Equity & Trend in Global CO2 Emission per Capita

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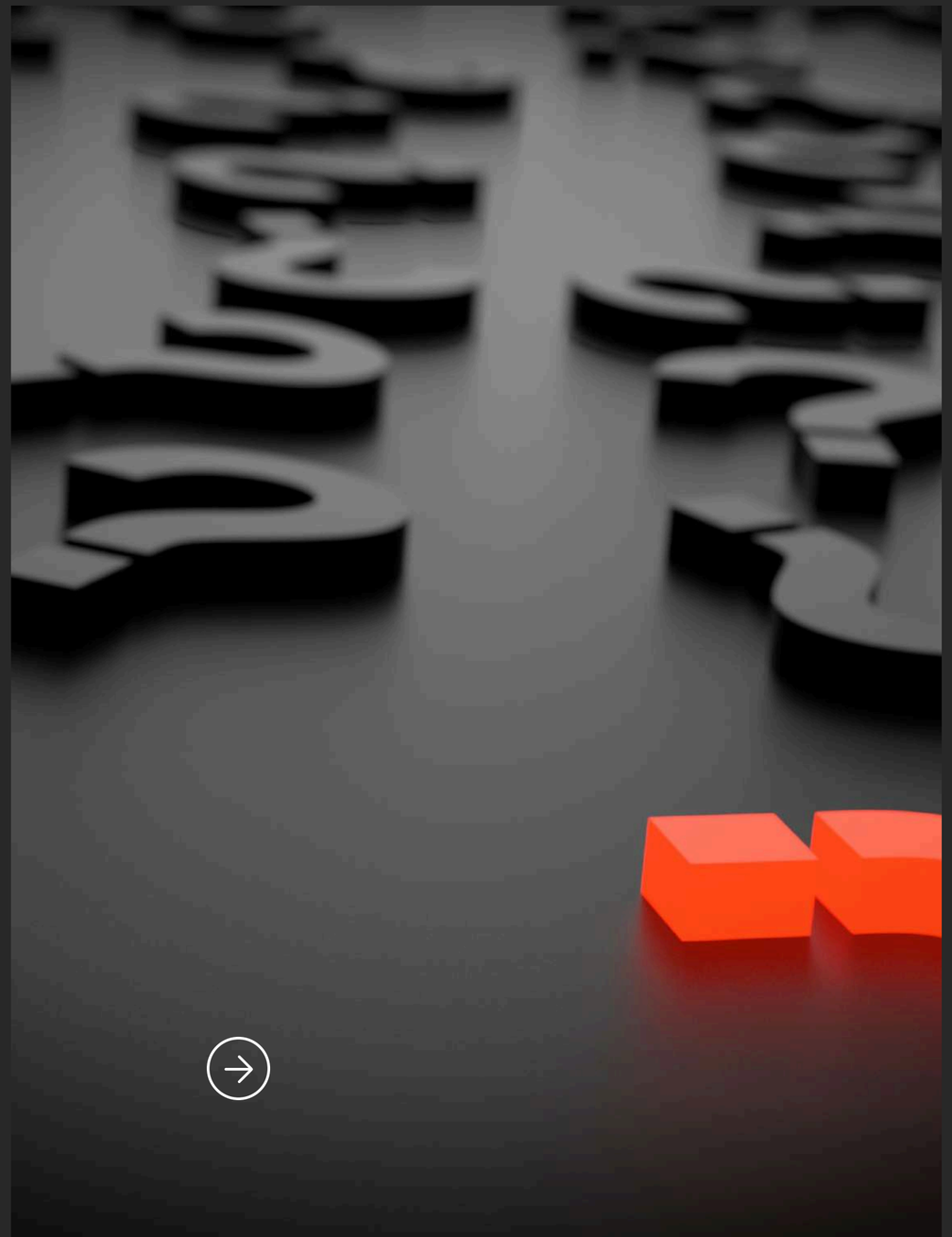
Contents

Project Introduction

Introduction

- CO2 is primary green house gas - Climate Changes
- fossil fuel production, cement production flaring and industrial activities
- Monitoring CO_2 emissions is critical
- No full capture the inequities between countries.
- Developed small population countries can emit as big population countries
- Understanding both perspectives is essential for creating balanced and effective global policies

Problem Statement



Problem Statement

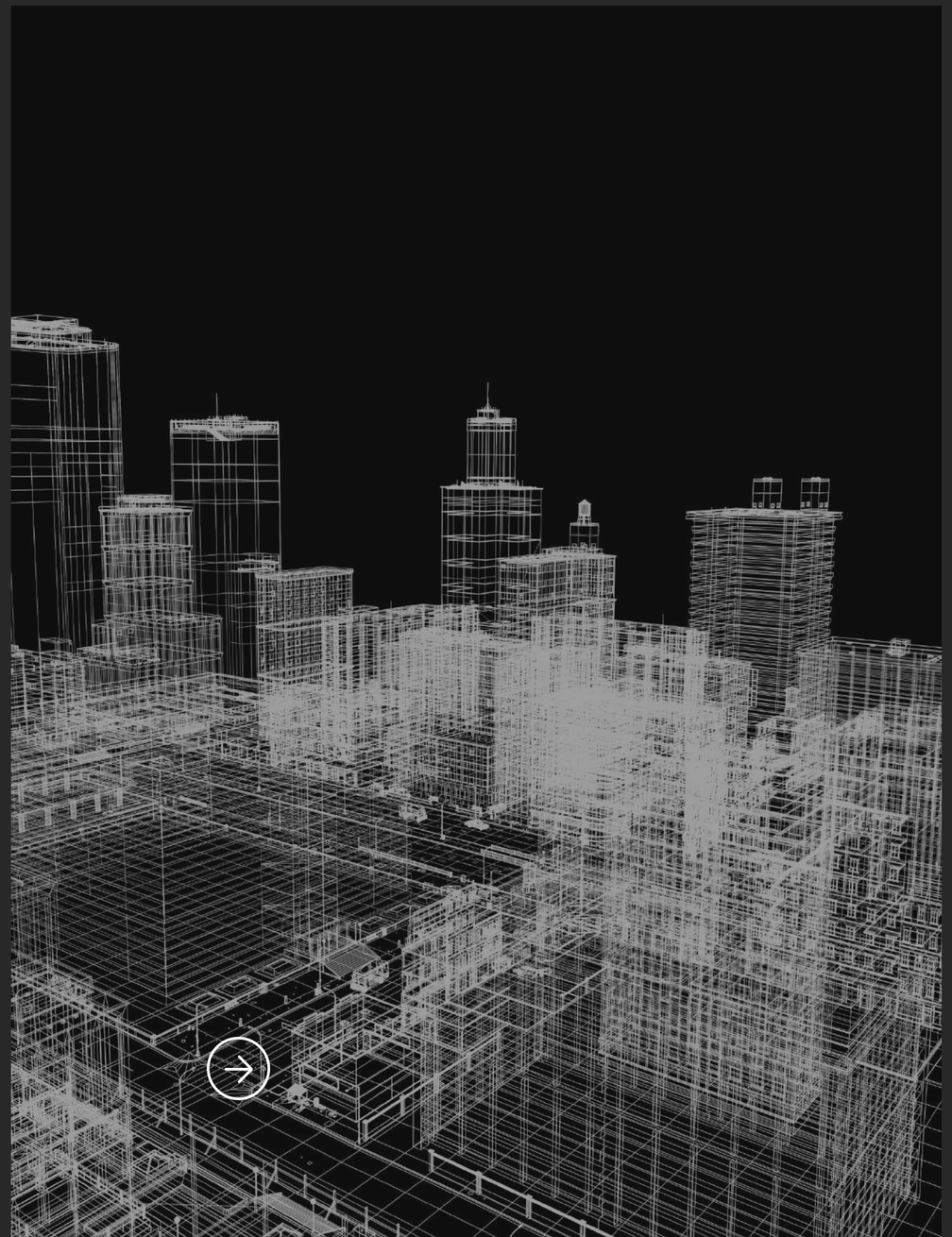
- Observing CO2 issue for years
- Carbon Target Projects - Electric Vehicle, Waste Management, Renewable Energy and other Green Projects and Campaigns
- Neglecting the point
  - CO2 emission is happening across the world with different levels of emission
  - Countries with more carbon emission should have more responsibility
  - Carbon emission different on development levels?
- Amounts vary between developing countries and developed countries

Project Aim

Project Aim

- Analyze, forecast and compare CO2 between small but developed countries & large developing countries.
- Highlight countries with greater responsibility
- Provide insights into emission inequity and effective climate policy recommendations.

Project Canva



Project Canva

DATA SCIENCE PROJECT CANVAS

Designed by: Thiri (st126018) and Aphisit (st126130) Date: 31/8/2025

Title: Equity and Trends in Global CO_2 Emissions per Capita

1. Problem Statement

What problem are you trying to solve? What larger issues do the problem address?

Countries have very different CO_2 emissions per capita. Developed countries often show decreasing trends, while developing ones are still increasing. This raises the issue of carbon equity: Who should bear greater responsibility?

2. Outcomes/Predictions

What prediction(s) are you trying to make? Identify applicable predictor (X) and/or target (y) variables.

- Forecast CO_2 emissions per capita trends
- Cluster countries into High / Medium / Low emitters

Target(y): Annual CO_2 emissions (per capita)

3. Value Propositions

What are we trying to do for the end-user(s) of the predictive system? What objectives are we serving?

- Policy makers: comparative insights for climate negotiations
- Public: awareness that some small rich countries emit more per capita than large developing ones

4. Data Acquisition

Where are you sourcing your data from? Is there enough data? Can you work with it?

Carbon (CO2) Emissions , population and total CO_2 datasets from public dataset.

1. Our World in Data, https://ourworldindata.org/
2. Kaggle

5. Modeling

What models are appropriate to use given your outcomes?

- Clustering: KMeans / Hierarchical
- Forecasting: Linear Regression/ARIMA
- Visualization: Choropleth maps, Bubble charts, Line graphs

6. Model Evaluation

How can you evaluate your model performance?

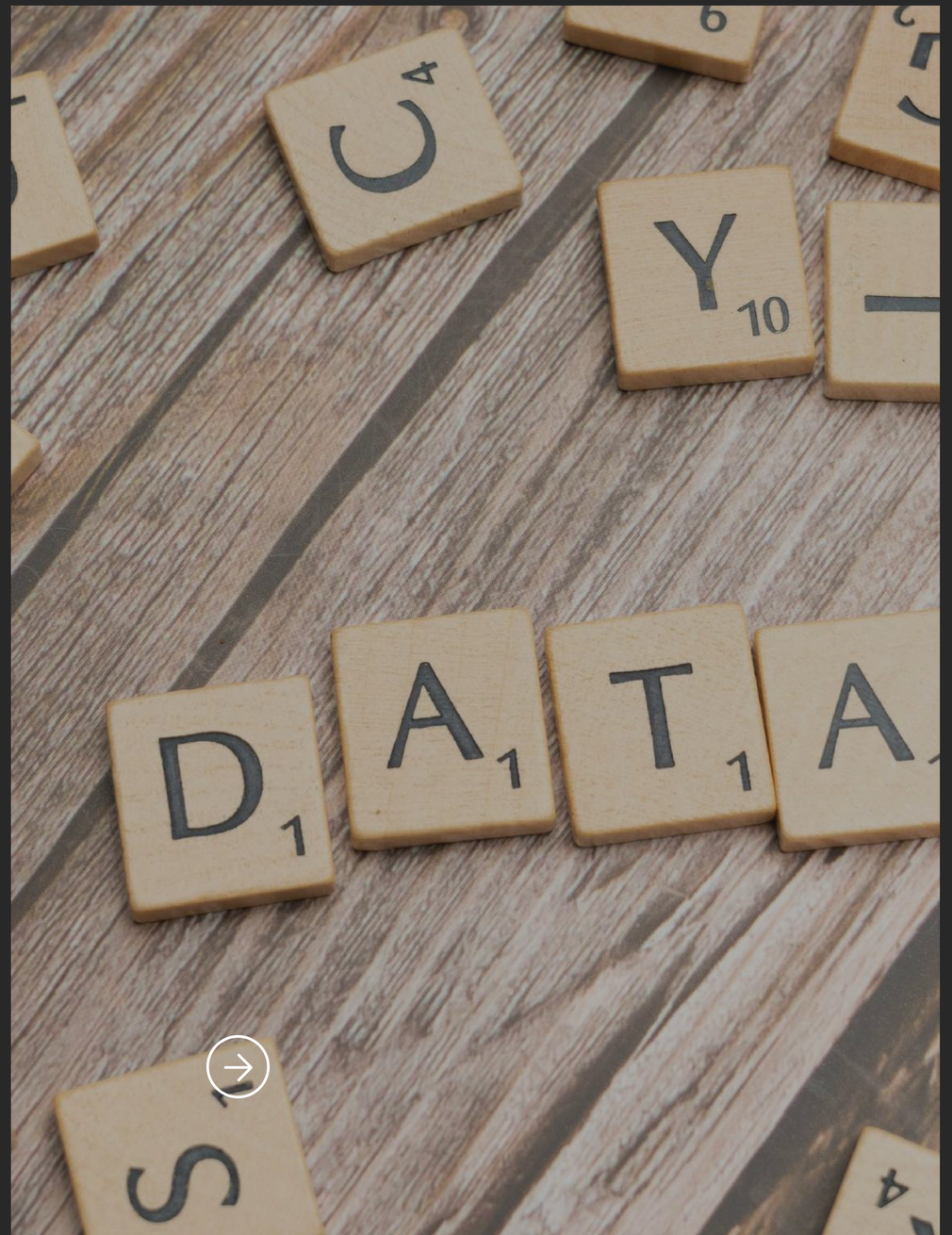
- Forecasting → RMSE, MAE

7. Data Preparation

What do you need to do to your data in order to run your model and achieve your outcomes?

- Clean dataset
- Normalize/scale data
- Aggregate by OECD vs Non-OECD or by regions
- Create new features: decade averages, growth rates

Data Source & Quality



Data Source & Quality

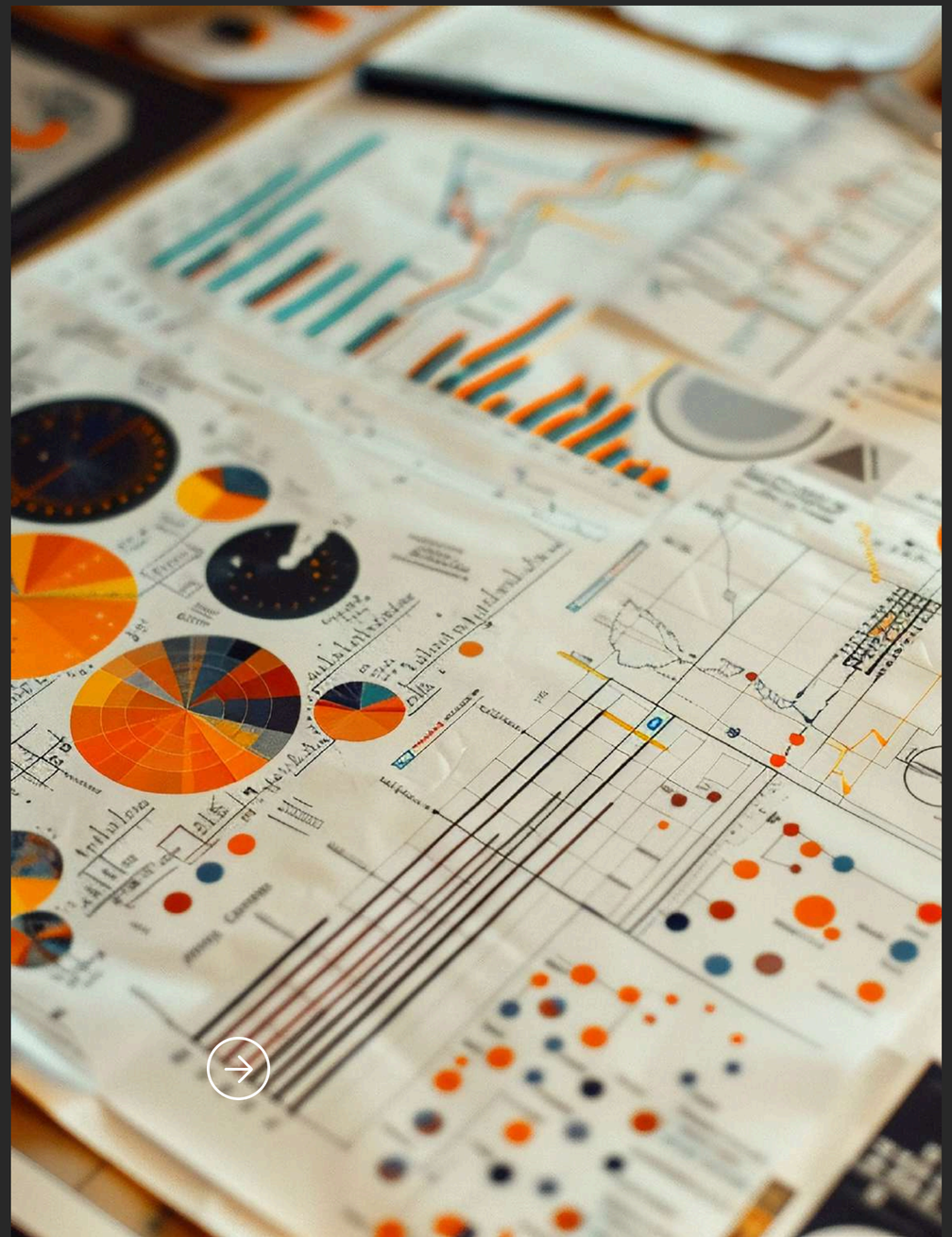
Global Fossil CO_2 Emissions by Country from Kaggle

	Country	iso3	Year	co2_pc_total	co2_pc_coal	co2_pc_oil	co2_pc_gas	co2_pc_cement	co2_pc_flaring	co2_pc_other
250	Afghanistan	AFG	2000	0.053581	0.000187	0.040309	0.011437	0.000523	0.001125	0.000000
251	Afghanistan	AFG	2001	0.054300	0.003536	0.038708	0.010608	0.000332	0.001117	0.000000
252	Afghanistan	AFG	2002	0.063856	0.002624	0.034639	0.026067	0.000525	0.000000	0.000000
253	Afghanistan	AFG	2003	0.068871	0.004054	0.043788	0.020596	0.000433	0.000000	0.000000
254	Afghanistan	AFG	2004	0.052529	0.003889	0.038579	0.009645	0.000416	0.000000	0.000000
...	...	...	...	...	...	...	...	...	...	...
63099	Global	WLD	2017	4.749682	1.908857	1.610910	0.940144	0.198416	0.051579	0.039776
63100	Global	WLD	2018	4.792753	1.919213	1.596350	0.979965	0.204225	0.053634	0.039366
63101	Global	WLD	2019	4.775633	1.896468	1.589920	0.984878	0.208309	0.056569	0.039490
63102	Global	WLD	2020	4.497423	1.807760	1.427353	0.963695	0.208844	0.051981	0.037789
63103	Global	WLD	2021	4.693699	1.893923	1.496614	1.001585	0.211472	0.052663	0.037443

	Country	iso3	Year	co2_total_mt	Coal	Oil	Gas	Cement	Flaring	Other	Per Capita
250	Afghanistan	AFG	2000	1.047128	0.003664	0.787760	0.223504	0.010216	0.021984	NaN	0.053581
251	Afghanistan	AFG	2001	1.069098	0.069616	0.762112	0.208848	0.006538	0.021984	NaN	0.054300
252	Afghanistan	AFG	2002	1.340995	0.055109	0.727438	0.547416	0.011033	0.000000	NaN	0.063856
253	Afghanistan	AFG	2003	1.559602	0.091813	0.991575	0.466408	0.009807	0.000000	NaN	0.068871
254	Afghanistan	AFG	2004	1.237247	0.091600	0.908672	0.227168	0.009807	0.000000	NaN	0.052529
...	...	...	...	...	...	...	...	...	...	...	...
63099	Global	WLD	2017	36096.739276	14506.973805	12242.627935	7144.928128	1507.923185	391.992176	302.294047	4.749682
63100	Global	WLD	2018	36826.506600	14746.830688	12266.016285	7529.846784	1569.218392	412.115746	302.478706	4.792753
63101	Global	WLD	2019	37082.558969	14725.978025	12345.653374	7647.528220	1617.506786	439.253991	306.638573	4.775633
63102	Global	WLD	2020	35264.085734	14174.564010	11191.808551	7556.290283	1637.537532	407.583673	296.301685	4.497423
63103	Global	WLD	2021	37123.850352	14979.598083	11837.159116	7921.829472	1672.592372	416.525563	296.145746	4.693699

5104 rows × 11 columns

Mathedology



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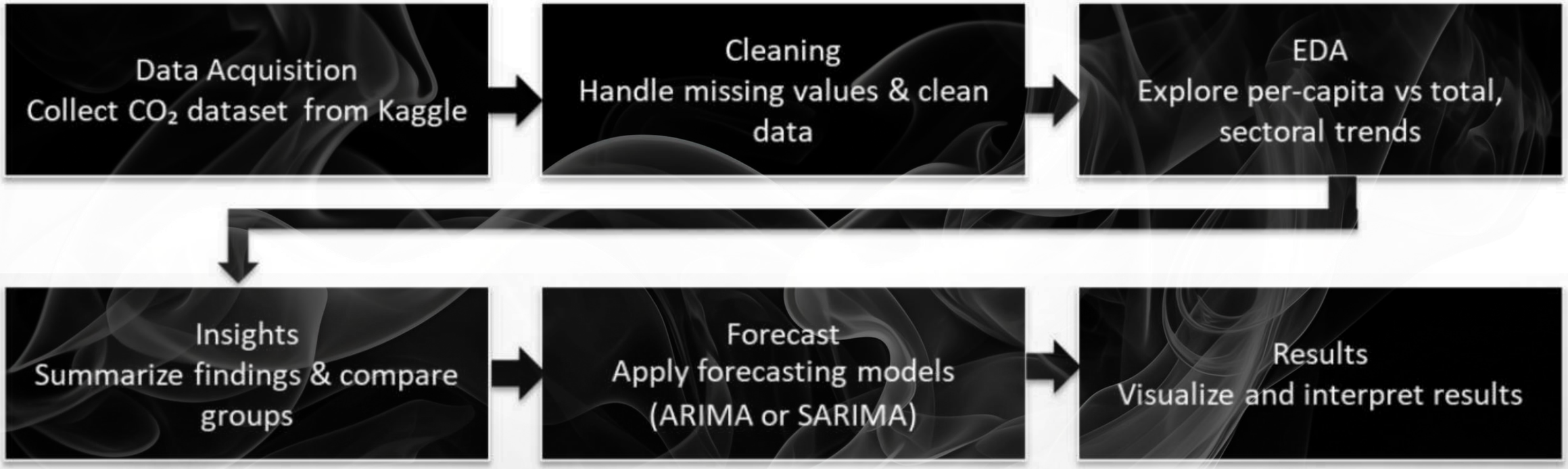
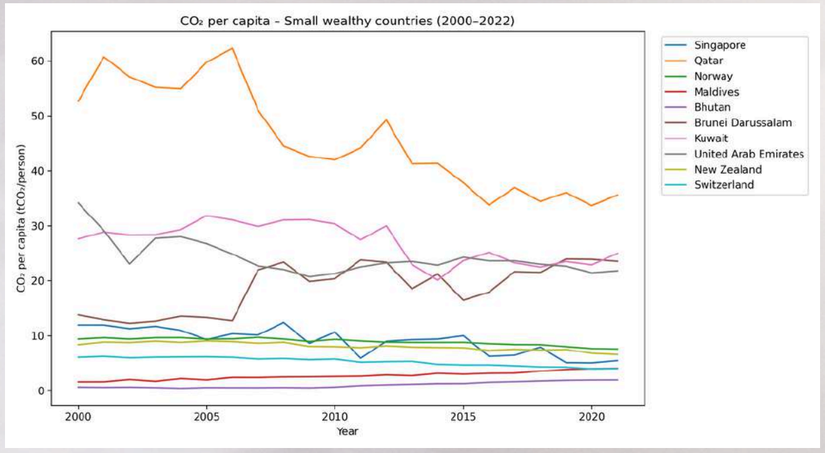
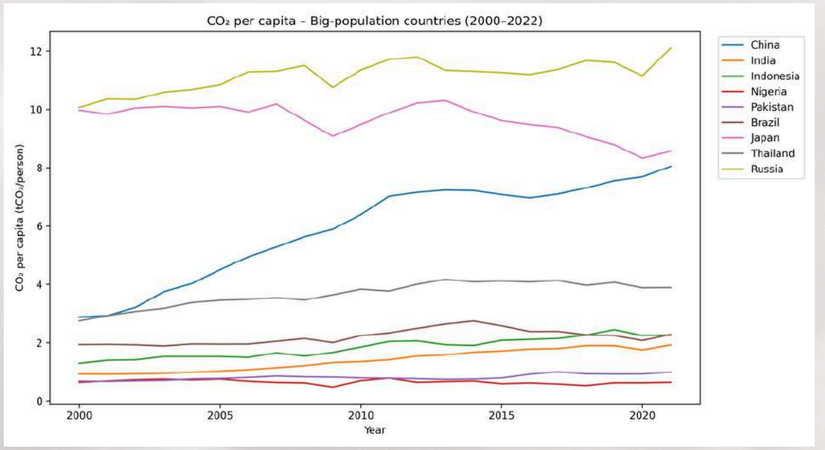
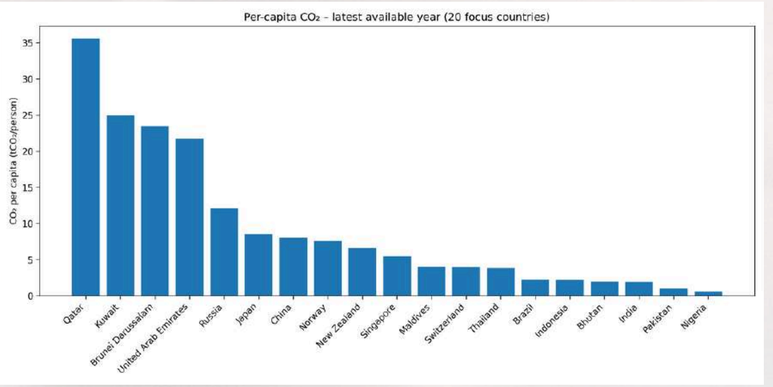
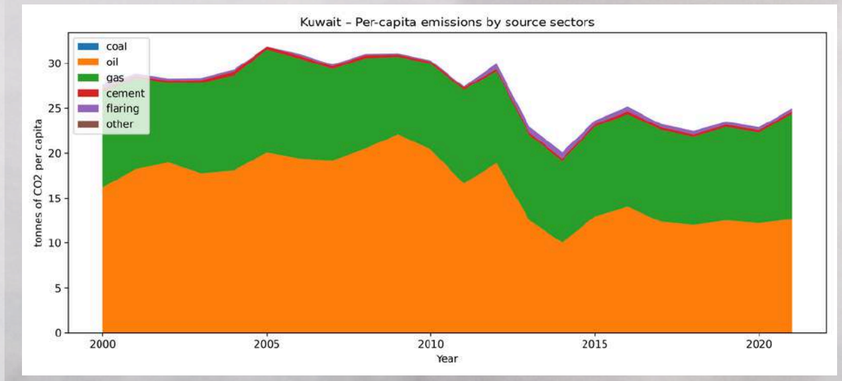


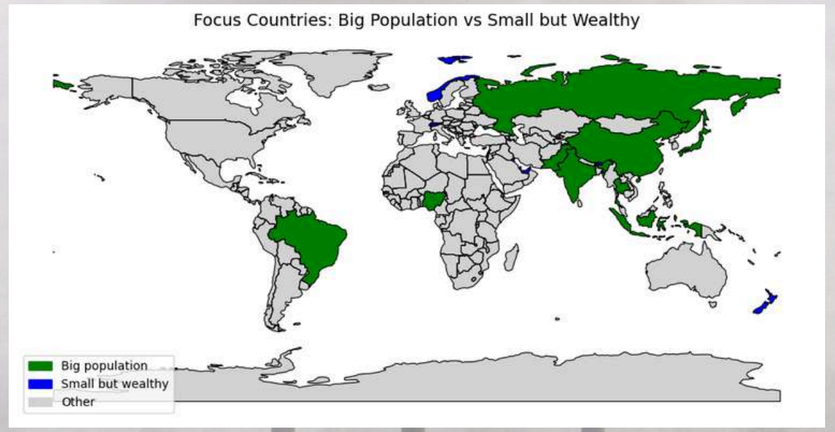
Exploratory Data Analysis

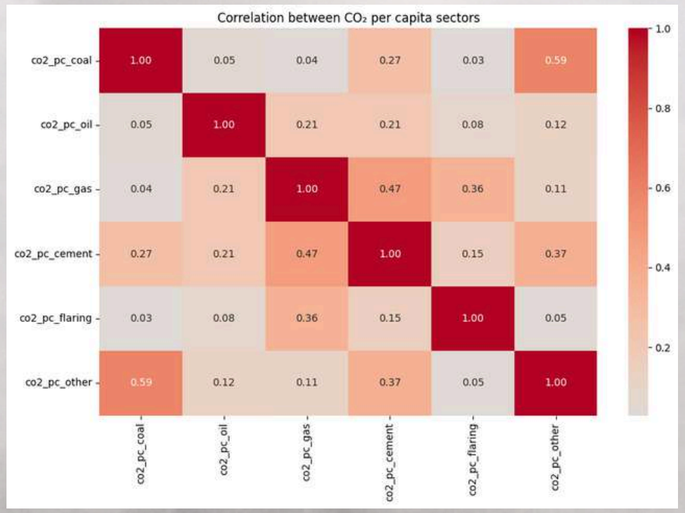












Model & Evaluation

Models

- Baseline Model - Naive Forecast
- ARIMA (Autoregressive Integrated Moving Average) model
- SARIMA (Seasonal ARIMA) model

Evaluation

- Error metrics (e.g., RMSE, MAE)

Result & What We Expect

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- Evidence of emission inequality from different countries
- Raise awareness
- Inform responsibility sharing
- Support policy-making discussions on climate responsibility.

Thanks for your attention