E-Commerce Data Analysis Project Report

Introduction

The e-commerce industry thrives on vast amounts of data generated daily through sales, inventory management, supplier interactions, and shipping logistics. Analyzing this data effectively can unlock valuable business insights, improve operational efficiency, and enhance decision-making. This project leverages data from a synthetic e-commerce database to address key business challenges and provide actionable recommendations. The database includes information about products, sales, suppliers, inventory, and shipping routes.

Problem Statement

Several challenges were identified in the e-commerce operations, including:

1. **Sales Performance**: Understanding which products and categories are driving revenue and identifying underperforming products.
2. **Inventory Management**: Monitoring stock levels, optimizing reorder points, and calculating stock turnover rates.
3. **Supplier Analysis**: Assessing supplier reliability, lead times, and dependence on specific suppliers for key categories.
4. **Shipping and Logistics**: Reducing shipping costs, improving route efficiency, and minimizing carbon footprint.

Tools and Technologies Used

1. **Database Management**: MySQL for data storage and SQL for performing complex queries and analysis.
2. **Data Visualization**: Power BI to create interactive dashboards and present insights.
3. **Development Tools**: Jupyter Notebooks and Python for data exploration and initial analysis.
4. **Version Control**: GitHub to document queries, analysis, and visualizations.

Methodology and Analysis

1. Sales Analysis

- **Key Metrics**:
  - Revenue by product category.
  - Top-selling and underperforming products.
  - Profit margins for each product and category.
- **Findings**:
  - Smartphones and laptops were the top revenue generators.
  - Accessories and tablets had high sales volumes but lower margins.
  - Products with low sales but high stock levels were flagged for potential discontinuation or promotion.

2. Inventory Management

- **Key Metrics**:
  - Inventory turnover rates.
  - Low-stock alerts based on reorder levels.
  - Average stock-to-reorder difference by category.
- **Findings**:
  - Tablets had the fastest turnover rate, indicating high demand.
  - Reorder levels were optimized to maintain a threshold of 100 units for key products.
  - Excess inventory was identified in specific categories, indicating overstocking.

3. Supplier Analysis

- **Key Metrics**:
  - Supplier reliability based on lead time and reliability scores.
  - Revenue contribution by supplier.
  - Supplier dependence for each product category.
- **Findings**:
  - Top suppliers for key categories were identified based on annual supply volume.
  - Suppliers with low reliability scores were flagged for potential risk.

4. Shipping and Logistics

- **Key Metrics**:
  - Shipping costs by region and route.
  - Average delivery times.
  - Carbon footprint by route.
- **Findings**:
  - Regions with the highest shipping costs were prioritized for route optimization.
  - Routes with excessive carbon emissions were identified for potential alternatives.

- Efficient routes were recommended based on delivery times and costs.

Solutions and Recommendations

1. **Sales Strategies**:
   - Introduce targeted promotions for underperforming products.
   - Focus on high-margin categories such as laptops and smartphones.
2. **Inventory Optimization**:
   - Adjust reorder levels based on turnover rates.
   - Develop a strategy to liquidate excess inventory.
3. **Supplier Management**:
   - Maintain strong relationships with reliable suppliers.
   - Diversify suppliers for critical categories to mitigate risk.
4. **Shipping Improvements**:
   - Negotiate better rates for high-cost regions.
   - Optimize routes to balance speed, cost, and carbon emissions.

Conclusion

This e-commerce data analysis project demonstrates the power of data-driven decision-making. By addressing key business challenges through SQL analysis and visualizing insights using Power BI, actionable strategies were developed to improve sales, inventory, supplier relationships, and logistics. This report and associated GitHub repository serve as a resource for future projects and decision-makers in the e-commerce domain.