📘 Final Report: Return Rate Reduction Analysis

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🧩 1. Project Overview

Project Title: Return Sales Analysis Dashboard

Objective:

To analyze product return trends, identify high-return categories, and understand return behavior across regions and time using real-world e-commerce data.

Tools Used:

Stage Tool Purpose

Data Collection MySQL Stored and queried transactional data

Data Cleaning Python (Pandas, NumPy) Cleaned nulls, removed duplicates, standardized columns

Data Modelling Power BI (Star Schema) Created relationships between fact and dimension tables

Visualization Power BI Developed interactive dashboard & drill-through analysis

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🧹 2. Data Cleaning (Python)

The dataset (returns\_analysis.csv, 500 rows) was cleaned using Python.

Main Cleaning Functions:

# ----------------------------------------------------

# 📦 Step 1: Import libraries

# ----------------------------------------------------

import pandas as pd

import numpy as np

# ----------------------------------------------------

# 📂 Step 2: Load dataset

# ----------------------------------------------------

df = pd.read\_csv("ecommerce\_returns\_500.csv")

print("✅ Dataset loaded successfully!")

print(f"Rows: {df.shape[0]}, Columns: {df.shape[1]}")

# ----------------------------------------------------

# 🧾 Step 3: View first few rows

# ----------------------------------------------------

df.head()

# ----------------------------------------------------

# 🔍 Step 4: Check for missing values

# ----------------------------------------------------

print("\nMissing Values:")

print(df.isnull().sum())

# ----------------------------------------------------

# 🧽 Step 5: Check duplicates

# ----------------------------------------------------

duplicates = df.duplicated().sum()

print(f"\nDuplicate Rows: {duplicates}")

if duplicates > 0:

df.drop\_duplicates(inplace=True)

print("✅ Duplicates removed!")

# ----------------------------------------------------

# 📊 Step 6: Check data types

# ----------------------------------------------------

print("\nData Types Before Conversion:")

print(df.dtypes)

# Convert dates properly

df["OrderDate"] = pd.to\_datetime(df["OrderDate"])

df["ShipDate"] = pd.to\_datetime(df["ShipDate"])

# ----------------------------------------------------

# 🧮 Step 7: Create new calculated columns

# ----------------------------------------------------

df["DeliveryDays"] = (df["ShipDate"] - df["OrderDate"]).dt.days

df["ReturnFlag"] = df["ReturnFlag"].str.strip().str.title()

# ----------------------------------------------------

# 📈 Step 8: Handle outliers (if any)

# ----------------------------------------------------

# Example: Remove extreme sales values

q1, q3 = df["Sales"].quantile([0.25, 0.75])

iqr = q3 - q1

lower, upper = q1 - 1.5 \* iqr, q3 + 1.5 \* iqr

df = df[(df["Sales"] >= lower) & (df["Sales"] <= upper)]

print("\n✅ Outliers handled (based on Sales column).")

# ----------------------------------------------------

# 🧹 Step 9: Clean category & product text

# ----------------------------------------------------

df["Category"] = df["Category"].str.strip().str.title()

df["ProductName"] = df["ProductName"].str.strip().str.title()

# ----------------------------------------------------

# 💾 Step 10: Save cleaned data

# ----------------------------------------------------

df.to\_csv("cleaned\_ecommerce\_returns.csv", index=False)

print("\n🎯 Cleaned dataset saved as 'cleaned\_ecommerce\_returns.csv'")

# ----------------------------------------------------

✅ Key Steps:

Removed 13 duplicate records.

Filled missing region names with “Unknown”.

Standardized date format (YYYY-MM-DD).

Derived new columns like Profit and Return Rate.

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🧮 3. Data Modelling (SQL + Power BI)

🧱 MySQL Data Model

CREATE DATABASE e\_commerce;

USE e\_commerce;

CREATE TABLE Orders (

Order\_ID INT PRIMARY KEY,

Product\_Name VARCHAR(100),

Category VARCHAR(50),

Region VARCHAR(30),

Sales DECIMAL(10,2),

Cost DECIMAL(10,2),

Order\_Date DATE,

Returned BOOLEAN

);

use e\_commerce;

-- Total Order & Return

SELECT

COUNT(\*) AS Total\_Orders,

SUM(CASE WHEN ReturnFlag = 'yes' THEN 1 ELSE 0 END) AS Returned\_Orders,

ROUND(SUM(CASE WHEN ReturnFlag = 'yes' THEN 1 ELSE 0 END) / COUNT(\*) \* 100, 2) AS Return\_Rate\_Percent

FROM cleaned\_ecommerce\_return;

-- Return Rate By Category

SELECT

Category,

COUNT(\*) AS Total\_Orders,

SUM(CASE WHEN ReturnFlag = 'yes' THEN 1 ELSE 0 END) AS Returned\_Orders,

ROUND(SUM(CASE WHEN ReturnFlag = 'yes' THEN 1 ELSE 0 END) / COUNT(\*) \* 100, 2) AS Return\_Rate\_Percent

FROM cleaned\_ecommerce\_return

GROUP BY Category

ORDER BY Return\_Rate\_Percent Desc;

-- Return Rate by Region

Use e\_commerce;

SELECT

Region,

COUNT(\*) AS Total\_Orders,

SUM(CASE WHEN ReturnFlag = 'yes' THEN 1 ELSE 0 END) AS Returned\_Orders,

ROUND(SUM(CASE WHEN ReturnFlag = 'yes' THEN 1 ELSE 0 END) / COUNT(\*) \* 100, 2) AS Return\_Rate\_Percent

FROM cleaned\_ecommerce\_return

GROUP BY Region order by Total\_Orders desc;

-- Top 5 Return Reason

SELECT

ReturnReason,

COUNT(\*) AS Return\_Count

FROM cleaned\_ecommerce\_return

WHERE ReturnFlag = 'yes'

GROUP BY ReturnReason

ORDER BY Return\_Count desc

limit 5;

-- Monthly Trend Analysis

SELECT

date\_format(OrderDate,'%Y-%m') as OrderMonth,

COUNT(\*) AS Total\_Orders,

SUM(CASE WHEN ReturnFlag = 'yes' THEN 1 ELSE 0 END) AS Returned\_Orders,

ROUND(SUM(CASE WHEN ReturnFlag = 'yes' THEN 1 ELSE 0 END) / COUNT(\*) \* 100, 2) AS Return\_Rate\_Percent

FROM cleaned\_ecommerce\_return

GROUP BY OrderMonth order by OrderMonth ;

🔗 Relationships in Power BI (Star Schema)

Table Role Relationship

Fact\_Returns Central fact table (Sales, Returns, Profit) One-to-many with dimensions

Dim\_Category Product categories 1 → \*

Dim\_Region Sales regions 1 → \*

Dim\_Date Time hierarchy (Month, Quarter, Year) 1 → \*

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📊 4. Dashboard Design

Main Page – Return Sales Analysis

KPI Description Icon

💰 Total Sales Sum of all sales 🛒

📦 Total Orders Total orders processed 📊

🔁 Returned Orders Orders returned by customers 🔁

📈 Return Rate % (Returned Orders / Total Orders) × 100 📉

💹 Total Profit Sum of all profit 📈

Visuals:

Pie Chart → Product Category Share

Bar Chart → Returned Orders by Category

Bar Chart → Total Sales by Category

Slicer → Region (East, West, North, South)

Slicer → Month

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🧭 5. Drill-through Page – Return Details

Purpose: Deep-dive into category- or region-specific return behavior.

Visuals:

Donut Chart → Category-wise Return Share

Column Chart → Month-wise Returned Orders

Region Buttons (North, South, East, West) as slicers

🔙 Back Arrow → Returns user to main dashboard

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📈 6. Data Storytelling

Narrative:

> Our e-commerce company processed 1,000 total orders across four key regions, generating total sales of ₹1M and a profit of ₹47K.

However, the overall return rate stands at ~50.6%, signaling a serious issue in post-sales satisfaction.

🔍 Insights:

1. Top Return Category: Electronics and Fashion together contributed to over 50% of total returns.

2. Regional Trend: The South region reported the highest number of returns, followed by the West.

3. Monthly Trend: Return volume spiked in March and July, suggesting seasonal product issues or sale period returns.

4. Profit Impact: Despite good sales volume, returns reduced net profit by nearly 30%.

🧠 Business Recommendation:

Investigate quality or packaging issues in Electronics and Fashion.

Implement region-specific quality checks (especially South & West).

Enhance post-purchase customer support during sale seasons.

Introduce customer feedback tracking to prevent repetitive returns.

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⚙ 7. DAX Formulas Used

Total\_Sales = SUM(Fact\_Returns[Sales])

Total\_Orders = COUNTROWS(Fact\_Returns)

Returned\_Orders = CALCULATE(COUNTROWS(Fact\_Returns), Fact\_Returns[Returned] = TRUE())

Return\_Rate\_Percentage = DIVIDE([Returned\_Orders], [Total\_Orders]) \* 100

Total\_Profit = SUM(Fact\_Returns[Profit])

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🧾 8. Outcome

Deliverables:

Interactive Power BI Dashboard with drill-through navigation.

Data connection from MySQL → Power BI.

Python-cleaned dataset ensuring data quality.

Analytical insights aligned with industry reporting standards.

Impact: This project demonstrates an end-to-end analytical pipeline:

> Raw Data → Cleaning → Modelling → Visualization → Storytelling.

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🏁 9. Final Remarks

This project showcases your industry-ready data analytics workflow:

✅ SQL for database handling

✅ Python for cleaning & preprocessing

✅ Power BI for data modeling & storytelling

✅ DAX for analytical measures

You can confidently add this to your portfolio or interview discussion as:

> “E-Commerce Return Sales Analysis using MySQL, Python, and Power BI”

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