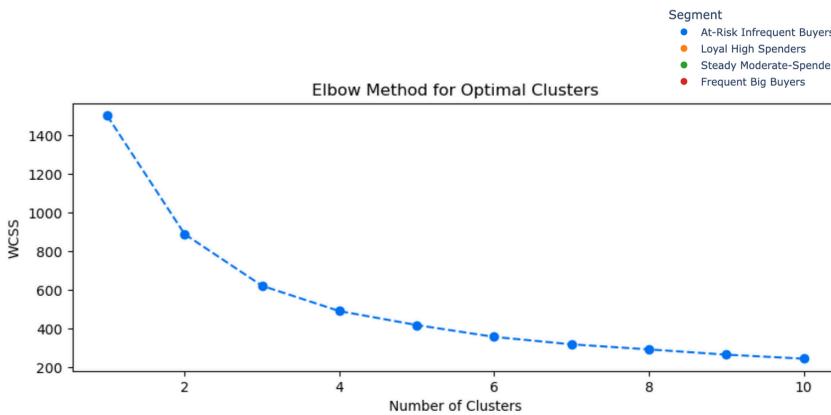
- The sales forecast for 2026 shows a steady upward trend with fluctuations.
- The highest forecasted sales occur in Q4 2026 (18.22M), while the lowest forecasted sales occur in Q1 2026 (16.76M).
- The confidence interval widens slightly towards Q4, indicating some level of uncertainty.
- Maximize Q4 Sales Growth:** Since Q4 is projected to have the highest sales, align marketing efforts, promotions, and product launches to capitalize on demand.
- Address Q1 Slowdown:** The dip in Q1 indicates a potential seasonal weakness; early-year discounts or bundled promotions can help sustain revenue.
- Monitor Market Trends:** Given the sales variations, closely track external factors (holidays, economic conditions, industry trends) that may influence sales.
- Adjust Pricing Strategies:** If demand is consistent, consider value-based pricing instead of aggressive discounts to maintain profit margins.

Quarterly Quantity Forecast (2026)



- The forecasted quantity remains steady at around 5.37M units per quarter throughout 2026, indicating minimal fluctuations.
- Historical data shows some fluctuations, but the forecast for 2026 suggests a more stable trend.
- The light blue shaded area indicates a narrow confidence interval, meaning a high level of certainty in the forecast.
- Unlike some prior quarters with notable peaks and dips, 2026 remains flat, suggesting a predictable demand pattern.
- Past data shows spikes above 5.5M units, but the forecast does not anticipate a return to those peaks.
- Since demand is steady, businesses should focus on maintaining optimal stock levels rather than preparing for drastic changes.**
- A consistent forecast suggests stable production planning without the need for significant scaling up or down.

RFM Analysis - Clustering



Cluster 1: Loyal Moderate-Spenders

- Recency:** Recent purchases (median = 11 days).
- Frequency:** Very frequent buyers (median = 59 transactions).
- Monetary:** High spenders (median = \$514K).
- Behavior:** Engaged, frequent buyers contributing significantly to revenue.
- Targeted Marketing:**
 - Offer loyalty rewards or exclusive discounts to retain them.
 - Upsell premium or new beverage products.

Cluster 3: At-Risk Infrequent Buyers

- Recency:** Long gaps since the last purchase (median = 61 days).
- Frequency:** Lowest frequency among clusters (median = 43 transactions).
- Monetary:** Moderate spenders (median = \$342K).
- Behavior:** At risk of churn, possibly shifting to competitors.
- Targeted Marketing:**
 - Send re-engagement campaigns with special discounts or offers.
 - Conduct surveys to understand their needs and improve satisfaction.

Cluster 2: Frequent Big Buyers

- Recency:** Recent purchases (median = 14 days).
- Frequency:** Regular buyers (median = 51 transactions).
- Monetary:** Moderate-to-high spenders (median = \$438K).
- Behavior:** Bulk buyers, major revenue contributors.
- Targeted Marketing:**
 - Offer bulk purchase discounts or volume-based incentives.
 - Introduce subscription-based models for regular deliveries.

Cluster 4: Steady Moderate-Spenders

- Recency:** Recent purchases (median = 11 days).
- Frequency:** Consistent buyers (median = 47 transactions).
- Monetary:** Stable spenders (median = \$389K).
- Behavior:** Reliable, steady customers.
- Targeted Marketing:**
 - Offer bundle deals or multi-buy discounts to encourage larger purchases.
 - Provide seasonal promotions to maintain their engagement.

Recommendation and Limitation

Recommendation

Market Expansion & Revenue Growth

- Maintain strong momentum in Italy, Canada, and Japan while strengthening market strategies in China, Mexico, and the USA to capture emerging opportunities.
- Focus on upselling and retention strategies for Davis Ltd, Jackson Inc, and Gonzalez Group, as they are top revenue contributors.
- Capitalize on seasonal sales trends by offering premium winter beverages (coffee, tea) and refreshing summer drinks (juice, soft drinks, energy drinks).
- Optimize pricing strategies by reducing discounts in months with already high sales (May, Aug, Sep) and introducing bundled deals in slower months (Feb, Jun, Nov).

Product Optimization & Inventory Management

- Prioritize Juice, Coffee, and Energy Drinks as key revenue drivers while reassessing low-performing products like Water and select Carbonated Soft Drinks.
- Enhance demand forecasting to align production levels with seasonal peaks in Q4 and avoid supply shortages.
- Optimize warehouse and facility utilization by consolidating low-performing locations and increasing efficiency in underutilized production lines.
- Supplier & Payment Terms Optimization
 - To secure longer credit terms, strengthen partnerships with suppliers in Canada, Spain, and Italy (NET30, NET45).
 - For immediate payment transactions (COD), focus sourcing efforts in India, UK, and Brazil to maintain cash flow efficiency.
- Expand supplier base in underrepresented markets like Germany, Japan, and France to reduce dependency on key regions and improve resilience.

Operational Efficiency & Supply Chain Enhancement

- Address production bottlenecks by better utilizing high-capacity lines like Line A_0 and Line G_6, currently underutilized at ~30%.
- Align batch sizes with production capacity to prevent overburdening low-capacity lines while maximizing high-output facilities.
- Improve demand planning for Q1 (historically lower sales) and ramp up inventory for Q4 (peak demand).
- Sales Forecast & Pricing Adjustments
 - Prepare for Q4 2026 as the highest sales period by aligning marketing efforts, promotions, and supply chain readiness.
 - Address Q1 slowdown with strategic promotions, early-year discounts, and targeted bundled offerings.
 - Adopt value-based pricing instead of aggressive discounting in months where demand remains stable to preserve profit margins.
- By implementing these strategies, the company can enhance revenue growth, improve operational efficiency, and build a more resilient supply chain.

Customer Segmentation & Engagement Strategies

- Loyalty Programs: Implement tiered loyalty programs to reward high-spending and frequent customers (Clusters 1 and 2).
 - Re-Engagement Campaigns: Target Cluster 3 with personalized offers and surveys to win them back.
 - Bulk Discounts: Offer volume-based discounts to attract Clusters 2 and 4, who are likely bulk buyers.
 - New Product Launches: Use Clusters 1 and 2 as early adopters for new or premium beverage products
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Limitations

This analysis is based on an educational dataset, which presents several limitations that may impact the accuracy and depth of insights.

- Data Inconsistencies: The dataset contains inconsistencies, particularly with ID and date values not following a sequential order, which may affect trend analysis.
- Unlinked Supplier Table: The supplier table is not connected to other tables, limiting the ability to analyze supplier-related transactions and dependencies.
- Inventory and Production Discrepancies: There are inconsistencies in the calculation of inventory quantity and production quantity, making it challenging to conduct a detailed analysis of stock levels and production efficiency.
- Geographical Constraints: City names in the dataset do not reflect actual locations, restricting the ability to perform precise geographical analysis and market targeting.

These limitations should be considered when interpreting the findings and making data-driven decisions.