**PROJECT REPORT**

1. **Project Title: Supply Chain Management Project Report**

**Course: Business Analyst Intern**

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1. **Acknowledgement:**

I would like to thank everyone who supported and guided me during this project. Their help made it possible to complete this work successfully.

1. **Abstract**:

This report presents a comprehensive analysis of business operations, leveraging data from various aspects including overall performance, product insights, and supplier management. The objective is to identify key trends, performance drivers, and areas for improvement in revenue, product sales, inventory, and cost management. Insights derived will support strategic decision-making in procurement, supply chain optimization, and sales and marketing efforts.

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2. **Introduction:**

In today's competitive business landscape, data-driven decision-making is paramount for sustained growth and efficiency. This project aims to provide a holistic view of the company's operational performance through a series of interactive dashboards. By analyzing key metrics across revenue, product performance, and supplier effectiveness, we seek to uncover actionable insights that can lead to optimized resource allocation, improved supply chain resilience, enhanced product profitability, and ultimately, greater overall business success. The report covers an overview of financial health, detailed product performance, and an in-depth look at supplier contributions and costs.

1. **Objectives:**

* To provide an overview of key operational metrics including total revenue, total products sold, stock level, and total order quantities.
* To analyze product performance based on average profit margin by product type and identify top and bottom-performing SKUs by revenue and quantity.
* To assess inventory health through stock levels by SKU and order quantities relative to manufacturing lead times.
* To evaluate supplier performance by analyzing total costs, shipping costs, defect rates by transportation mode, and profit margin versus defect rates.
* To understand customer demographics' impact on total revenue.
* To identify opportunities for optimizing product offerings, inventory management, supplier selection, and logistics.

1. **Tools and Technlogies:**

* Microsoft Excel: Potentially used for initial data collection, manual data entry, small-scale data cleaning, and preliminary aggregation of raw sales, inventory, and supplier cost data. It could serve as an interim staging area for data before being loaded into more robust systems or directly into Power BI for smaller datasets.
* SQL (Structured Query Language): Likely employed for querying, extracting, transforming, and loading large volumes of structured data from relational databases. This includes performing complex joins between sales, inventory, and supplier databases, filtering specific periods, aggregating data, and ensuring data integrity and consistency before visualization in Power BI. SQL enables efficient data preparation for sophisticated analysis.
* Microsoft Power BI: The core visualization and business intelligence tool used. Its capabilities include:
* Data Connectivity: Connecting to various data sources (including Excel files and SQL databases).
* Power Query (Data Transformation): Performing robust data cleaning, reshaping, and merging operations to prepare raw data for analysis.
* Data Modeling (DAX - Data Analysis Expressions): Building a sophisticated data model, establishing relationships between tables, and creating calculated measures and columns (e.g., Total Revenue, Avg Profit Margin %, Total Costs) to derive key insights.
* Interactive Visualizations: Designing and building the interactive dashboards with various charts, graphs, and tables that allow users to drill down, filter, and explore data dynamically.
* Report Publishing: Sharing the interactive reports and dashboards with stakeholders for decision-making..

1. **Methodology:**

The analysis was conducted by systematically reviewing three distinct Power BI dashboard views: "Overview," "Product Insight," and "Supplier Insight." Each view provides a different perspective on the business data, allowing for a comprehensive assessment.

* **Data Extraction & Preparation:** Assumed raw sales, cost, inventory, and supplier data was extracted from source systems (likely using SQL) and potentially pre-processed in Excel for basic hygiene. This prepared data was then loaded into Power BI.
* **Dashboard Navigation & Interpretation:** Each dashboard view was examined to understand the displayed KPIs, trends, and distributions.
  + **Overview:** Focused on high-level financial and operational summaries, customer demographics, and overall defect rates.
  + **Product Insight:** Delved into product-specific metrics, including sales by SKU, profit margins by product type, stock levels, and lead times.
  + **Supplier Insight:** Concentrated on supplier performance, costs, defect rates by transportation mode, and stock contributions.
* **Data Analysis & Findings Generation:** Insights were extracted by comparing values, identifying patterns in charts (e.g., trends, distributions, outliers), and correlating different metrics across the dashboards. This involved looking at top/bottom performers, major cost drivers, and areas of inefficiency.
* **Recommendation Formulation:** Based on the identified findings, actionable recommendations were developed to address challenges and leverage opportunities for business improvement.

1. **Analysis & Findings:**

**SQL codes:**

**KPIs:**

1. TOTAL REVENUE

select round(SUM(Revenue\_generated),0)as Total\_Revenue

from supply\_chain



2. TOTAL PRODUCT SOLD

select round(SUM(Number\_of\_products\_sold),0)as Total\_Product\_Sold

from supply\_chain



3. TOTAL COST

with cte\_1 as (

select Costs,Manufacturing\_costs,Shipping\_costs,

(Costs + Manufacturing\_costs + Shipping\_costs) as sum\_Cost

from supply\_chain

select round(SUM(sum\_Cost),0) as Total\_Cost

from cte\_1;



4. AVERAGE PROFIT MARGIN%

with cte\_1 as (

select Revenue\_generated, Costs,Manufacturing\_costs,Shipping\_costs,

(Costs + Manufacturing\_costs + Shipping\_costs) as sum\_Cost

from supply\_chain)

select round(avg((Revenue\_generated - sum\_Cost)/Revenue\_generated \*100),2)as Profit\_Margin\_percentage

from cte\_1;

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5. TOTAL STOCK LEVEL

select SUM(Stock\_levels) as Total\_Stock\_Level

from supply\_chain

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6. TOTAL REVENUE BY SKU

select top 10 SKU,round(SUM(Revenue\_generated),2) as Total\_Revenue

from [supply\_chain\_data (1)]

group by SKU

order by Total\_Revenue desc

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7. TOTAL REVENUE BY PRODUCT TYPE

select Product\_type,round(SUM(Revenue\_generated),2) as Total\_Revenue

from [supply\_chain\_data (1)]

group by Product\_type

order by Total\_Revenue desc

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8. TOTAL REVENUE BY CUSTOMER DEMOGRAPHICS

select Customer\_demographics,round(SUM(Revenue\_generated),2) as Total\_Revenue

from [supply\_chain\_data (1)]

group by Customer\_demographics

order by Total\_Revenue desc

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9. TOTAL REVENUE BY SHIPPING CARRIERS

select Shipping\_carriers,round(SUM(Revenue\_generated),0) as Total\_Revenue

from [supply\_chain\_data (1)]

group by Shipping\_carriers

order by Total\_Revenue desc

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10. AVERAGE PROFIT MARGIN% BY SUPPLIER NAME

with cte\_1 as (

select Supplier\_name,Revenue\_generated, Costs,Manufacturing\_costs,Shipping\_costs,

(Costs + Manufacturing\_costs + Shipping\_costs) as sum\_Cost

from supply\_chain)

select Supplier\_name,

round(avg((Revenue\_generated - sum\_Cost)/Revenue\_generated \*100),0)as avg\_Profit\_Margin\_percentage

from cte\_1

group by Supplier\_name;

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11. AVERAGE DEFECT RATE% BY PRODUCT TYPE

select Product\_type,

round(avg(Defect\_rates\*100),2) as avg\_defect\_rate\_percentage

from [supply\_chain\_data (1)]

group by Product\_type

order by avg\_defect\_rate\_percentage desc

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12. ORDER QUANTITY BY SKU

select top 10 SKU, SUM(Order\_quantities) as Total\_Quantity

from [supply\_chain\_data (1)]

group by SKU

order by Total\_Quantity desc

A table with numbers and letters

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13. TOTAL STOCK LEVELS BY SKU

select top 10 SKU, SUM(Stock\_levels) as Total\_Stock\_Level

from [supply\_chain\_data (1)]

group by SKU

order by Total\_Stock\_Level desc

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14. AVERAGE PROFIT MARGIN% BY PRODUCT TYPE

with cte\_1 as (

select Product\_type,Revenue\_generated, Costs,Manufacturing\_costs,Shipping\_costs,

(Costs + Manufacturing\_costs + Shipping\_costs) as sum\_Cost

from [supply\_chain\_data (1)])

select Product\_type,

round(avg((Revenue\_generated - sum\_Cost)/Revenue\_generated \*100),0)as avg\_Profit\_Margin\_percentage

from cte\_1

group by Product\_type;

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15. TOTAL COST BY TRANSPORTATION MODE

with cte\_1 as (

select Transportation\_modes, Costs,Manufacturing\_costs,Shipping\_costs,

(Costs + Manufacturing\_costs + Shipping\_costs) as sum\_Cost

from [supply\_chain\_data (1)])

select Transportation\_modes, round(SUM(sum\_Cost),0) as Total\_Cost

from cte\_1

group by Transportation\_modes

order by Total\_Cost desc;

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16. AVERAGE PROFIT MARGIN% BY PRODUCT TYPE

with cte\_1 as (

select Supplier\_name,Revenue\_generated, Costs,Manufacturing\_costs,Shipping\_costs,

(Costs + Manufacturing\_costs + Shipping\_costs) as sum\_Cost

from [supply\_chain\_data (1)])

select Supplier\_name,

round(avg((Revenue\_generated - sum\_Cost)/Revenue\_generated \*100),0)as avg\_Profit\_Margin\_percentage

from cte\_1

group by Supplier\_name

order by avg\_Profit\_Margin\_percentage desc

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17. AVERAGE DEFECT RATE BY TRANSPORT MODES

select Transportation\_modes,

round(avg(Defect\_rates\*100),2) as avg\_defect\_rate\_percentage

from [supply\_chain\_data (1)]

where Transportation\_modes IN('Road','Rail','Sea','Air')

group by Transportation\_modes

order by avg\_defect\_rate\_percentage desc

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**Power Bi Report:**

Overall Business Performance (Overview Dashboard)

* + Total Revenue: $578K
  + Total Costs: $58K
  + Total Product Sold: 46099 units
  + Avg Profit Margin %: 86.07%
  + Stock Level: 4777 units

Finding: The business shows a healthy average profit margin of over 86%, indicating strong profitability. Revenue is substantial at $578K, with manageable total costs.

Total Revenue by Product Type:

* + Skincare: $0.24M
  + Haircare: $0.17M
  + Cosmetics: $0.16M

Finding: Skincare is the leading product type in terms of revenue, contributing significantly more than haircare and cosmetics.

Total Revenue by Customer Demographics:

* + Unknown: 29.97%
  + Female: 27.96%
  + Male: 21.92%
  + Non-binary: 20.15%

Finding: A significant portion of revenue comes from customers with unknown demographics. Among known demographics, Female customers contribute the most.

Avg Defect Rate % by Product type:

* + Haircare: 36.86%
  + Skincare: 34.65%
  + Cosmetics: 28.49%

Finding: Haircare and Skincare products have higher average defect rates compared to cosmetics, indicating potential quality control issues or higher return rates in these categories.

Total Revenue by Shipping carriers:

* + Carrier B: $0.25M
  + Carrier C: $0.18M
  + Carrier A: $0.14M

Finding: Carrier B handles the largest volume of revenue, suggesting it's the primary shipping partner.

Total Revenue by Top 5 SKU:

* + SKU51: 9.9K
  + SKU38: 9.7K
  + SKU31: 9.7K
  + SKU90: 9.6K
  + SKU2: 9.6K

Finding: These five SKUs are the top revenue generators, with very similar contributions, indicating a relatively even distribution among the highest performers.

Product Insight (Product Dashboard)

Avg Profit Margin % by Product type:

* + Cosmetics: 33.76%
  + Haircare: 33.26%
  + Skincare: 32.98%

Finding: All three product types have very similar average profit margins, hovering around 33%, suggesting consistent pricing strategies relative to costs across categories.

Order quantities by SKU:

* + High order quantities for SKUs like SKU0, SKU32, SKU39, SKU15, SKU4 (all around 96-98 units).
  + Lower order quantities for SKUs like SKU21, SKU72, SKU73, SKU75 (all around 68-72 units).

Finding: There's a notable range in order quantities across SKUs, from approximately 68 to 98 units, highlighting varying demand for individual products.

* + Order quantities by SKU (with Mfg lead time):
  + SKU32 has 6 units with a lead time of 30 days.
  + SKU39 has 7 units with a lead time of 30 days.
  + Several SKUs (e.g., SKU0, SKU49, SKU81, SKU6) have 9 units with 28 days lead time.
  + SKU3 has 24 units with a lead time of 24 days.

Finding: Manufacturing lead times vary, and some high-order quantity SKUs also have longer lead times, which could impact inventory planning. The "Sum of Mfg lead time" for SKU3 with 24 units and 24 days suggests efficient, high-volume production for this SKU compared to others.

Total Price and Total Product Sold by SKU and Product type:

* + This scatter plot visualizes the relationship between price, units sold, and product type.

Finding: Without specific labels or interaction, it's hard to derive precise findings. However, it generally shows a spread of products across different price points and sales volumes, with cosmetics, haircare, and skincare interspersed. There appear to be clusters of products (represented by dots) within certain price and sales ranges.

Stock Level by SKU:

* + SKU12, SKU51, SKU59 have stock levels around 100 units.
  + SKU21, SKU64, SKU71, SKU94 have stock levels around 69-73 units.
  + Finding: Stock levels vary significantly per SKU, suggesting a need for dynamic inventory management based on demand and lead times.

Supplier Insight (Supplier Dashboard)

* + Supplier Analysis (Sum of Costs, Shipping Costs, Mfg Costs):
  + Supplier 1: Total Cost ~ $16.89K (dominated by Sum of Costs and Sum of Mfg Costs)
  + Supplier 2: Total Cost ~ $12.37K
  + Supplier 5: Total Cost ~ $10.56K
  + Supplier 4: Total Cost ~ $10.63K
  + Supplier 3: Total Cost ~ $7.76K (lowest total cost)
  + Finding: Supplier 1 has the highest total cost, followed by Supplier 2. Supplier 3 has the lowest total cost. Manufacturing costs seem to be a significant component of total supplier costs.

Avg Profit Margin % by Supplier name (from Overview dashboard):

* + Supplier 3: 91.08% (Highest)
  + Supplier 2: 87.24%
  + Supplier 5: 85.27%
  + Supplier 1: 84.16%
  + Supplier 4: 84.11% (Lowest)

Finding: Supplier 3, despite having the lowest total costs, yields the highest average profit margin. Supplier 1 and 4 have the lowest profit margins. This suggests Supplier 3 provides better value or has more competitive pricing for its products.

Avg Defect Rate % by Transportation modes:

* + Road: 30.52% (Highest)
  + Rail: 28.71%
  + Sea: 25.5%
  + Air: 20.09% (Lowest)

Finding: Road transportation has the highest defect rate, while Air has the lowest. This highlights potential risks associated with different shipping methods.

Total Costs by Transportation modes:

* + Road: 28.71% (Highest)
  + Rail: 27.25%
  + Air: 13.52% (Lowest)
  + Sea: 30.52% (Highest percentage, likely representing the largest proportion of total costs by mode, although the chart is somewhat ambiguous in its labeling.)

Finding: Sea and Road transportation appear to be the most costly modes, while Air is the least costly. This needs to be cross-referenced with defect rates for overall efficiency.

Supplier name - Sum of Stock levels:

* + Supplier 1: 1142 units
  + Supplier 2: 1022 units
  + Supplier 4: 1061 units
  + Supplier 5: 898 units
  + Supplier 3: 654 units

Finding: Supplier 1 contributes the most to current stock levels, while Supplier 3 (which has the highest profit margin) contributes the least stock. This indicates reliance on certain suppliers for inventory.

Profit Margin and Defect Rate by Supplier Name (Scatter Plot):

Finding: Supplier 3 clearly stands out with a very high profit margin and a relatively low defect rate. Supplier 1 and Supplier 4 show lower profit margins and potentially higher defect rates. Supplier 5 seems to have a similar profit margin to Supplier 1 and 4, but its defect rate location needs clearer interpretation from the chart. This plot is excellent for quickly identifying ideal suppliers (high margin, low defect) and problematic ones.

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**F. Implementation:**

Based on the analysis, the following implementation steps are recommended:

* Product Strategy:
  + Revenue Focus: Prioritize marketing and sales efforts for Skincare products, as they are the highest revenue generators.
  + Quality Control: Investigate the root causes of high defect rates in Haircare and Skincare categories. This could involve reviewing manufacturing processes, supplier quality, or packaging.
  + SKU Optimization: Review the performance of low-order quantity SKUs. Consider running promotions or bundles for these products to boost sales, or evaluate their continued presence in the product portfolio if they are unprofitable.
  + Inventory Management: Implement dynamic inventory reorder points for SKUs based on their individual demand patterns and manufacturing lead times to optimize stock levels and minimize carrying costs and stockouts.
* Supplier Management:
  + Preferred Supplier Program: Strengthen partnership with Supplier 3 due to its high profit margin contribution and relatively low defect rate. Explore opportunities to increase order volume with them.
  + Supplier Evaluation: Conduct a thorough review of Supplier 1 and Supplier 4 due to their lower profit margins and potentially higher defect rates. Negotiate better terms or explore alternative suppliers if performance doesn't improve.
  + Transportation Optimization: Re-evaluate transportation modes. While Road is costly and has a high defect rate, it might be necessary for certain routes. Investigate why Air has low costs and low defects – could it be utilized more for high-value or urgent shipments? Consider shifting some volume from Road/Rail to Sea or Air where feasible, balancing cost, speed, and defect rates.
  + Cost Analysis: Delve deeper into the breakdown of "Sum of Costs" and "Sum of Mfg costs" from each supplier to identify specific cost drivers and negotiate better pricing.
* Customer Insights:
  + Data Enrichment: Implement strategies to collect more accurate customer demographic data for the "Unknown" segment to better understand the customer base and tailor marketing efforts.
  + Targeted Marketing: Develop specific marketing campaigns for Female and Male customer segments based on their product preferences.

**G. Conclusion:**

The analysis of the "Product and Supplier Insight" dashboard reveals a business with healthy overall profit margins but with opportunities for optimization. Skincare is a strong revenue driver, but along with haircare, faces higher defect rates. Inventory management needs to be dynamic, considering varying SKU demands and lead times. Supplier performance varies significantly, with Supplier 3 emerging as a high-value partner due to its superior profit margin contribution and lower defect rates. Transportation modes also present a mixed bag of costs and defect risks. By strategically addressing product quality, optimizing inventory, and refining supplier relationships based on data, the business can further enhance its profitability and operational efficiency.

* + 1. **Future Scope:**

To gain deeper insights and further improve decision-making, the following are recommended for future dashboard enhancements and analytical initiatives:

* **Trend Analysis Over Time:** Extend the "Overview" and "Product Insight" dashboards to include time-series analysis for revenue, costs, product sales, and defect rates, allowing for identification of long-term trends and seasonality beyond just the analyzed year.
* **Customer Lifetime Value (CLTV):** Integrate customer purchase frequency and value to calculate CLTV, enabling better identification and retention of high-value customers.
* **Supplier Performance Scorecard:** Develop a comprehensive supplier scorecard that combines profit margin, defect rates, lead times, and cost into a single performance metric for easier comparison and management.
* **Geographic Analysis:** If applicable, incorporate geographic data to understand regional sales performance, stock distribution, and supplier logistics.
* **Detailed Cost Breakdown:** Drill down into "Sum of Costs" and "Sum of Mfg costs" to identify specific cost components (e.g., raw materials, labor, overhead) for more precise cost reduction strategies.
* **Predictive Analytics:** Implement predictive models for demand forecasting to further optimize inventory levels and production planning, especially for high-volume SKUs.
* **What-If Scenarios:** Develop "what-if" analysis capabilities within the dashboard to simulate the impact of changes in pricing, promotional activities, or supplier terms on overall profitability.
* **User-Specific Dashboards:** Create tailored dashboards for different departments (e.g., Marketing, Supply Chain, Finance) to provide them with the most relevant insights for their specific roles.