# Typology of pathways for sustainable transformation

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# Outline

- 1. Motivation
- 2. Literature
- 3. Methodology
  - 3.1. Choices
  - 3.2. Interpretation
- 4. Results
- 5. Application
- 6. Discussion

## 1. Motivation | need for systematic guidance

Climate stabilization (1.5°C) requires **immediate action, but it is unclear** what are the main strategies that actors and policymakers can pursue.

There is a need to understand the different types of **strategies for decarbonization (or pathways)**.

Each pathway is expected to have **different** requirements and benefits.

Is it possible to construct a typology of mitigation strategies?

Can we infer such typology from the literature?

## 2. Literature | some approaches

#### Generic mitigation approaches:

- Vertical, CO<sub>2</sub> taxation (NORDHAUS 2019)
- Horizontal, missions (MAZZUCATO 2019)

#### Potential futures, but no strategies:

- IPCC's SSPs (shared socioeconomic pathways) (RIAHI et al 2017)
- Narratives (SKEA et al 2021)

Highly aggregate analysis:

- 3 broad strategies (SACHS et al 2009)
  - "decarbonization of electricity generation"
  - "energy efficiency in final energy use"
  - "electrification of current uses of fossil fuels"
- Disciplines in the literature (CALLAGHAN et al 2020)



Fig 1: "A map of the literature on climate change"

Callaghan, M. W., Minx, J. C., & Forster, P. M. (2020). A topography of climate change research. Nature Climate Change, 10(2), 118-123.



### 3. Methodology | overview

Fig 3: Approach process



## 3. Methodology | detailed

Literature selection:

- ASReview (VANDESCHOOT et al 2021)

#### Natural language processing:

- LDA (BLEI et al 2001)
- UMAP (MCINNES et al 2020)
- SBERT (REIMERS et al 2019)
- BERTopic (GROOTENDORST 2022)

Co-citation analysis:

- Agglomerative, bottom up (PEIXOTO 2014)

Interpretation:

- Tea leaves (CHANG et al 2009)



## 1.1. Methodology | choices

- Query
- Literature selection
- Preprocessing
- Hyperparameter tuning
- Number of pathways and dimensions
- (In)frequent term rejection

(a) Probability of articles being of interest



#### Fig 6: Literature selection

(b) Article picks in common across models





Fig 7: Pathways selection

## 1.2. Methodology | typology interpretation



Fig 8: frequent and representative terms and keywords





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Fig 10: expert topic's terms and keywords



Fig 11: expert topic's description

## 4. Results | 6 decarbonization strategies



Integrated systems



Technology breakthrough



Demand & co-benefits



Decarbonization of electricity







Land use and circularity



Fig 12: Pathways in the typology

## 4. Results | key topics by strategy



## 4. Results | dimensions across the strategies



## 4. Results | themes at the intersection



Fig 15: Detailed description of the decarbonization strategies by dimensions

## 5. Application | change in countries's strategies, via proxy













## 6. Discussion | some contributions

Taxonomy of strategies identified:

- more **complete** number of strategies
- detailed representation of strategies

Country analysis show **heterogeneity** in mitigation:

- differences among countries
- stability of strategies within countries over time

There are **limitations**. E.g.: data access and topic quality assessment.

Further work and applications:

- understanding strategy mixes
- ongoing strategy evaluation in different domains (i.e. technology, geography, policy)

## Thank you



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