KOÇ UNIVERSITY

Decarbonization Pathways: A Comprehensive Data-Driven Analysis of Global Low-Carbon Technology Ecosystems

"Shaping sustainable futures through data-driven insights"

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CSSM 502: Advanced Python

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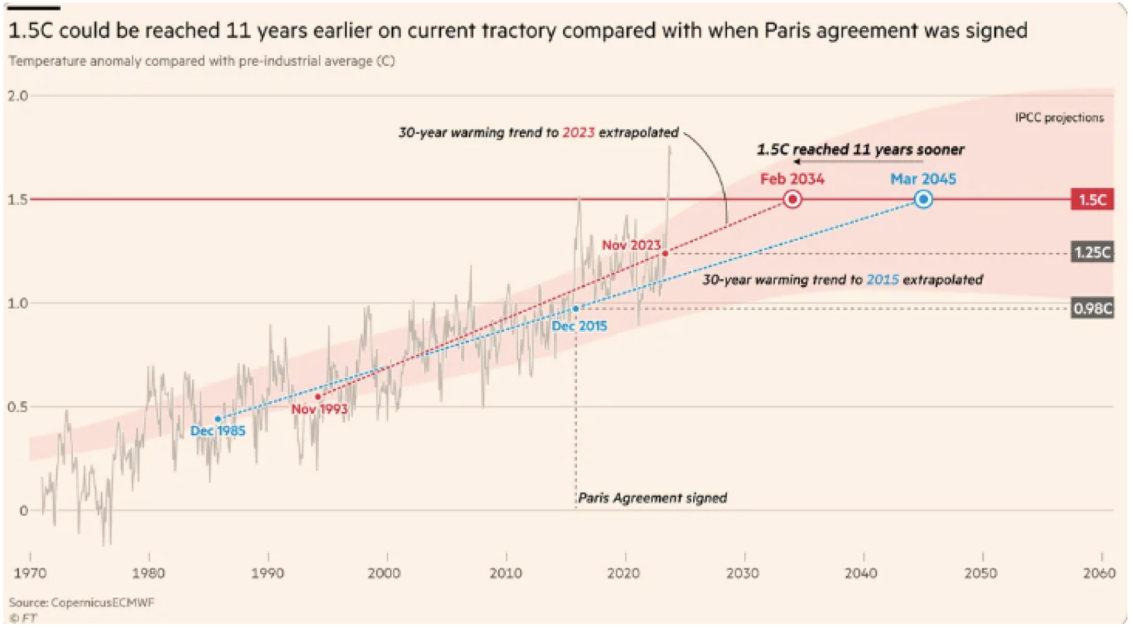
Purpose and Importance



Source: Chart showing trajectory of global warming in 2023 compared with when the Paris Agreement was signed in 2015, Financial Times

Key Question: How can global low-carbon technology transfers be optimized to address climate change?

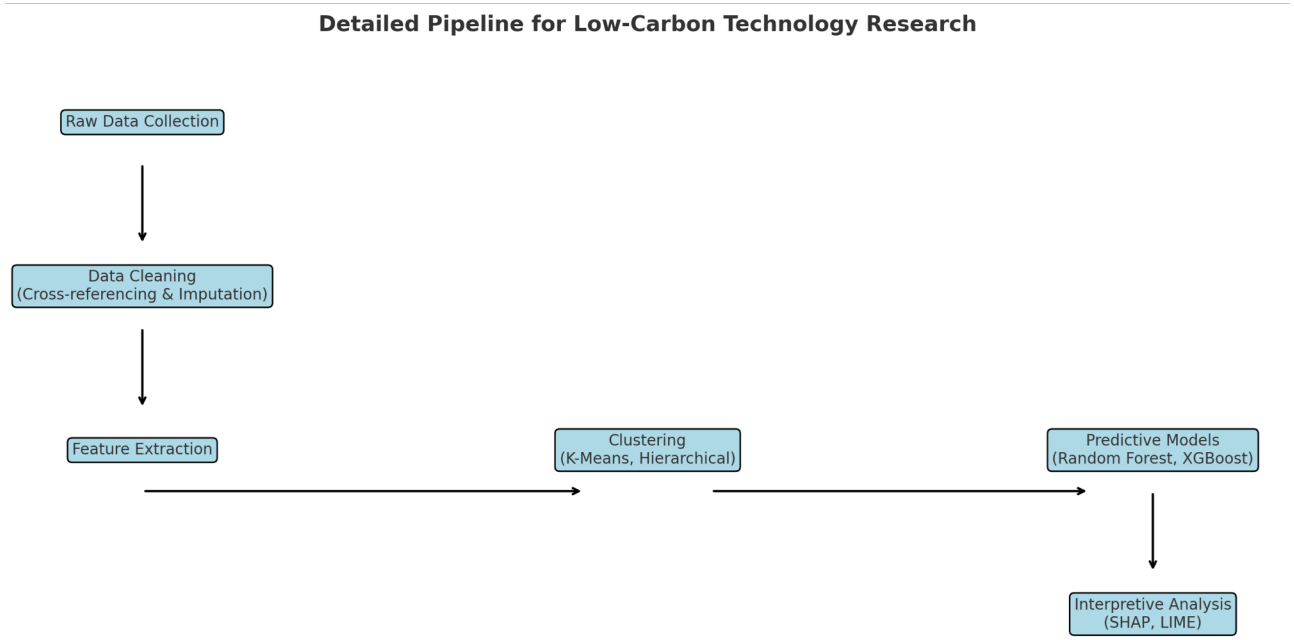
Why it Matters

- Climate change demands innovation and collaboration
- Technology transfer is pivotal for sustainability goals

Research Objectives

- **Unveil** global low-carbon technology transfer patterns
- **Analyze** their impact on national sustainability outcomes
- **Inform** policies for effective, equitable technology diffusion

Methodology Overview



Techniques

- Random Forest & XGBoost: Predictions/classification
- K-Means & Hierarchical Clustering: Emerging clusters
- SHAP & LIME: Feature analysis and interpretability

Data Pipeline

- **Data Cleaning**: Cross-referencing and imputation
- **Analysis Tools**: Python libraries – Pandas, Scikit-learn, NetworkX

Data Sources

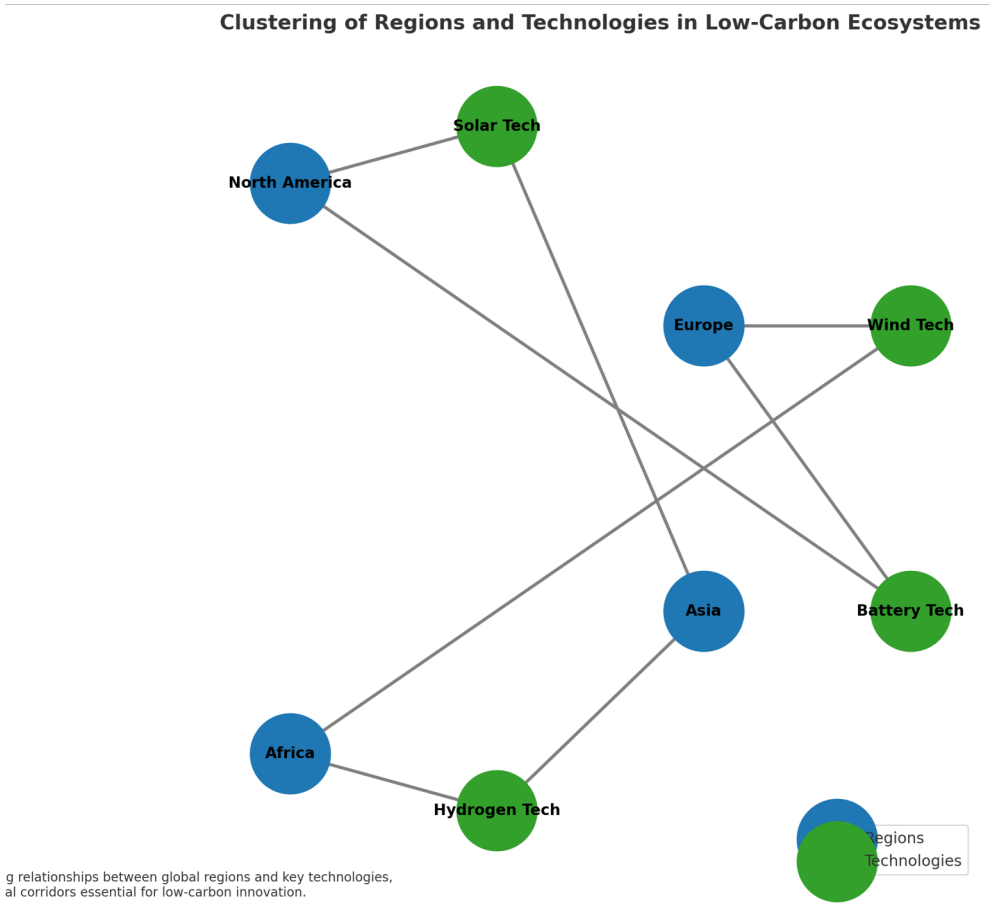
Primary Data Sources

- IMF Global Low Carbon Tech Trade Dataset
- World Bank Sustainable Development Indicators
- OECD Innovation Database

Key Steps

- Cross-referencing and validation
- Sensitivity analyses

Research Design



Overview

Theoretical Frameworks

- Network Governance Frameworks for collaboration
- Sustainable Transition Theories for innovation pathways

Clustering Design

Approach

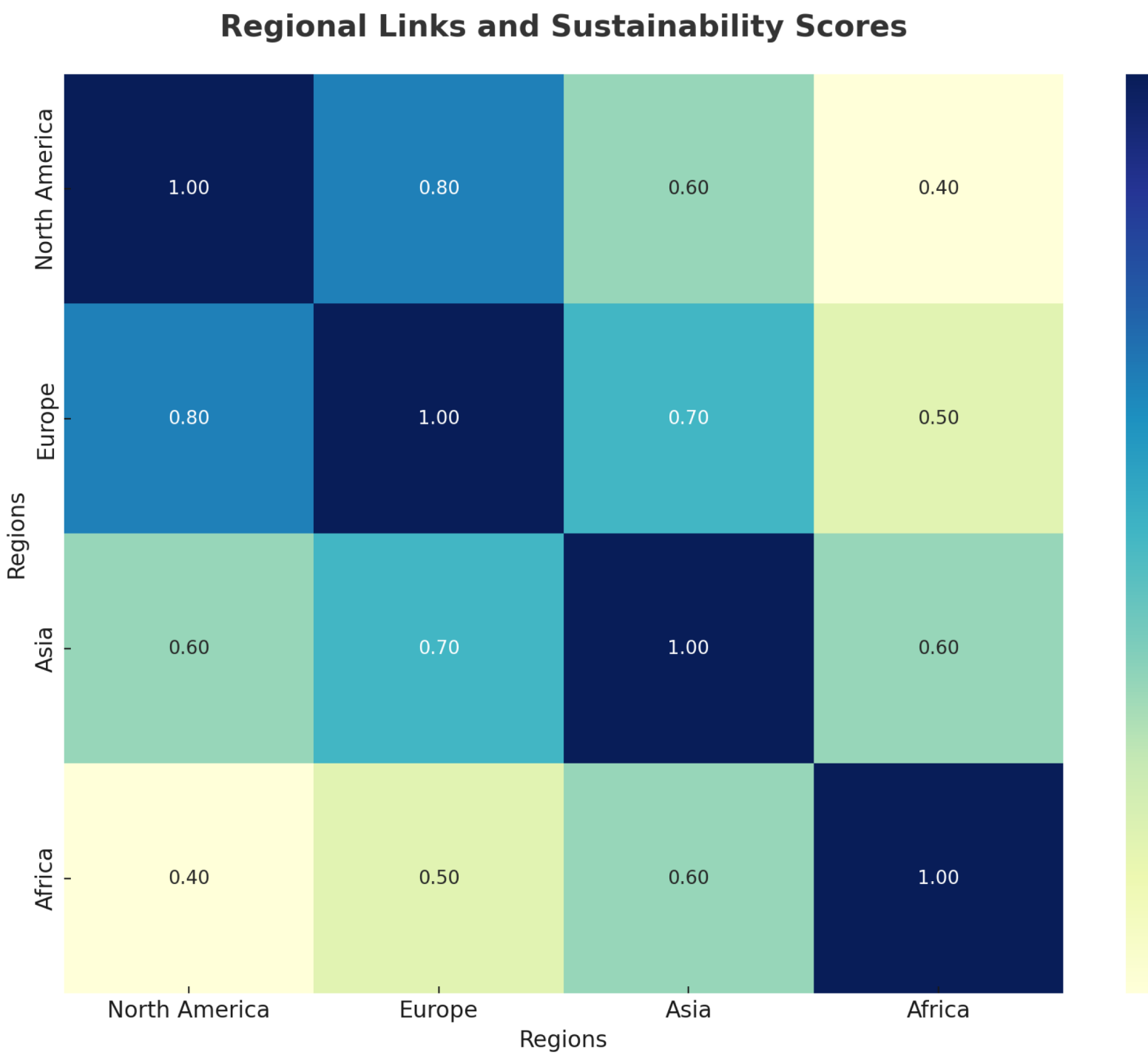
- Identifying “technological corridors” through clustering models
- Mapping critical factors impacting success

Model Outputs

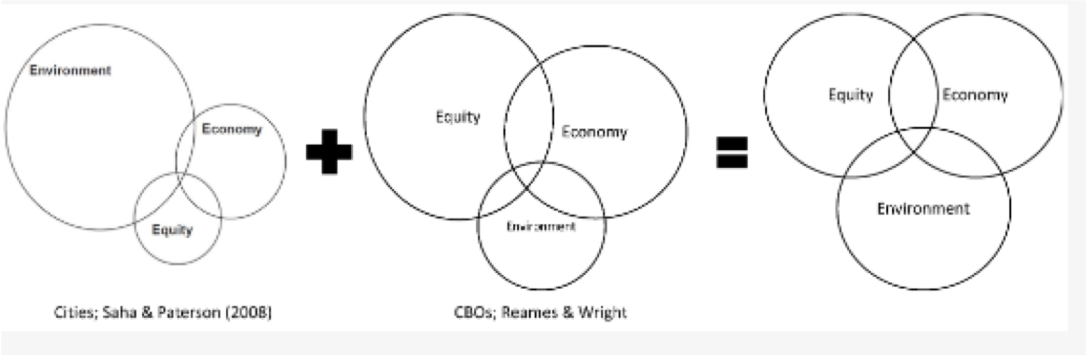
- Predictive models guiding policy frameworks

Key Findings

- **Finding #1**: The heatmap reveals "technological corridors" through strong interregional links
- **Finding #2**: It showcases the correlation between technology transfer (regional links) and sustainability outcomes
- **Finding #3**: This insight can guide policy recommendations for targeted regional collaborations



Key Contributions



Theoretical

- Frameworks for equitable collaboration
- Insights into socio-technical transitions

Practical

- Strategies for equitable innovation diffusion
- Policy recommendations for low-carbon growth

Conclusion

Key Message

- Decarbonization requires analytics, innovative policies, and global commitment

Impact

- Bridging gaps in technological equity
- Providing actionable sustainability insights

"Together, we can accelerate a low-carbon future."

Reference

- Angrist & Pischke (2009), *Mostly Harmless Econometrics*.
- Geels (2002), *Technological Transitions as Evolutionary Reconfiguration Processes*.
- OECD Innovation Database