mport pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

# Sample Dataset Creation

data = pd.DataFrame({

    'Year': [2018, 2019, 2020, 2021, 2022] \* 5,

    'Material\_Name': ['Wheat', 'Wheat', 'Wheat', 'Wheat', 'Wheat',

                      'Corn', 'Corn', 'Corn', 'Corn', 'Corn',

                      'Rice', 'Rice', 'Rice', 'Rice', 'Rice',

                      'Soybeans', 'Soybeans', 'Soybeans', 'Soybeans', 'Soybeans',

                      'Barley', 'Barley', 'Barley', 'Barley', 'Barley'],

    'Price': [220, 210, 230, 245, 260,    # Wheat prices

              180, 185, 190, 200, 210,    # Corn prices

              150, 155, 160, 165, 170,    # Rice prices

              300, 295, 310, 320, 330,    # Soybeans prices

              130, 140, 145, 150, 155]    # Barley prices

})

# Data Preprocessing

data['Year'] = pd.to\_datetime(data['Year'], format='%Y')

data.sort\_values(['Material\_Name', 'Year'], inplace=True)

# Calculate Price Range

price\_range = data.groupby('Material\_Name')['Price'].agg(['min', 'max', 'mean']).sort\_values(by='mean', ascending=False)

high\_range = price\_range.head(3)  # Top 3 high range materials

low\_range = price\_range.tail(3)   # Bottom 3 low range materials

# Calculate Percentage Change

data['Price\_Change'] = data.groupby('Material\_Name')['Price'].pct\_change() \* 100

# Identify High/Low % Change Materials

price\_change\_summary = data.groupby('Material\_Name')['Price\_Change'].mean().sort\_values(ascending=False)

high\_change = price\_change\_summary.head(3)  # Top 3 high percentage change materials

low\_change = price\_change\_summary.tail(3)   # Bottom 3 low percentage change materials

# Correlation Analysis and Heatmap

pivot\_data = data.pivot(index='Year', columns='Material\_Name', values='Price')

correlation\_matrix = pivot\_data.corr()

# Displaying Results

print("High Range Materials:\n", high\_range)

print("\nLow Range Materials:\n", low\_range)

print("\nHigh Percentage Change Materials:\n", high\_change)

print("\nLow Percentage Change Materials:\n", low\_change)

# Visualization

plt.figure(figsize=(10, 8))

sns.heatmap(correlation\_matrix, annot=True, cmap='coolwarm')

plt.title('Correlation Heatmap of Agricultural Raw Material Prices')

plt.show()