Final Power BI Project

Project Title: Integrated Business Performance Dashboard: AdventureWorks Analysis

Objective: Design and develop an interactive Power BI dashboard that provides comprehensive insights into sales performance, product profitability, and production efficiency. This dashboard should serve as a critical tool for stakeholders to understand trends, identify opportunities, and make data-driven decisions across the entire value chain.

This dashboard will provide a comprehensive view of sales, product, and production performance, enabling users to gain actionable insights through interactive visualizations and advanced Power BI features. Please note: While these instructions are detailed, they are adaptable; however, the use of Power BI's advanced features and a multi-page dashboard structure are mandatory for this task.

Sales Performance Analysis

Objective: To provide a holistic understanding of sales trends, performance drivers, and areas for improvement.

Detailed Analysis Points:

- **Overall Sales Trends Over Time:**
    - **Visualizations:** Line charts, area charts, or bar charts.
    - **Granularity:**
        - **Monthly Sales:** Total sales value and quantity sold per month.
        - **Quarterly Sales:** Aggregated sales for each quarter.
        - **Yearly Sales:** Total annual sales figures.
    - **Further Analysis:** Year-over-year growth/decline, month-over-month comparisons, identification of seasonal patterns or significant sales events.
        - *Assumption:* If specific sales events are not in the data, we will identify peaks and troughs and assume external factors like promotions or market shifts.
- **Sales by Product Category, Subcategory, and Individual Products:**

    - **Visualizations:** Bar charts, treemaps, or sunburst charts.
    - **Hierarchical Drilldown:** Implement drilldown functionality to move from Category → Subcategory → Individual Product.
    - **Further Analysis:**
        - **Top N Sales (Dynamic):** Implement a dynamic "Top N" filter (e.g., Top 5, Top 10) for products, categories, and subcategories based on sales value or quantity. This will utilize a numeric range parameter.
        - **Underperforming Products/Categories:** Identify products or categories with consistently low sales, negative growth, or below-average performance compared to their peers.
        - **Sales Mix Analysis:** Understand the proportion of sales contributed by different product segments.
        - *Assumption:* If product profit margins are not directly available in sales data, we will infer profitability based on sales volume and assume a standard gross margin per product type to categorize products as high/low margin.
- **Sales by Region, Territory, and Customer Segment:**
    - **Visualizations:** Maps (for regions/territories), bar charts, or stacked column charts.
    - **Hierarchical Drilldown:** Region → Territory.
    - **Further Analysis:**
        - **Geographic Performance Hotspots/Coldspots:** Identify regions or territories with exceptionally high or low sales performance.
        - **Customer Segment Profitability:** Analyze which customer segments are most valuable based on sales contribution.
        - *Assumption:* If customer segments are not explicitly defined, we will categorize customers based on purchase behavior (e.g., "High-Value," "Frequent Buyer," "New Customer") using sales volume and frequency.
- **Identify Top-Performing and Underperforming Products and Categories:**
    - **Visualizations:** Bar charts with conditional formatting, tables with ranking.
    - **Further Analysis:** Use ranking functions (RANKX) to dynamically rank products/categories based on sales value or quantity. Apply conditional formatting to highlight top performers (e.g., green) and underperformers (e.g., red).
- **Analyze Sales Performance Against Targets:**
    - **Visualizations:** Bullet charts, gauge visuals, or bar charts with target lines.

    - **Further Analysis:** Calculate variance from target (actual sales - target sales) and percentage of target achieved.
        - *Assumption:* Sales targets will be available as a separate dataset or can be simulated as a percentage increase over previous period's sales.

- **Returns Analysis:**
    - **Visualizations:** Trend lines for returns over time, bar charts for reasons for return.
    - **Metrics:** Total number of returns, total value of returned products, return rate (returns / total sales).
    - **Further Analysis:**
        - **Return Rate by Product/Category/Region:** Identify specific products, categories, or regions with high return rates.
        - **Reasons for Returns:** If data permits, analyze common reasons for returns to identify underlying product quality or customer expectation issues.
        - *Assumption:* Reasons for return will be available as categorical data in the returns dataset. If not, we will assume generic categories like "Defective," "Wrong Item," "Customer Changed Mind."
- **Complaints Analysis:**
    - **Visualizations:** Bar charts for complaint categories, trend lines for complaint volume.
    - **Metrics:** Total number of complaints, complaint categories (e.g., product quality, delivery, customer service).
    - **Further Analysis:**
        - **Correlation with Sales/Returns:** Investigate if spikes in complaints correlate with specific product sales or return rates.
        - **Complaint Resolution Time:** (If data available) Analyze the average time taken to resolve complaints.
        - **Assumption:** Complaint categories and timestamps will be available. If not, we will categorize based on keywords in complaint descriptions.

Product Analysis

Objective: To assess the financial viability and performance of individual products.

Detailed Analysis Points:

- **Product Production Costs and Profitability:**
    - **Visualizations:** Tables, bar charts (e.g., profit margin by product), waterfall charts.

- **Metrics:**
    - **Cost of Goods Sold (COGS) per Unit:** (If available)
    - **Production Cost per Unit:** (If available)
    - **Selling Price per Unit:**
    - **Gross Profit per Unit:** Selling Price - COGS/Production Cost.
    - **Gross Profit Margin:** (Gross Profit / Selling Price) * 100.
    - **Total Profitability by Product:** Sum of gross profit for each product.
- **Further Analysis:**
    - **Profitability by Product Category/Subcategory:** Aggregate profitability metrics.
    - **Low-Profit Products:** Identify products with consistently low-profit margins.
    - **Cost Drivers:** (If detailed cost data is available) Analyze which components or processes contribute most to production costs.
    - *Assumption:* Production cost per unit will be available or can be estimated based on material and labor costs. If only COGS is available, we will use that as the primary cost metric.

Production Analysis

Objective: To evaluate the efficiency and utilization of production resources.

Detailed Analysis Points:

- **Machine Utilization and Downtime:**
    - **Visualizations:** Gauge charts, bar charts, line charts.
    - **Metrics:**
        - **Machine Uptime:** Total operational hours / Total available hours.
        - **Machine Downtime:** Total non-operational hours, categorized by reason (e.g., maintenance, breakdown, setup).
        - **Utilization Rate:** (Actual production time / Scheduled production time) * 100.
    - **Further Analysis:**
        - **Downtime Trends:** Identify patterns in downtime (e.g., specific shifts, recurring issues).
        - **Impact of Downtime on Production:** Quantify lost production due to downtime.

        - *Assumption:* Machine logs or production schedules will provide data on machine states (running, idle, maintenance) and associated timestamps. If not, we will infer downtime from periods of zero production output.

- **Production Output and Efficiency:**
    - **Visualizations:** Line charts, bar charts, scatter plots.
    - **Metrics:**
        - **Total Production Output:** Quantity of products produced per period (daily, weekly, monthly).
        - **Production Rate:** Units produced per hour/shift.
        - **Efficiency Rate:** (Actual output / Standard output) * 100.
        - **Defect Rate:** (Number of defective units / Total units produced) * 100.
    - **Further Analysis:**
        - **Production Bottlenecks:** Identify stages or machines that are consistently limiting overall production.
        - **Correlation of Production with Sales:** Analyze if increased production leads to higher sales or if excess production is leading to inventory buildup.
        - **Impact of Machine Performance on Output:** Analyze how machine utilization/downtime directly affects production output.
        - Assumption: Standard output targets for machines/production lines will be available or can be set based on historical best performance. Defect data will be available.

Power BI Features to Demonstrate

- **Drillthrough/Drilldowns:**
    - **Sales Performance Page:** Drill down from overall sales trends (Year/Quarter) to monthly sales. Drill down from sales by category to subcategory, and then to individual products.
    - **Production Analysis Page:** Drill down from overall machine utilization to specific machine downtime reasons.
    - **Mechanism:** Create dedicated drillthrough pages for detailed product, customer, and machine insights.
- **Conditional Formatting:**
    - **Sales Tables:** Highlight top N sales in green, bottom N in red. Highlight products below target sales in red.
    - **Returns/Complaints:** Highlight high return rates or complaint volumes using color scales.

    - **Production Tables:** Highlight low machine utilization or high defect rates.
    - **Visual Cues:** Use data bars, icons, and font colors to enhance readability and highlight key performance indicators.
- **Field Parameters:**
    - **Dynamic Sales View:** Allow users to dynamically switch between viewing "Sales by Region," "Sales by Territory," or "Sales by Customer Segment."
    - **Dynamic Sales Measures:** Enable users to toggle between displaying "Total Sales Value," "Quantity Sold," or "Gross Profit" in key sales charts.
    - **Dynamic Production Measures:** Allow users to switch between "Production Output," "Efficiency Rate," or "Downtime Hours" in production visuals.
    - **Top N Analysis:** Dynamically control the "N" value for "Top N" sales analysis using a numeric field parameter.
- **Interactive Visualizations:**
    - **Slicers:** Implement intuitive slicers for filtering data by:
        - Date Range (Year, Quarter, Month)
        - Product Category/Subcategory
        - Region/Territory
        - Customer Segment
        - Machine Type/ID
        - Reason for Return/Complaint
    - **Filters:** Utilize page-level and visual-level filters to refine data exploration.
    - **Tooltips:** Provide rich, detailed tooltips for all visualizations, displaying additional relevant metrics when hovering over data points (e.g., for a sales bar, show sales value, quantity, and profit margin).
    - **Cross-Filtering/Highlighting:** Ensure that selecting a data point in one visual filters or highlights related data in other visuals across the dashboard.
- **Data Storytelling:**
    - **Dashboard Flow:** Design the dashboard with a logical flow, starting with high-level summaries and gradually moving to detailed insights through drilldowns and interactive elements.
    - **Key Performance Indicators (KPIs):** Prominently display key KPIs on summary pages (e.g., Total Sales, Overall Profit Margin, Average Machine Utilization, Overall Return Rate).

- **Actionable Insights:** Use text boxes and narrative elements to provide brief summaries of key findings and potential actions (e.g., "Identified a spike in returns for Product X, investigate potential quality issues," "Region Y consistently underperforming, consider targeted marketing campaigns").
- **Clear and Concise Labels:** Ensure all titles, labels, and legends are clear, concise, and easy to understand.
- **Advanced Visual Formatting:** Utilize custom themes, appropriate color palettes, and consistent font styles to enhance the visual appeal and professionalism of the dashboard. Employ custom visual headers, borders, and backgrounds to create a polished look. Consider using visual elements like shapes and images to guide the user's eye and add context.

Deadline: 8/10/2025