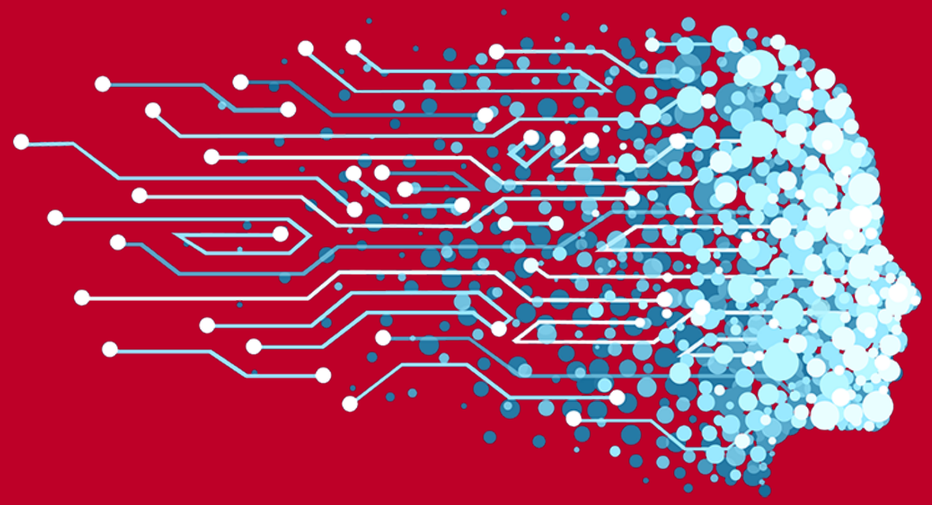
Data Science Case Study

An Overview of Supply Chain Analysis



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on 29 March 2024

Understanding the Data

Sales Data (sales_test.csv)

- Comprehensive Sales Transactions: Captures detailed sales transactions, including dates, items, and quantities.
- Key Metrics:
  - Order No: Unique identifier for each sales order.
  - Order Date: The date when each order was placed.
  - Item Code: SKU identifying each product.
  - Qty Ordered: The number of units ordered by clients.
  - Qty Shipped: Actual units delivered to clients.

Cancellations Data (canceled_test.csv)

- Order Cancellation Records: Details on orders that were cancelled after being placed, including cancellation dates and quantities.
- Key Metrics:
  - Order No: Corresponds to the sales order numbers in the sales data for matching transactions.
  - Qty Cancelled: The number of units cancelled from each order.

We integrated the sales and cancellations data by using an outer join, ensuring we captured all transactions, including those without cancellations, to provide a comprehensive view of order fulfilment and customer demand.

Objective of the Analysis

Overview: Leveraging sales and cancellation data to drive operational excellence and customer satisfaction in our supply chain.

Key Analysis Goals:

- Trend Identification: Uncover patterns in sales and cancellations over time to identify demand trends and operational bottlenecks.
- SKU and Client Prioritisation: Apply ABC classification to SKUs and clients to strategically allocate resources and focus on high-value areas.
- Service Level Assessment: Calculate service levels by SKU and client to evaluate fulfilment efficiency and identify improvement opportunities.
- Actionable Insights: Derive actionable insights from the data analysis to enhance inventory management, reduce cancellations, and improve overall service delivery.

Key Metrics from Sales and Cancellations

	Qty Ordered	Qty Cancelled	Qty Shipped
count	31977.000000	31977.000000	31977.000000
mean	6.728211	0.997999	5.730212
std	44.791064	29.203275	34.129841
min	1.000000	0.000000	0.000000
25%	1.000000	0.000000	1.000000
50%	1.000000	0.000000	1.000000
75%	3.000000	0.000000	2.000000
max	4500.000000	4500.000000	2000.000000

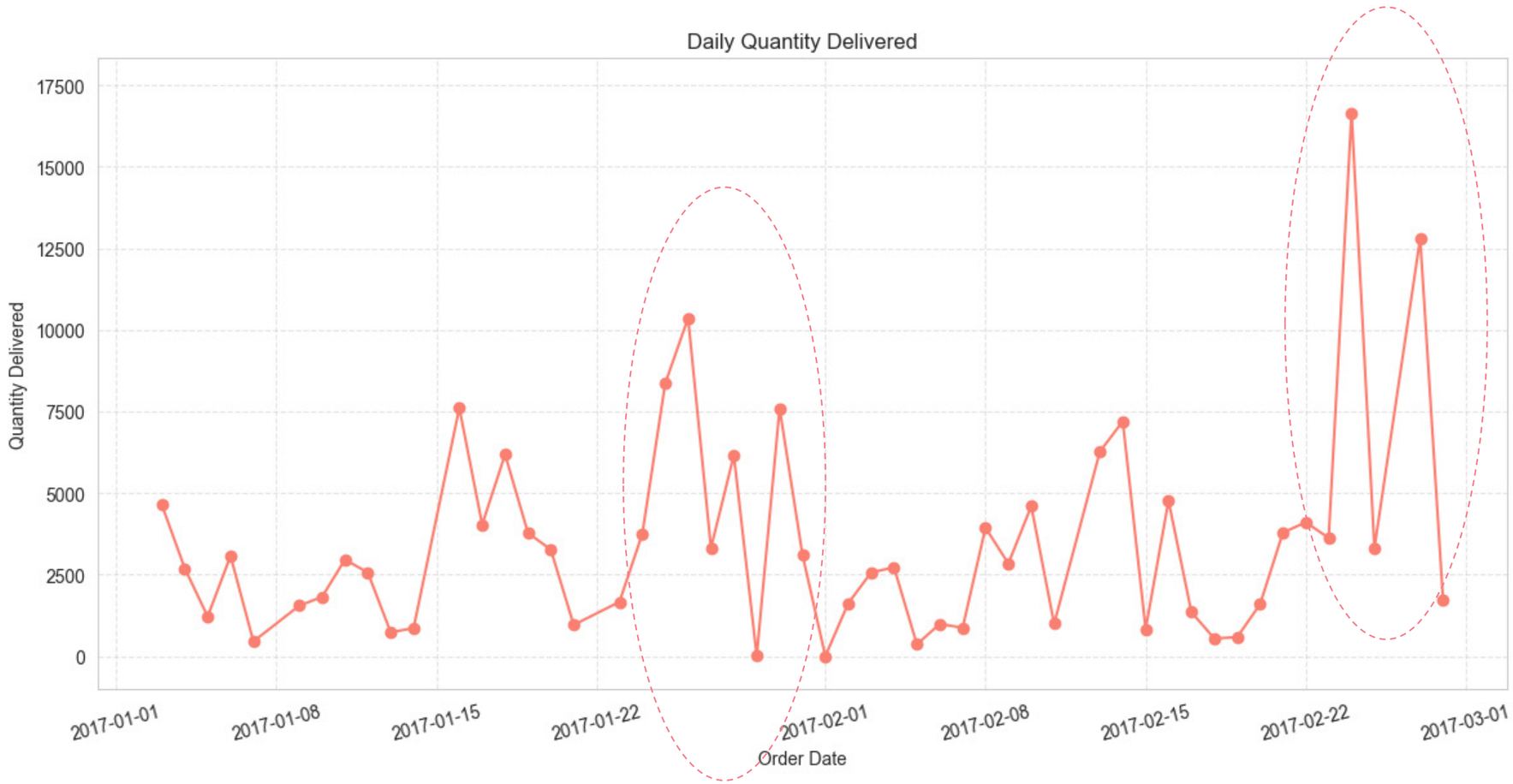
- **Total Records:** 31,977 transactions captured in the period.
- **Orders:** On average, around 7 items per order with a maximum of 4,500 items ordered.
- **Deliveries:** Typically, 5 to 6 items delivered per order, with up to 2,000 items delivered in a single order.
- **Cancellations:** Relatively rare, on average less than 1 item cancelled per order.

The standard deviation suggests significant variability in order sizes and quantities delivered.

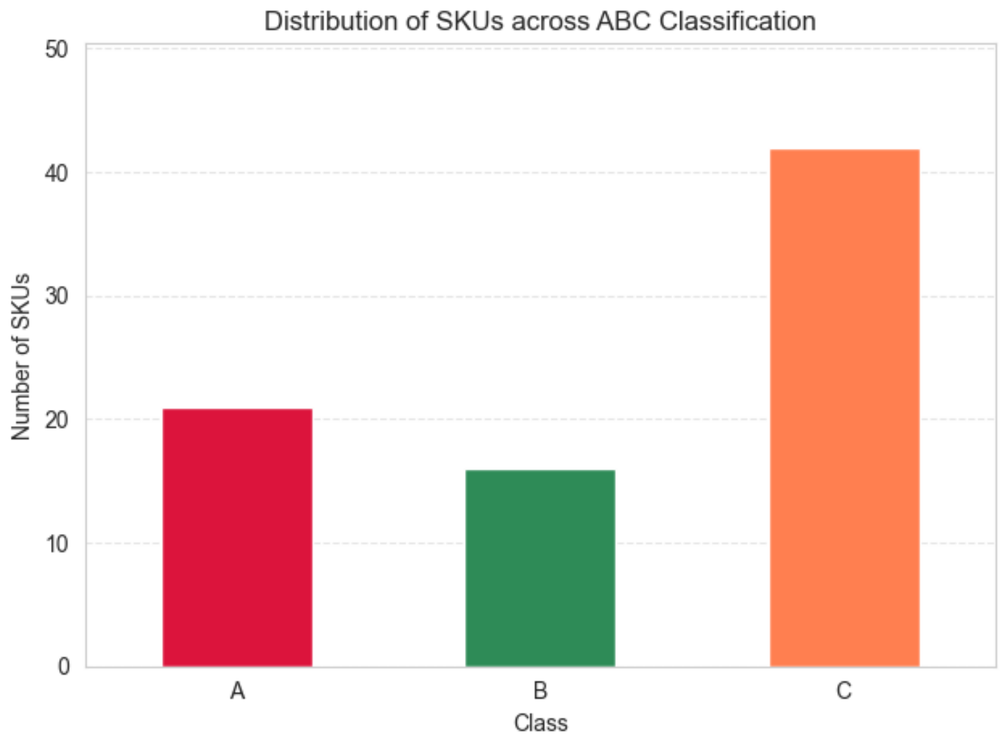
- Majority of deliveries involve fewer than 10 items, consistent with the median value.
- Presence of outliers indicates occasional large orders.
- Wide range of deliveries, up to 2,000 items, signifies diverse order sizes.

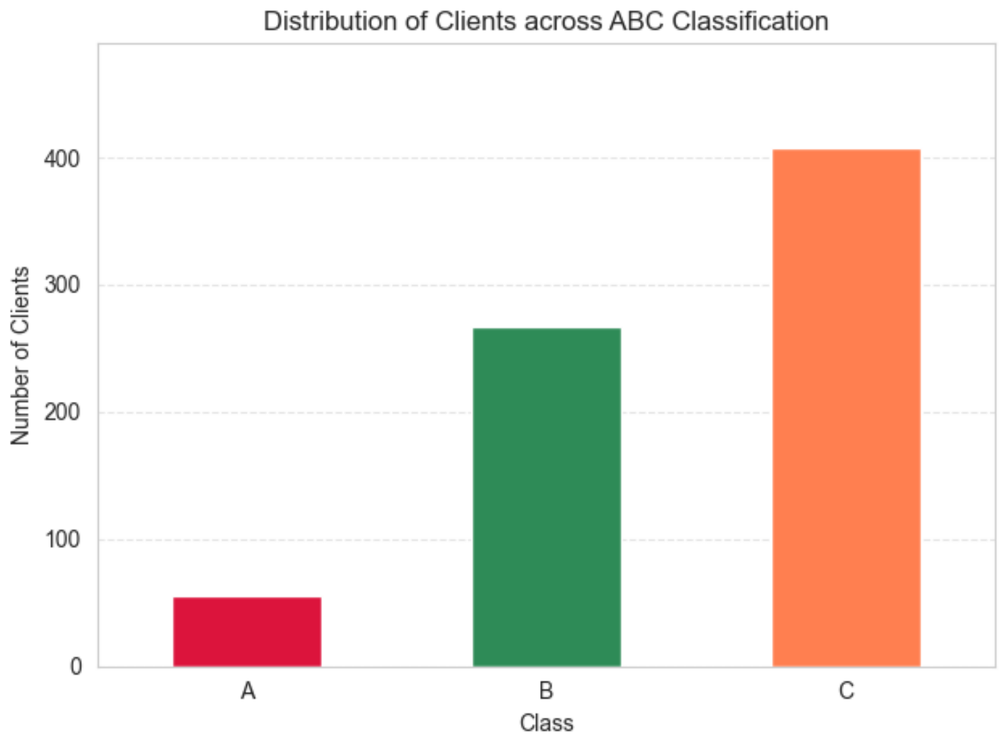
Daily Delivery Volume Fluctuations

- Fluctuating daily delivery volumes, with several notable peaks suggesting high-demand periods.
- Sharp increases towards the end of each month may indicate *a trend or seasonal demand spike*.
- Potential for further investigation into causes of these peaks for better demand forecasting.



ABC Classification of SKUs and Clients

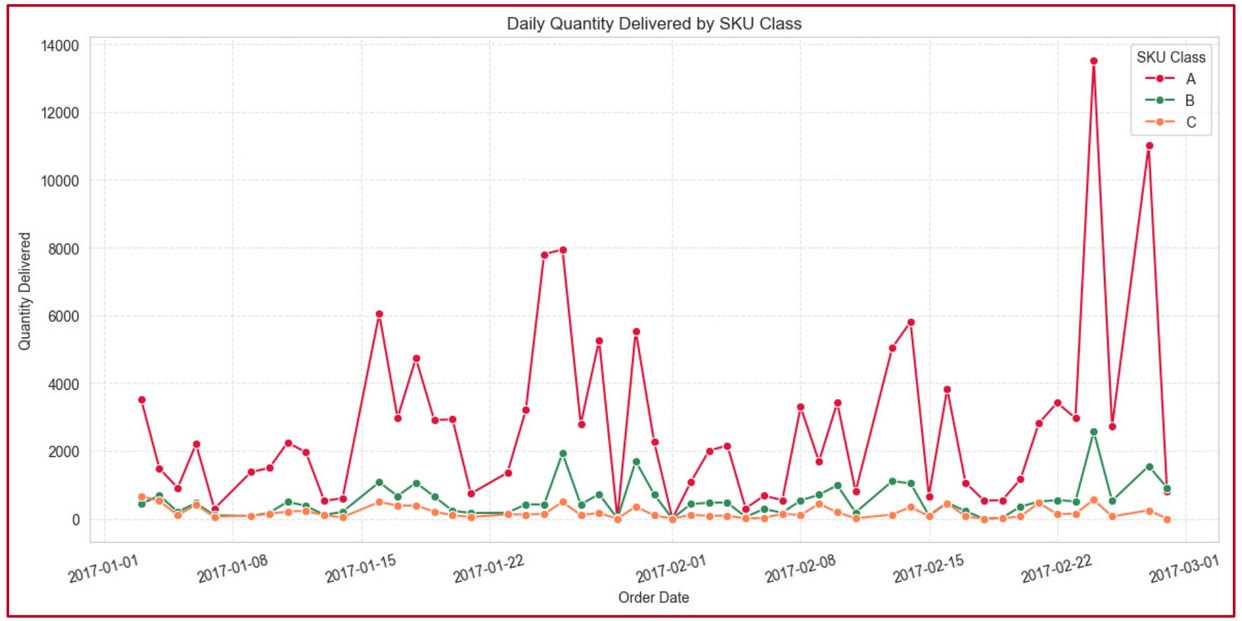


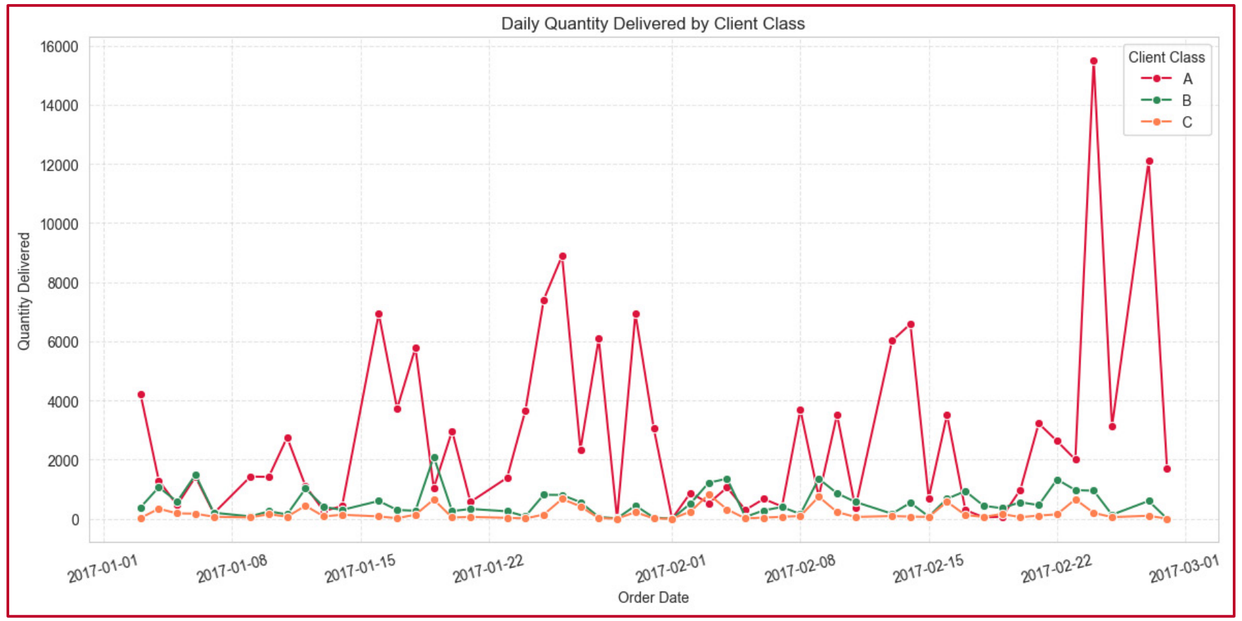


- A segment of SKUs (Class A) represents high-volume or high-value items critical to sales performance.
- Classes B and C SKUs contribute less to sales but might be essential for product diversity and customer satisfaction.

- A small number of clients (Class A) account for a significant portion of business, indicating a concentration of high-value relationships.
- Classes B and C represent clients with medium to lower transaction volumes, respectively.

Delivery Performance by ABC Classification





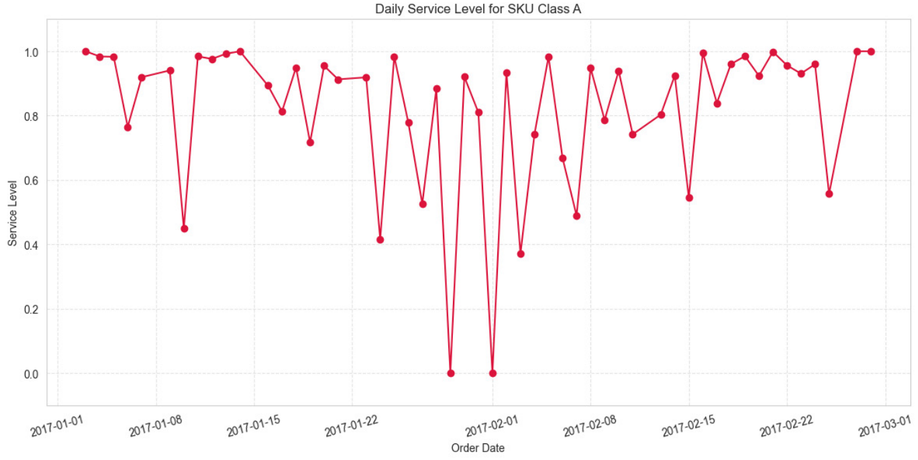
- The daily quantity delivered fluctuates, with Class A SKUs and Clients often showing the highest variability, which indicate high demand variability or stock issues.
- Classes B and C show more stable, but generally lower volumes, which might suggest steady but low demand, or well-managed stock levels.

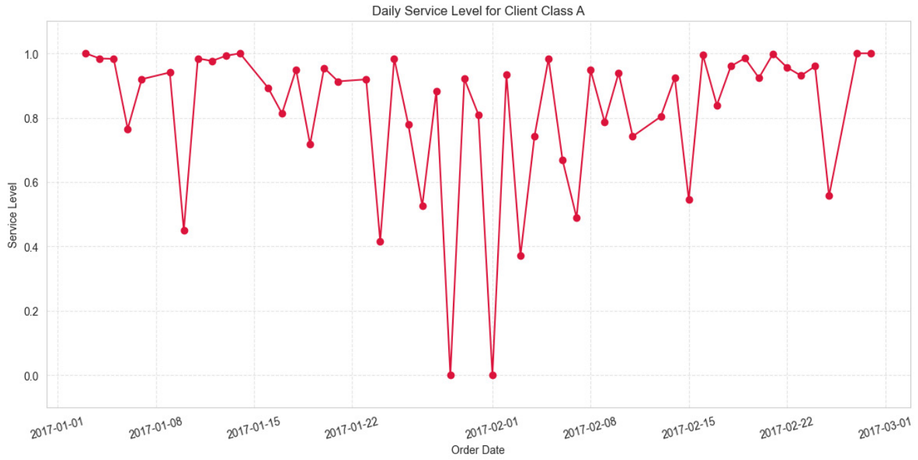
Insights:

- Investigate the peaks for Class A to understand potential causes such as promotional events, seasonal demand, or supply chain disruptions.
- Consider strategies to stabilise the variability in Class A deliveries to improve predictability and efficiency.

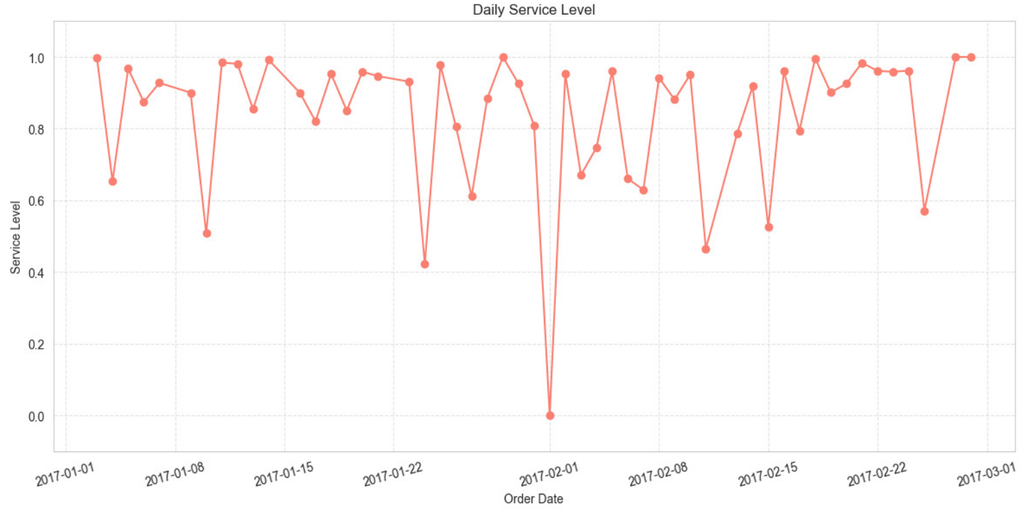
Analysis of Daily Service Level

Class A SKUs and Clients generally maintain high service levels, yet occasional dips could signal specific fulfilment challenges: significant variance in service levels, indicating potential stock issues or demand forecasting errors.





Overall service levels are relatively stable, but sudden drops warrant further investigation.



Recommendations:

- **Action 1:** Investigate the causes of significant dips in service level to prevent future occurrences.
- **Action 2:** Maintain robust communication with Class A clients to understand and meet their needs effectively.
- **Action 3:** Implement advanced analytics to predict and mitigate factors leading to service level volatility.

Service Level Excellence and Opportunities for Class A

Top 5 SKUs - Highest Service Level

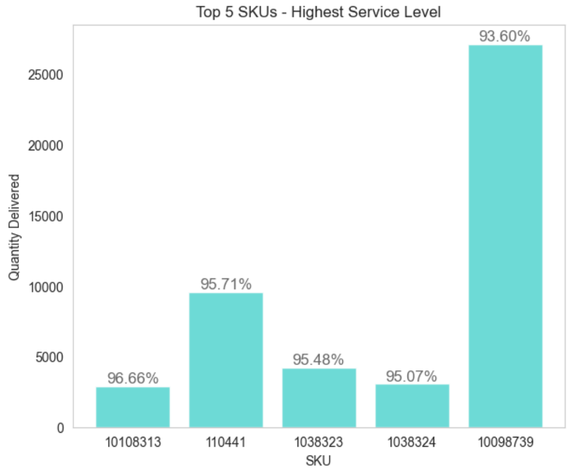
Analysis: The SKUs with the highest service levels are performing exceptionally well, with service levels above 93%. This suggests a strong supply chain and fulfilment process for these products.

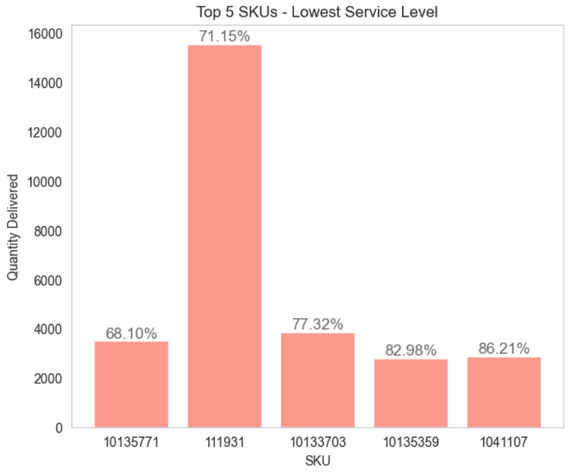
Recommendation: Continue to monitor these high-performing SKUs for sustained excellence and use them as benchmarks for other products. Investigate what drives their high service levels and apply these practices across the board.

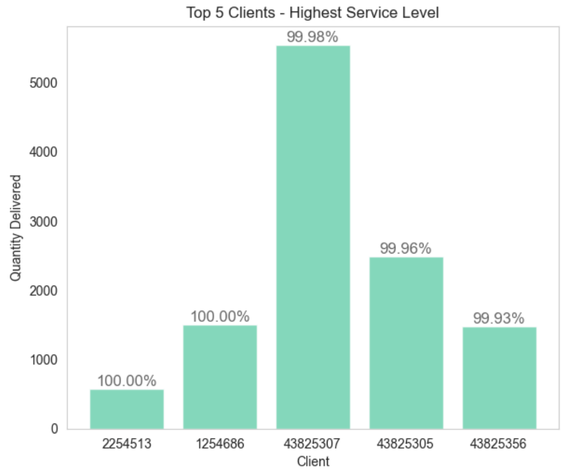
Top 5 SKUs - Lowest Service Level

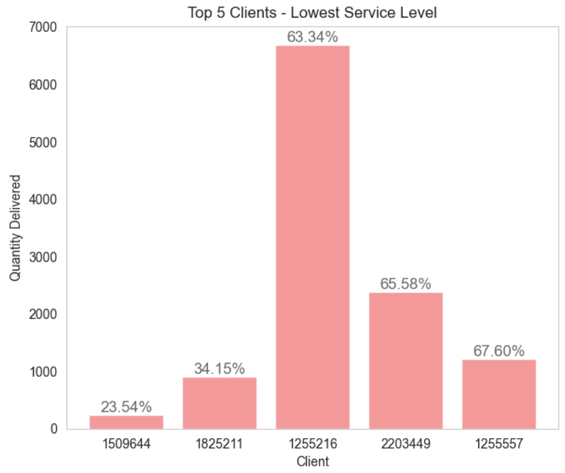
Analysis: The SKUs with the lowest service levels present a significant gap, with service levels as low as 68%. This indicates potential issues in inventory management, demand forecasting, or supplier reliability.

Recommendation: Conduct a root cause analysis to determine why these SKUs are underperforming and develop targeted strategies to improve their service levels. Consider additional training for teams managing these SKUs or a review of supplier contracts.

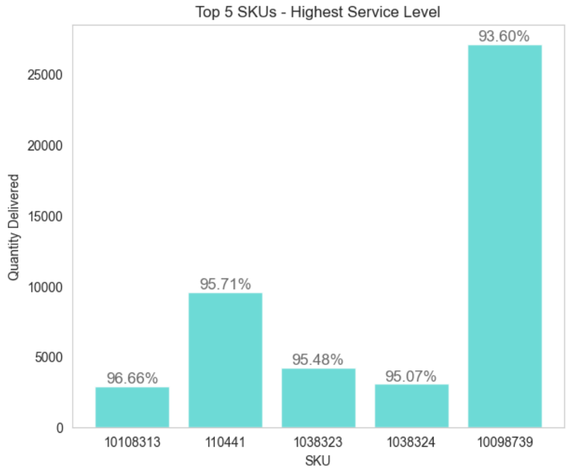


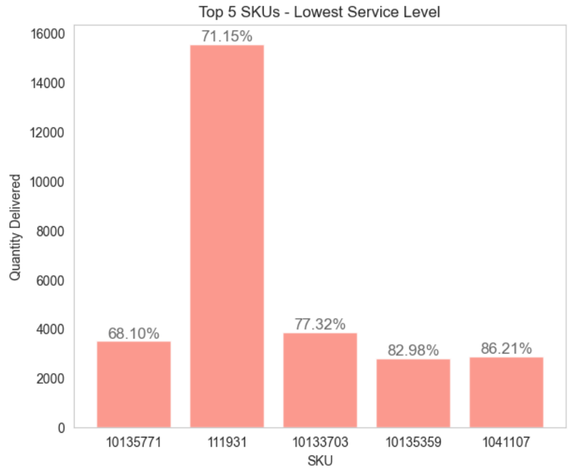


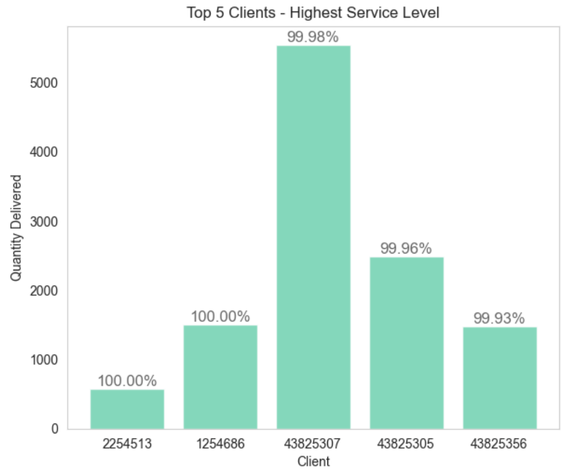


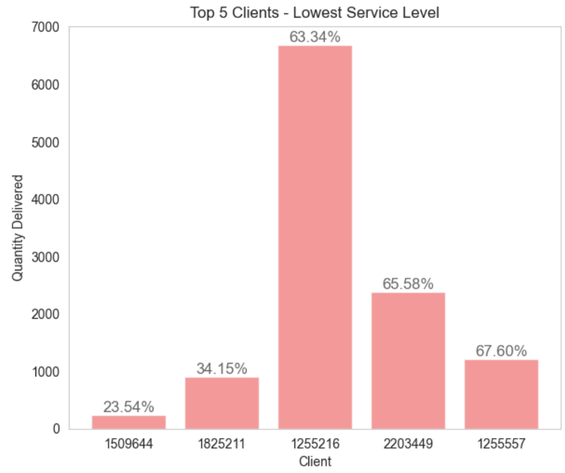


Service Level Excellence and Opportunities for Class A









Top 5 Clients - Highest Service Level

Analysis: The top clients are receiving near-perfect service levels, which is indicative of successful client management strategies and operational efficiency.

Recommendation: Maintain high-touch relationships with these clients to keep service levels high. Explore opportunities for upselling or providing additional value-added services to further cement these relationships.

Top 5 Clients - Lowest Service Level

Analysis: The service levels for the lowest performing clients suggest that there are significant issues that could affect client satisfaction and retention.

Recommendation: Prioritise these clients for service recovery strategies and personalised engagement to address their specific pain points. Improve communication channels and response times to enhance their experience and service perception.

Summary with Strategic Recommendations

- Use SKUs with high service level as case studies to replicate success across other product lines.
- Analyse supply chain and inventory practices to identify and rectify causes of underperformance.
- Prioritise improvements in SKUs with low service levels, as these could significantly impact customer satisfaction and retention.
- Engage clients with high service level for feedback to understand what is working well and consider loyalty programmes.
- For clients with the lowest service levels, develop a personalised recovery strategy that could include special attention, discounts, or service credits to rebuild trust and prevent churn.
- Utilise data from top-performing SKUs and clients to create a company-wide best practices guide.

Thank you