Quantifying Climate Policy Action and Its Links to Development Outcomes

A Cross-National, Data-Driven NLP–Econometric Framework

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https://github.com/booktrackerGirl/climate_change_policy_analysis

Climate Change AI

NEURAL INFORMATION PROCESSING SYSTEMS 2025

UNIVERSITY OF BIRMINGHAM

LANCET COUNTDOWN: TRACKING PROGRESS ON HEALTH AND CLIMATE CHANGE

In collaboration with Wellcome

MOTIVATION

- Climate policy tracking lacks thematic, quantitative indicators
- Machine learning (ML) offers scalable extraction of policy emphasis
- Linking to development outcomes can guide policy and resource alignment

DATA & METHODS

Dataset 1: **Climate Change Laws of the World** (CCLW) database [1]; which has 800+ national policies, multilingual, 4 themes (Mitigation, Adaptation, DRM, Loss & Damage)

• **Classification Model**: Multilingual DistilBERT fine-tuned, F1 ≈ 0.90

Policy text → DistilBERT → Mitigation, Adaptation, Disaster Risk Management, Loss and Damage

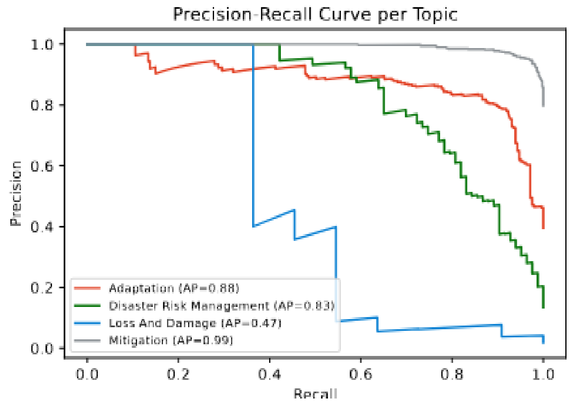
Dataset 2: **World Bank World Development Indicators** (WDI) [2] (2015 onwards)

• **Correspondence Analysis (CA):** Visualize clusters (e.g., SIDS emphasize Adaptation, G7 emphasize Mitigation)

• **Statistical Analysis**: **Panel Regression (Two-way Fixed Effects):** Estimate associations with WDI outcomes

RESULTS & EXPERIMENTS

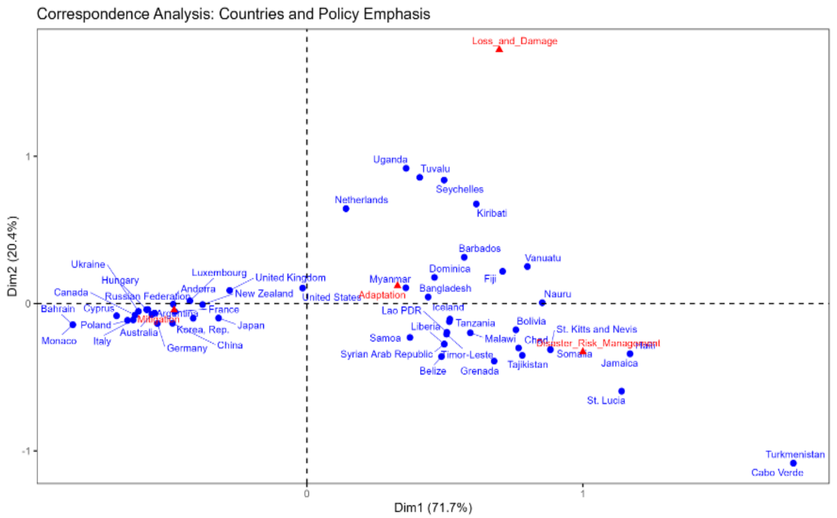
1) Classification Report



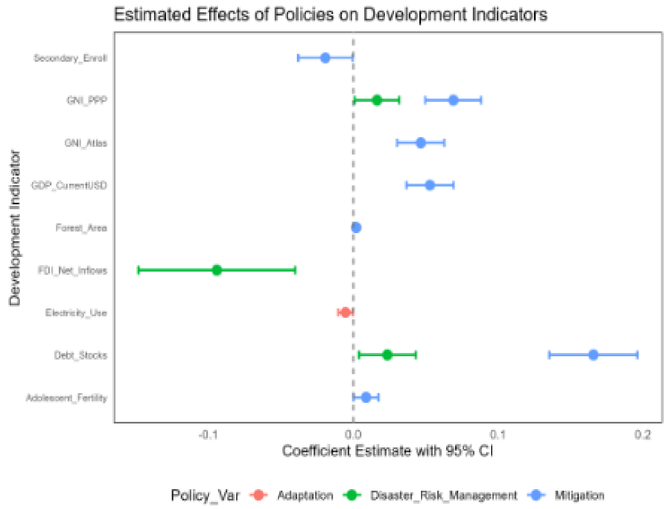
Category	Precision	Recall	F1-Score	Support
Adaptation	0.82	0.87	0.84	247
Disaster Risk Management	0.77	0.66	0.71	83
Loss and Damage	1.00	0.36	0.53	11
Mitigation	0.95	0.97	0.96	498
Micro Avg	0.90	0.90	0.90	839
Macro Avg	0.89	0.72	0.76	839
Weighted Avg	0.90	0.90	0.90	839
Samples Avg	0.92	0.93	0.91	839

Insights:
Machine learning enables scalable, theme-specific tracking of climate policy focus. But class imbalance account for weaker recall for rarer themes.

2) Statistical Report



CA Findings:
Developed economies (e.g., DE, UK, FR) → Mitigation-oriented
Small islands (e.g., Tuvalu, Seychelles) → Adaptation / DRM focus
Loss & Damage: minimal, niche activity
Explained variance: > 90% (total); captures global policy patterns



Panel Regression Findings:
Mitigation → ↑ **GDP**, ↑ **GNI**, ↑ **Debt**
(growth co-benefits; fiscal capacity enables climate action)
Disaster Risk Management → ↑ **GNI (PPP)**, ↑ **Debt**, ↓ **FDI**
(preparedness financing but risk-averse investors)
Adaptation → ↓ **Electricity use**
(possible efficiency gains; weak macro link)
Loss & Damage → no clear association
(reflects limited global implementation)

Insights:
1. Visualization from the CA indicate that policy emphasis mirrors national capacity and climate vulnerability.
2. Developed nations emphasize Mitigation, climate-vulnerable nations emphasize Adaptation/DRM.

Effects are correlational, not causal — but reveal how policy emphasis aligns with national development pathways.

POLICY & RESEARCH IMPLICATIONS

This framework enables scalable, cross-country tracking of climate policy emphasis: supporting evidence-based governance. In a nutshell, it:

- Serves as a quantitative tool for cross-country climate policy monitoring
- Enables theme-specific, evidence-based policy comparisons
- Can inform Paris Agreement and SDG 13 tracking

Limitations: class imbalance, correlational not causal, long-doc constraints in DistilBERT

References:
[1] Grantham Research Institute on Climate Change and the Environment and Sabin Center for Climate Change Law. Climate change laws of the world database. https://climate-laws.org, 2025. Accessed: 2025-06-30.
[2] World Bank. World development indicators. https://databank.worldbank.org/source/world-development-indicators, 2025. Accessed: 2025-06-30.