Project Overview:

The goal of this project is to understand the impact of sustainability on fashion brands by analyzing a dataset that includes various metrics related to their sustainability practices, such as carbon footprint, material types, eco-friendly manufacturing, and more. By evaluating these factors, the project aims to identify global sustainability trends and offer insights for future improvements in the fashion industry.

About the Data:

The dataset contains 75,075 entries available on Kaggle and includes the following key features:

- **Brand_ID**: Unique identifier for each brand.
- **Country**: The country where the brand is based.
- **Year**: Year the data was collected.
- **Sustainability_Rating**: Rating of the brand's sustainability (e.g., A, B, C, D).
- **Material_Type**: Type of material used for production (e.g., recycled polyester, organic materials).
- **Eco_Friendly_Manufacturing**: Whether the brand follows eco-friendly manufacturing practices.
- **Carbon_Footprint_MT**: Carbon footprint in metric tons.
- **Water_Usage_Liters**: Amount of water used in production.
- **Waste_Production_KG**: Amount of waste produced in kilograms.
- **Recycling_Programs**: Whether the brand has adopted a recycling program.
- **Product_Lines**: Types of products produced by the brand.
- **Average_Price_USD**: Average price of the brand's products in USD.
- **Market_Trend**: Market growth of the brand.
- **Certifications**: Certifications held by the brand.

Tools:

- **Excel**: Initial check for missing data upon uploading the CSV file.
- **Jupyter Notebook**: Used for data cleaning, preparation, and analysis with Python libraries (e.g., Pandas, Matplotlib, Seaborn).

Data Cleaning / Preparation:

1. **CSV Import**: The dataset was initially imported into Excel for a quick overview.
2. **Jupyter Notebook**: The dataset was uploaded into Jupyter, and the `info ()` function was used to check for missing data.
3. **Handling Missing Data**:

- The **"Certification"** column had missing values, which were filled using the `fillna()` function, replacing them with "No Certification".

Exploratory Data Analysis (EDA):

The analysis focuses on several key performance indicators (KPIs) to understand the impact of sustainability:

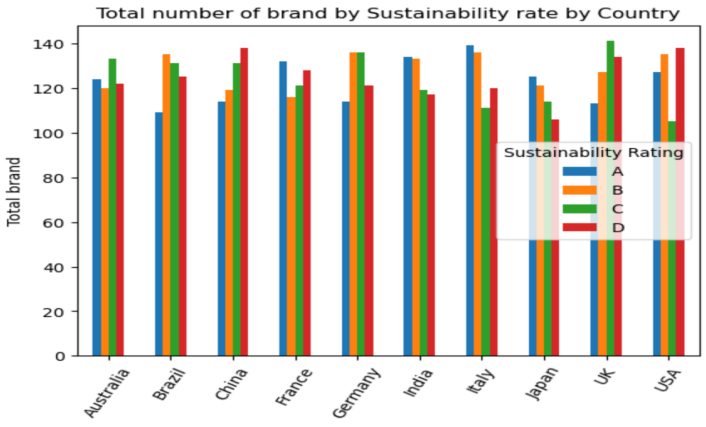
1. **Sustainability Rating Across the Globe**: Analyzing how brands from different countries are rated based on sustainability.
2. **Carbon Footprint by Country**: Identifying which countries have the highest carbon footprint based on the dataset.
3. **Material Types**: Investigating the most commonly used materials in fashion production.
4. **Correlation Between Carbon Footprint, Sustainability, and Material Types**: Analyzing how carbon footprint correlates with sustainability rating and material types.
5. **Percentage of Eco-Friendly Brands**: Determining the proportion of brands that are eco-friendly and those that have adopted recycling programs.

Data Analysis:

The entire project was executed in Python using the Pandas library for data analysis. The following are key insights:

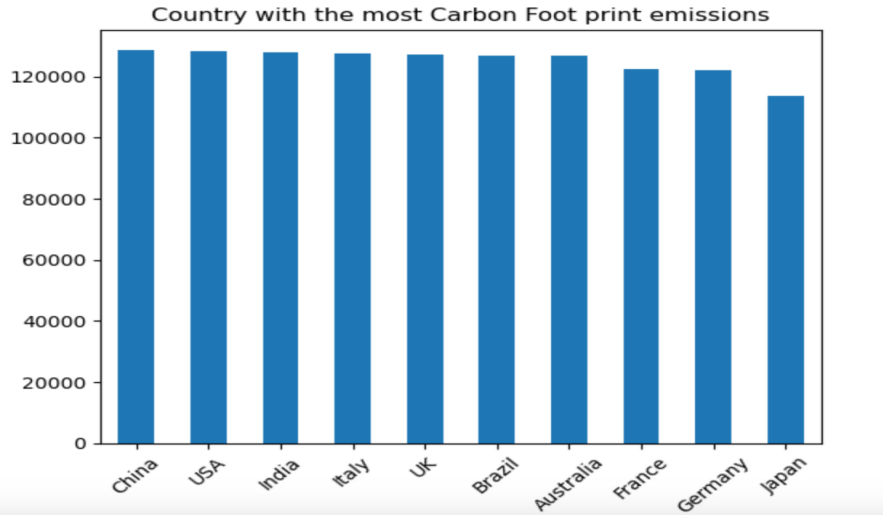
a) *Analysis of Sustainability Across the Globe:*

- **Top Sustainable Countries**: Italy, India, and France have the highest number of brands rated “A” (most sustainable). The USA and China are more frequently rated with a “D” (least sustainable).
- **Global Sustainability Trends**: Over the years, sustainability ratings across the globe remained balanced, with a variety of ratings observed across different brands.



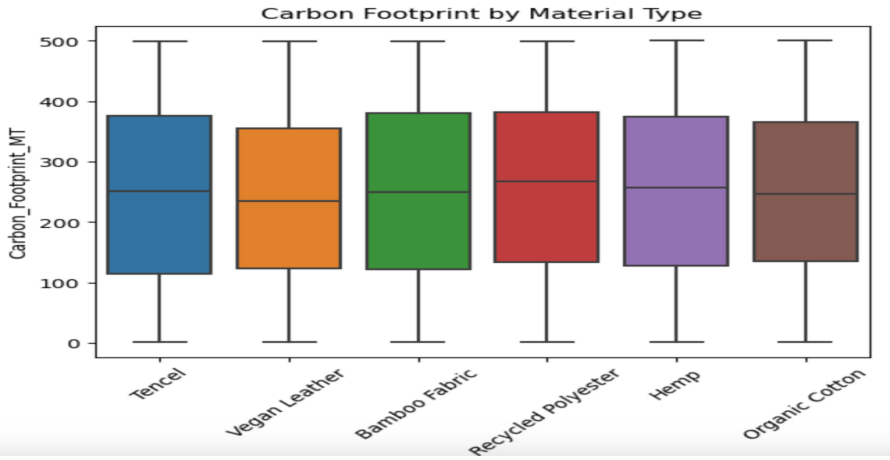
b) Country with the Most Carbon Footprint:

- **Top Carbon Footprint Countries**: China, the USA, and Italy emerged as the countries with the highest carbon footprint emissions.



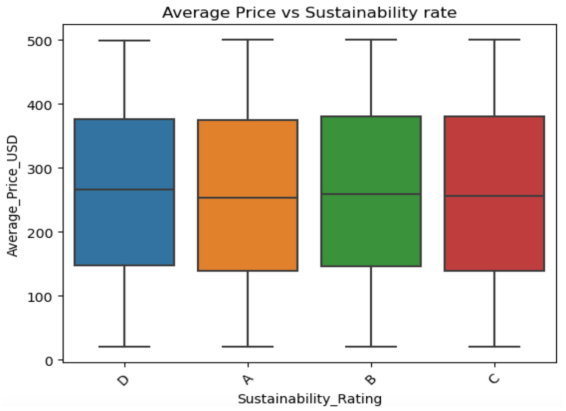
c) *Analysis of Material Types Used in Production:*

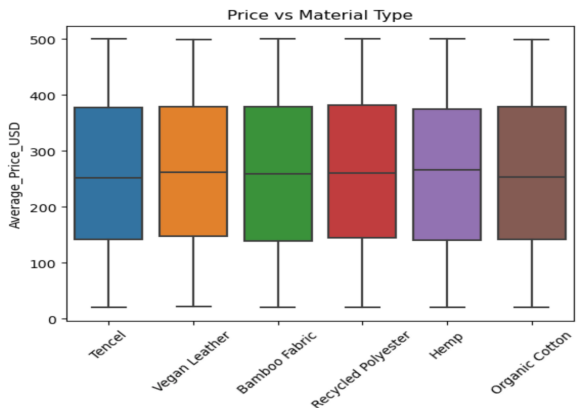
- **High Carbon Footprint Materials**: Materials such as Tencel, recycled polyester, and bamboo fabric have been identified as having a significant environmental impact due to their high carbon footprints.



d) *Correlation Between Price, Sustainability Rate, and Material Type:*

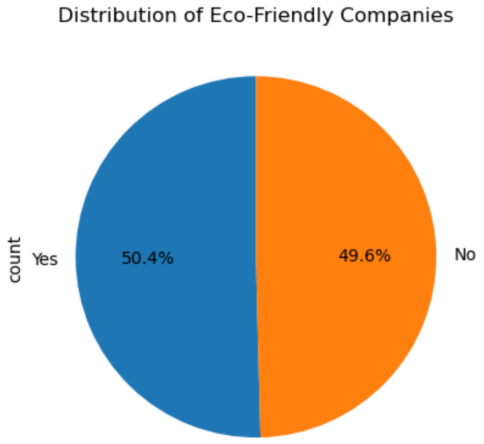
- A strong negative correlation was observed between **carbon footprint** and **sustainability ratings**. Brands with higher carbon footprints tend to have lower sustainability ratings, while brands using more eco-friendly materials (e.g., organic cotton) tend to have higher ratings.

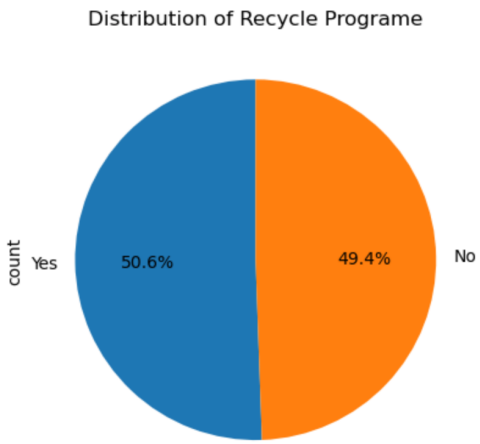




e) *Eco-Friendly Brands and Recycling Programs:*

- A balanced proportion of the brands in the dataset are eco-friendly, with a significant number also adopting recycling programs.





Results and Findings:

1. **Sustainability Ratings**:
    - Countries like **Italy**, **India**, and **France** are more likely to have brands rated **A** for sustainability, while **USA** and **China** are more frequently rated **D**.
2. **Carbon Footprint**:
    - **China**, **USA**, and **Italy** have the highest carbon emissions, suggesting that these countries' brands are contributing significantly to global environmental concerns.
3. **Material Types**:
    - Materials like **Tencel**, **recycled polyester**, and **bamboo fabric** contribute heavily to carbon emissions, raising concerns about the sustainability of these materials despite their eco-friendly appearance.
4. **Sustainability and Material Choices**:
    - There is a notable correlation between the use of **eco-friendly materials** and **higher sustainability ratings**, while **carbon-intensive materials** often correlate with lower sustainability scores.
5. **Eco-Friendliness & Recycling**:
    - A significant portion of brands are adopting **eco-friendly manufacturing practices**, and many are also beginning to implement **recycling programs** to further reduce their environmental footprint.

Recommendations:

Based on the findings, the following recommendations can be made to improve sustainability in the fashion industry:

1. **Encourage Sustainable Materials**: Brands should be incentivized to move toward more sustainable materials, such as organic cotton and hemp, which have a lower environmental impact than polyester or bamboo.
2. **Promote Eco-Friendly Practices**: Brands with higher carbon footprints should be encouraged to adopt more eco-friendly manufacturing processes, such as using renewable energy sources and reducing water usage.
3. **Carbon Footprint Reduction Programs**: Countries with the highest carbon emissions (e.g., China, USA, Italy) should implement stricter regulations and incentives for carbon footprint reduction.
4. **Increase Recycling Initiatives**: Brands should continue to expand recycling programs, both in terms of material recovery and product lifecycle management.
5. **Transparency in Certification**: Fashion brands should be transparent about their certifications and sustainability efforts, allowing consumers to make informed decisions.

Limitations:

1. **Incomplete Data**: Some columns had missing values, though efforts were made to handle them (e.g., filling missing certifications with "No Certification") , and no data about the brand name .
2. **Data Scope**: The dataset focuses on brands from specific countries and may not represent global trends comprehensively, especially in emerging markets.
3. **Static Snapshot**: The dataset is limited to a particular timeframe, and the findings may not capture long-term trends or recent shifts in the fashion industry.

Reference: find the complete code here : Project_sustainable_fashion_trends