India Trade Analysis Dashboard (2010–2021)

1.Introduction

India is one of the fastest growing economies in the world. International trade plays a major role in strengthening India's economic development. Trade enables India to export domestic products to other countries and import essential goods required for industries and consumers.

Analyzing trade data provides valuable insights into India's export and import performance, major traded commodities, and key partner countries. This project focuses on understanding India's trade trends from 2010 to 2021 using modern data analytics tools.

An interactive dashboard was developed to visualize trade patterns and provide meaningful insights for stakeholders.

2. Problem Statement

Trade between nations is a critical component of economic progress. India's export and import performance has changed significantly over the last decade.

The main objective of this project is to analyze India/s international trade data and answer the following business questions:

 What commodities does India export the most each year?
 Which commodities contribute the highest import values?
 Which countries are India's top trading partners?
 How has India's export and import trend changed from 2010 to 2021?
 What is India's trade balance over the years?

The project aims to provide a structured data pipeline and dashboard solution for effective trade analysis.

3. Dataset Overview

The dataset used in this project is obtained from Kaggle:

Dataset Name: India – Trade Data
Time Period: 2010–2021
Trade Basket: HS2 Commodity Classification

Unit of Measurement: Million US Dollars

The dataset is tidy, meaning each row represents a single trade observation.

Main Columns in Dataset

Column Name	Description
HSCode	Commodity classification code (HS2 level)
Commodity	Commodity category name
Value	Trade value in million US$
Country	Partner country involved in trade
Year	Year of trade record
Trade_Type	Export or Import

The dataset contains separate export and import files which were combined during preprocessing.

4. Tools and Technologies Used

This project was implemented using the following tools:

- **Python (Pandas**) : Used for data loading, cleaning, preprocessing, and exporting clean datasets.

- **PostgreSQL Database** : Used for storing trade data, performing SQL queries, and preparing structured views for dashboard integration.

- **Power BI** : Used for creating an interactive dashboard with trends, KPIs, commodity insights, and country-level trade analysis.

- **GitHub Repository** : Used for uploading project files and maintaining version control.

5. Methodology and Workflow

The project was completed using a step-by-step workflow:

1. Business Problem Definition
2. Data Loading and Cleaning in Python
3. Exporting cleaned dataset
4. Loading data into PostgreSQL
5. Performing SQL-based trade analysis
6. Creating Power BI Dashboard
7. Report Documentation and Presentation Preparation

8. Uploading project to GitHub

This workflow ensures an end-to-end data analytics pipeline.

6. Data Preprocessing and Cleaning (Python)

The export and import datasets were first loaded into Python using Pandas.

 Cleaning steps performed:

- ◊ Combined export and import datasets into one unified dataset
- ◊ Added a new column `trade_type` to differentiate export/import records
- ◊ Removed missing values and incomplete rows
- ◊ Removed duplicate entries
- ◊ Standardized column names in lowercase
- ◊ Converted numerical columns (`year`, `value`) to proper datatypes
- ◊ Cleaned string fields such as commodity and country names

The cleaned dataset was saved as:

`india_trade_cleaned.csv`

This file was used for PostgreSQL import.

7. PostgreSQL Database Implementation

After cleaning, the dataset was loaded into PostgreSQL for efficient analysis.

Database Details

- Database Name: india_trade_db
- Table Name: trade_data

Table Structure

The table stores:

- Commodity information
- Country-wise trade values
- Year-wise exports and imports
- Trade type classification

1.Top 10 Trading Partner Countries

```sql
SELECT country, SUM(value) AS total_trade
FROM trade_data
GROUP BY country
ORDER BY total_trade DESC
LIMIT 10;
```

Output:

	country text	total_trade double precision
1	CHINA P RP	1876169.9799999986
2	U S A	1737570.4400000009
3	U ARAB EMTS	1441900.8200000005
4	SAUDI ARAB	811094.4600000002
5	HONG KONG	565108.1800000002
6	SWITZERLA...	558108.1599999989
7	GERMANY	514239.7599999999
8	SINGAPORE	504968.15999999945
9	INDONESIA	466348.5599999995
10	IRAQ	456088.7200000002

2.Top Export Commodity Year-Wise

```sql
SELECT year, commodity, SUM(value) AS total_export
FROM trade_data
WHERE trade_type = 'Export'
GROUP BY year, commodity
ORDER BY year, total_export DESC;
```

Output:

	year integer	commodity text
1	2010	NATURAL OR CULTURED PEARLS,PRECIOUS OR SEMIPRECIOUS STONES,PRE.METALS,CLAD WITH PRE.METAL AND ARTCLS THEREOF;IMIT.JEWLRY;COIN.
2	2010	MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THEIR DISTILLATION; BITUMINOUS SUBSTANCES; MINERAL WAXES.
3	2010	MISCELLANEOUS GOODS.
4	2010	ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS /
5	2010	VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING STOCK, AND PARTS AND ACCESSORIES THEREOF.
6	2010	NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHANICAL APPLIANCES; PARTS THEREOF.
7	2010	ORGANIC CHEMICALS
8	2010	IRON AND STEEL
9	2010	COTTON.
10	2010	PHARMACEUTICAL PRODUCTS

3. Top 5 Import Commodities of India

```sql
SELECT commodity, SUM(value) AS total_import
FROM trade_data
WHERE trade_type = 'Import'
GROUP BY commodity
ORDER BY total_import DESC
LIMIT 5;
```

Output :

	commodity text
1	MINERAL FUELS, MINERAL OILS AND PRODUCTS OF THEIR DISTILLATION; BITUMINOUS SUBSTANCES; MINERAL WAXES.
2	NATURAL OR CULTURED PEARLS,PRECIOUS OR SEMIPRECIOUS STONES,PRE.METALS,CLAD WITH PRE.METAL AND ARTCLS THEREOF;IMIT.JEWLRY;COIN.
3	ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS AND REPRODU
4	NUCLEAR REACTORS, BOILERS, MACHINERY AND MECHANICAL APPLIANCES; PARTS THEREOF.
5	ORGANIC CHEMICALS

Views were created for smooth Power BI integration.

8. Power BI Dashboard Development

The PostgreSQL database was successfully connected to Power BI.
An interactive dashboard was created to represent Indias trade performance visually.

Dashboard Components

- Export vs Import trend line chart
- Top 10 commodities by trade value
- Top trading partner countries
- Pie chart showing Export vs Import share
- KPI cards for:

    1. Total Export
    2. Total Import
    3. Total Trade
    4. Trade Balance

Interactive Filters Added

- Year slicer
- Country slicer
- Commodity slicer
- Trade type slicer

Figure 1: India Trade Analysis Dashboard (2010–2021)
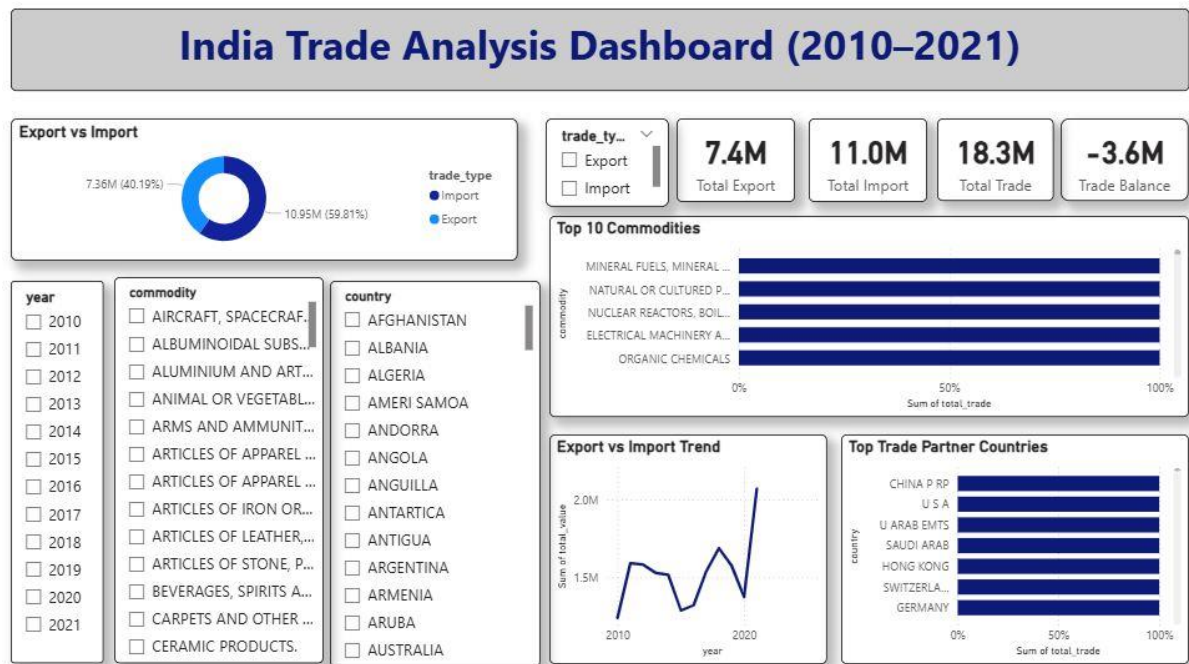
9. Key Insights and Findings

The analysis provided several important insights:

Indias total imports were higher than exports during the period, resulting in a trade deficit.
China, USA, UAE, and Saudi Arabia emerged as Indias top trade partner countries.
Mineral fuels, machinery, and electrical equipment contributed significantly to Indias trade volume.
Trade values increased over the years, indicating consistent growth in international trade activity.

These findings help understand Indias economic dependency and commodity trade structure.

10. Conclusion

This project successfully demonstrates an end-to-end trade analytics solution using Python, PostgreSQL, and Power BI. The dashboard provides an interactive platform to explore Indias export and import trends, major commodities, and top partner countries.

Such analysis can support economic planning, trade policy decisions, and market research.