**(Supplier Analysis ):**

* **Supplier 4** shows **zero reliability** and all products failed inspection — **not recommended for critical product lines**.
* **Supplier 1** has **the highest revenue and sales volume**, but still struggles with **low reliability (48.1%)**.
* **Supplier 2 and 3** have **very high lead times** and **performance variability**, which can impact delivery timelines and planning.
* **Skincare products** are the top-performing category across all suppliers.
* **Route A** appears frequently as the **highest transportation cost**, especially for the weaker-performing suppliers.

**Suggested Solutions:**

* **Phase out Supplier 4** and avoid assigning key products due to total inspection failures.
* **Negotiate better terms or performance improvements** with Supplier 1 to boost reliability.
* **Consider onboarding new suppliers** with better quality control and stable delivery times.
* **Optimize logistics routing**, especially Route A, to reduce high transportation costs.
* **Assign skincare product manufacturing** to more reliable and faster suppliers for efficiency.

**Manufacturing Insights by Product Category**

* **Skincare**:
  + **Highest production volume (24,366)** but **high inspection failure by suppliers (197.5%)**.
  + **Defect rate: 2.33**, average MLT: 13.78 days.
* **Haircare**:
  + **Highest defect rate (2.48)** and highest **inspection failure rate by product (38.24%)**.
  + MLT: 17.07 days – the **slowest category**.
* **Cosmetics**:
  + **Lowest defect rate (1.92)** and **shortest MLT (13.31)**.
  + But still suffers from **165% supplier failure** and **38.46% product inspection failure rate**.

**Suggested Solutions**

1. **Product-Specific Focus:**
   * For **Haircare**, reduce the defect rate by **revising product design specs or improving quality control processes**.
   * For **Skincare**, identify top-performing suppliers only and **centralize production with the most efficient**.
   * **Shift more manufacturing to Cosmetics**, where defect rates and lead times are more favorable.
2. **Manufacturing Process Improvements:**
   * **Implement stricter pre-shipment inspections**.
   * **Adopt Lean or Six Sigma principles** for continuous improvement.
   * **Digitize manufacturing tracking** to spot anomalies in real-time.

**Inventory Management Insights**

**General**

* **Total Stock Levels:** 5,000 units
* **Stock Turnover Efficiency:**
  + A **higher turnover ratio** indicates faster stock movement, which is preferable.

**Stock Turnover Ratio by Supplier**

* **Supplier 1** has the highest turnover, suggesting better efficiency.
* **Supplier 4** stands out with the lowest performance, aligned with your quality findings.

**Stock Turnover by Product**

* **Skincare** performs best with the fastest inventory movement.
* **Cosmetics** has the slowest turnover – possible overstock or weaker demand.

**Average Stock Level by Product**

* **Skincare** is leanest, aligning with its high turnover rate.

**Total Stock vs. Order Quantities**

* **Skincare** is understocked despite being the fastest moving.
* **Cosmetics** may be overstocked and underperforming.

**Recommendations**

1. **Reallocate Inventory Focus:**
   * Reduce **cosmetics** stock levels, as they show low turnover.
   * **Increase skincare** inventory to meet demand and reduce lost sales.
2. **Review Supplier 4’s Involvement:**
   * Low turnover and prior quality issues suggest reconsidering their role.
3. **Forecast Based on Turnover:**
   * Align purchasing with actual product movement trends, especially for skincare.

**Customer Analysis Insights**

1. **Gender Distribution (SKU %)**
   * The largest customer group (31%) chose "Prefer not to say."
   * This indicates a need for more inclusive, non-gendered marketing and product labeling.
2. **Revenue Contribution**
   * Customers who "Prefer not to say" generated the **highest revenue** ($173.09k).
   * Female customers, despite representing only 25% of SKUs, generated a strong $161.51k.
   * This shows **a high average order value** for both these groups.
3. **Top Product Preference**
   * Skincare dominates across all genders, except for "Prefer not to say," where **haircare** is the top choice.
   * Tailoring product bundles and promotions by gender preference can improve conversions.
4. **Units Sold**
   * "Prefer not to say" segment also leads in units sold (15,211), followed by females (12,801).
   * Suggests high engagement from this group – a strong case for enhancing personalization even without explicit gender data.

**Problems Identified**

* Lack of targeted marketing for "Prefer not to say" group, despite their high revenue and purchase volume.
* Missed personalization opportunities due to reliance on traditional gender segmentation.
* Potential product mismatch for male and non-binary segments, who show lower revenue and volume.

**Recommended Solutions**

1. **Adopt Inclusive Marketing:**
   * Use neutral language and visuals in campaigns.
   * Offer product recommendations based on behavior, not gender.
2. **Behavioral Segmentation:**
   * Segment users by purchasing patterns and interests rather than gender.
   * Use AI to offer personalized suggestions.
3. **Product Strategy Refinement:**
   * Promote haircare more heavily to “Prefer not to say” customers.
   * Reassess product appeal for male and non-binary users to optimize engagement.
4. **Data-Driven A/B Testing:**
   * Test inclusive vs. gender-targeted campaigns.
   * Measure the impact on click-through, conversion, and average order value.

**Shipping and Transportation analysis**

**1. Findings**

* **Total transportation cost:** 52.92K
* **Total shipping cost:** 554.82K
* **Average shipping time:** 5.75 days
* **Most used transportation mode:** Road

**Transportation Cost by Mode (Average):**

* Air: 561.71
* Road: 553.39
* Rail: 541.75
* Sea: 417.82

**Transportation Cost by Mode (Total):**

* Road: 16.05K
* Rail: 15.17K
* Air: 14.6K
* Sea: 7.1K

**Average Shipping Time & Cost by Location:**

* **Fastest:** Bangalore (5.28 days)
* **Slowest:** Chennai (6 days)
* **Highest shipping cost:** Mumbai (6.25)
* **Lowest shipping cost:** Chennai (4.69)

**Route Insights:**

* **Route A** is the most expensive, especially by Air and Rail.
* **Route B** shows higher Road cost than Air — a sign of inefficiency.
* **Route C** (repeated Route A in data) has the lowest total transportation costs.

**2. Problems**

* **Air transportation** is widely used despite being the most expensive.
* **Road** is the most used mode, but not cost-efficient in some routes (e.g., Route B).
* **Mumbai** has the highest shipping cost — potential inefficiencies in supplier or carrier choice.
* **Chennai**, while low in cost, has the longest shipping time.
* **Route A** incurs high transportation costs across all modes.

**3. Solutions**

* **Optimize Mode Usage:**  
  Shift from **Air** and **Road** to **Sea** or **Rail** when delivery time is flexible to reduce cost.
* **Route Optimization:**  
  Investigate and redesign **Route A** and **Route B** operations to identify delay or high-cost drivers.
* **Location Review:**  
  Evaluate the cost structure of **Mumbai** deliveries and assess if alternate suppliers or logistics providers can reduce cost.
* **Balance Cost vs Time:**  
  For **Chennai**, consider improving shipping time even if it increases cost slightly, depending on customer expectations.
* **Smart Mode Assignment:**  
  Develop a **mode-selection logic**:
  + Sea for non-urgent, low-cost shipping
  + Road for medium urgency and moderate cost
  + Air only for high-priority or high-value goods