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Aerospace Supply Chain Performance Analysis Project Report

Turbine Blade Supply Chain Analysis Using Excel, Power BI, and Simulation Modeling

1. Abstract

This project analyzes the supply chain performance of turbine blade components, focusing on supplier delivery performance, lead time variability, defect rates, and inventory risk. Through Excel, Power BI visualizations, and simulation modeling, the study identifies top-performing suppliers, provides recommendations to reduce inventory costs, and offers strategies to mitigate stockout risks. VendorA and VendorB emerge as the most reliable, while VendorC, VendorD, and VendorE exhibit higher lead time and defect rates. Targeted recommendations address supplier management, safety stock adjustments, and the adoption of real-time monitoring dashboards.

2. Objectives

- Assess supplier delivery performance and variability in lead times.
- Build an inventory simulation to estimate stockout risks.
- Develop data-driven inventory monitoring dashboards.
- Offer actionable recommendations to boost supply chain efficiency.

3. Dataset Summary

- **Total Orders**: 1,000
- **Suppliers**: VendorA, VendorB, VendorC, VendorD, VendorE
- **SKUs**: TB 100, TB 200, TB 300

Sample Orders Data

order_id	order_date	delivery_date	supplier	sku	order_qty	received_qty	lead_time_days	defect_rate	on_time
ORD10000	2024 08 02	2024 08 12	VendorA	TB 100	10	9	10	0.0062	1
ORD10001	2024 08 13	2024 08 26	VendorC	TB 100	50	48	13	0.0308	0
ORD10002	2024 08 17	2024 08 22	VendorB	TB 100	20	19	5	0.0113	1
ORD10003	2024 08 20	2024 08 28	VendorA	TB 300	20	19	8	0.0071	1
ORD10004	2024 08 21	2024 09 04	VendorE	TB 100	10	9	14	0.0213	0
ORD10005	2024 08 22	2024 08 30	VendorE	TB 200	10	9	8	0.0305	1
ORD10006	2024 08 22	2024 09 01	VendorA	TB 100	100	99	10	0.0042	1

ORD10007	2024 08 29	2024 09 07	VendorA	TB 100	50	50	9	0.0	1
ORD10008	2024 09 01	2024 09 03	VendorB	TB 300	10	9	2	0.01	1
ORD10009	2024 09 05	2024 09 17	VendorE	TB 100	10	9	12	0.0152	0

4. Supplier Performance Metrics

Supplier	Total Orders	Avg Lead Time Days	Std Dev Lead Time	On-Time %	Avg Defect Rate %	Total Qty Ordered	Total Qty Received
VendorA	198	6.35	2.86	94.44	0.68	5,490	5,348
VendorB	179	6.39	2.97	91.06	0.82	5,420	5,273
VendorC	212	11.37	2.95	38.68	1.97	5,520	5,281
VendorD	212	11.58	2.94	33.96	1.97	6,100	5,848
VendorE	199	11.22	2.90	41.21	2.07	6,320	6,068

5. Charts and Visuals

Chart 1 Supplier On-Time Delivery %

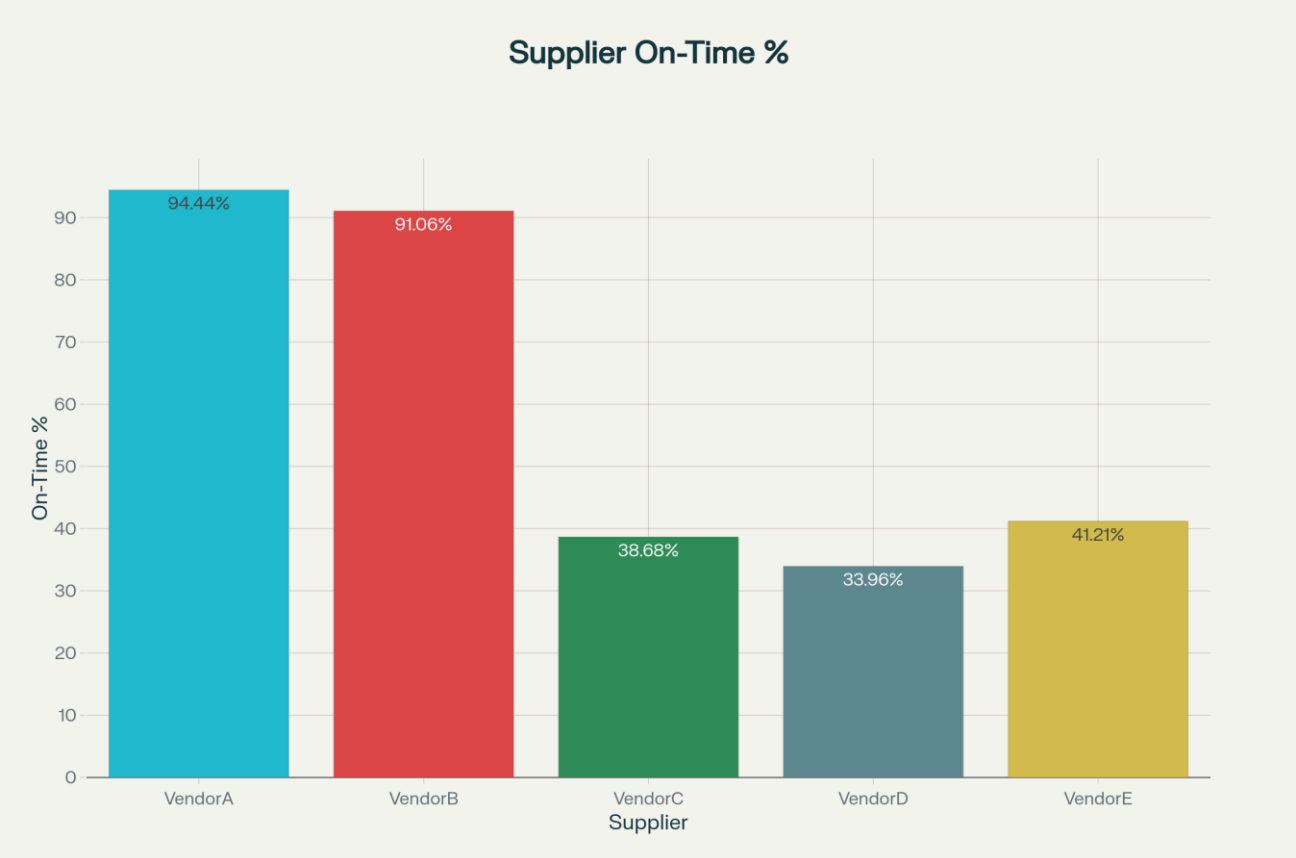


Chart 2 Lead Time Distribution

This histogram displays the distribution of lead times (in days) across all suppliers, as observed in your dataset. Lead Time Distribution Across All Suppliers Histogram):

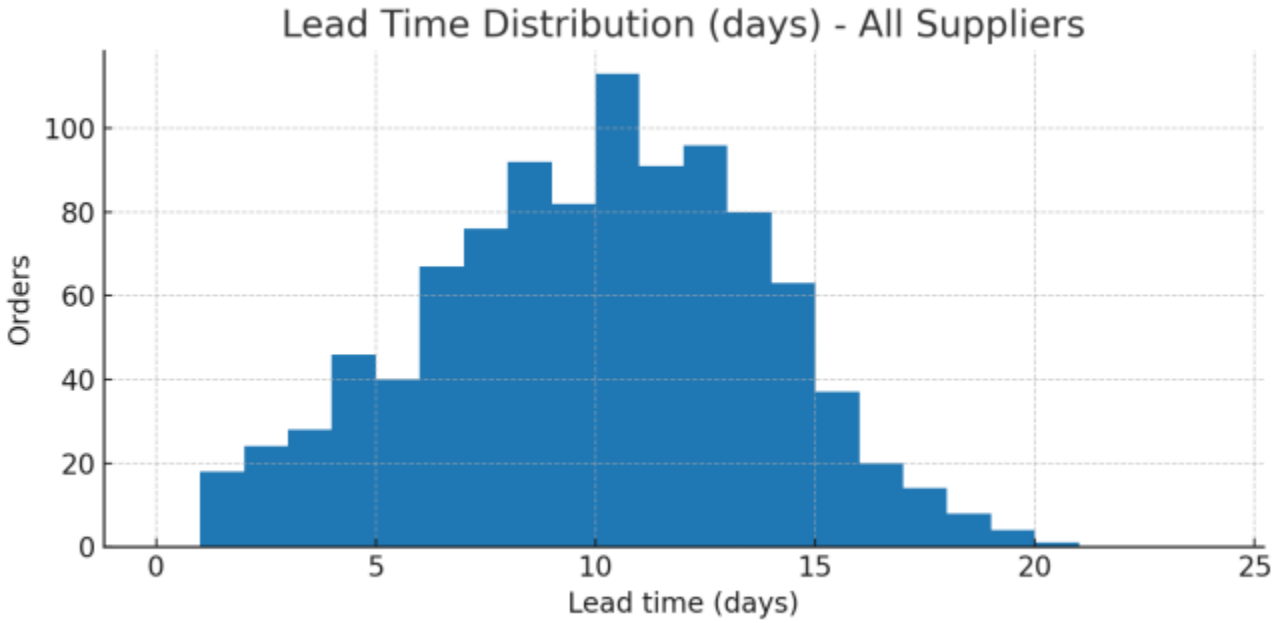
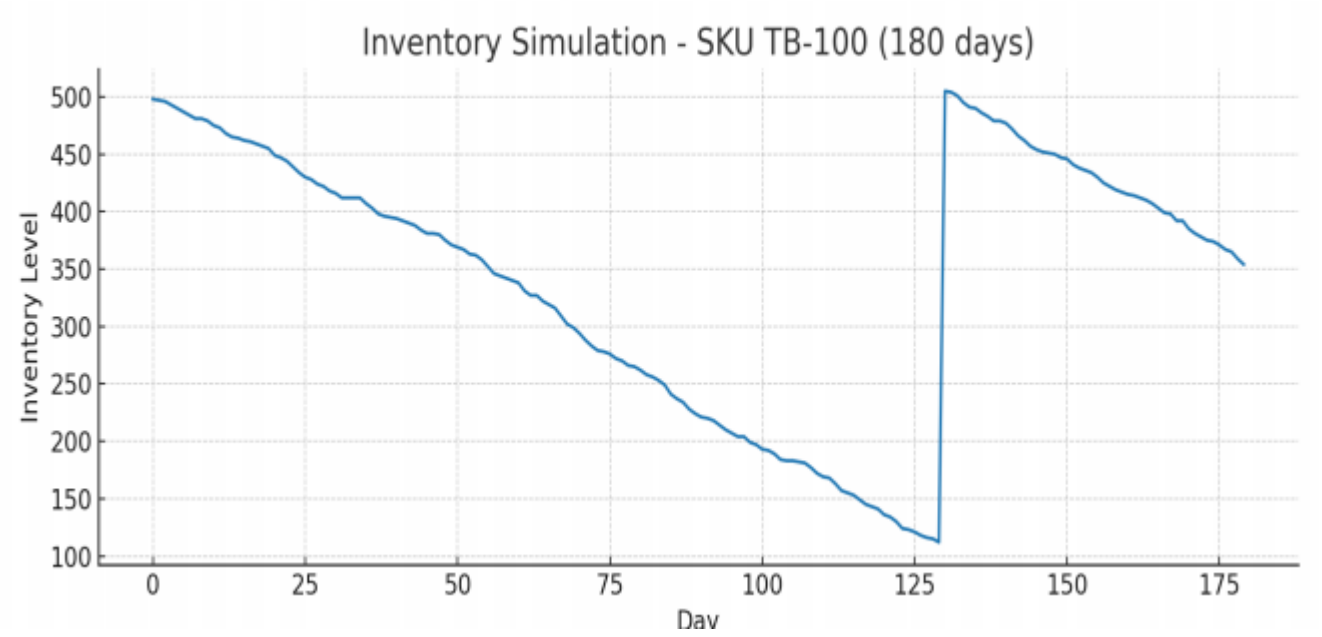


Chart 3 Inventory Simulation Results for SKU TB 100

This line chart shows inventory levels over simulation periods, highlighting points of stockout (when inventory reaches zero) for SKU TB 100, and demonstrates the importance of increased safety stock to mitigate lead time variability risks.



6. Inventory Simulation Results

- **SKU** TB 100
- **Reorder Point ROP** 150 units •

Reorder Quantity: 400 units

- The simulation revealed occasional stockouts, particularly with suppliers exhibiting higher lead time variability VendorC, VendorD, VendorE .
- There is a clear need to **increase safety stock** to offset risk from unpredictable supply lead times.

7. Key Insights

- **VendorA and VendorB** provide the shortest lead times and highest on-time delivery percentages.
- **VendorC**, **VendorD**, **and VendorE** suffer from long lead times, lower on-time rates, and higher defect rates. •

Inventory risks and occasional stockouts arise mainly due to the variability in supplier lead times.

- **Adjusting safety stock** upwards is essential for mitigation.
- Dashboard-driven monitoring enables early interventions to supplier issues.

8. Recommendations

Prioritize VendorA and VendorB for all critical and time-sensitive turbine blade orders.

Negotiate stricter SLAs or improvement plans with VendorC, VendorD, and VendorE.

Adjust safety stock using calculated lead time standard deviation to buffer against delays.

Implement Power BI dashboards for real-time visualization and supplier performance tracking.

Conduct quarterly supplier reviews to enforce discipline on quality and delivery adherence.

9. Conclusion

The project demonstrates that optimizing the turbine blade supply chain depends on choosing reliable suppliers, strictly monitoring performance metrics, and proactively managing inventory. Strategic implementation of these findings will build resilience, reduce costs, and minimize operational disruptions.