CAN AI SUPPORT CLIMATE PLANNING?

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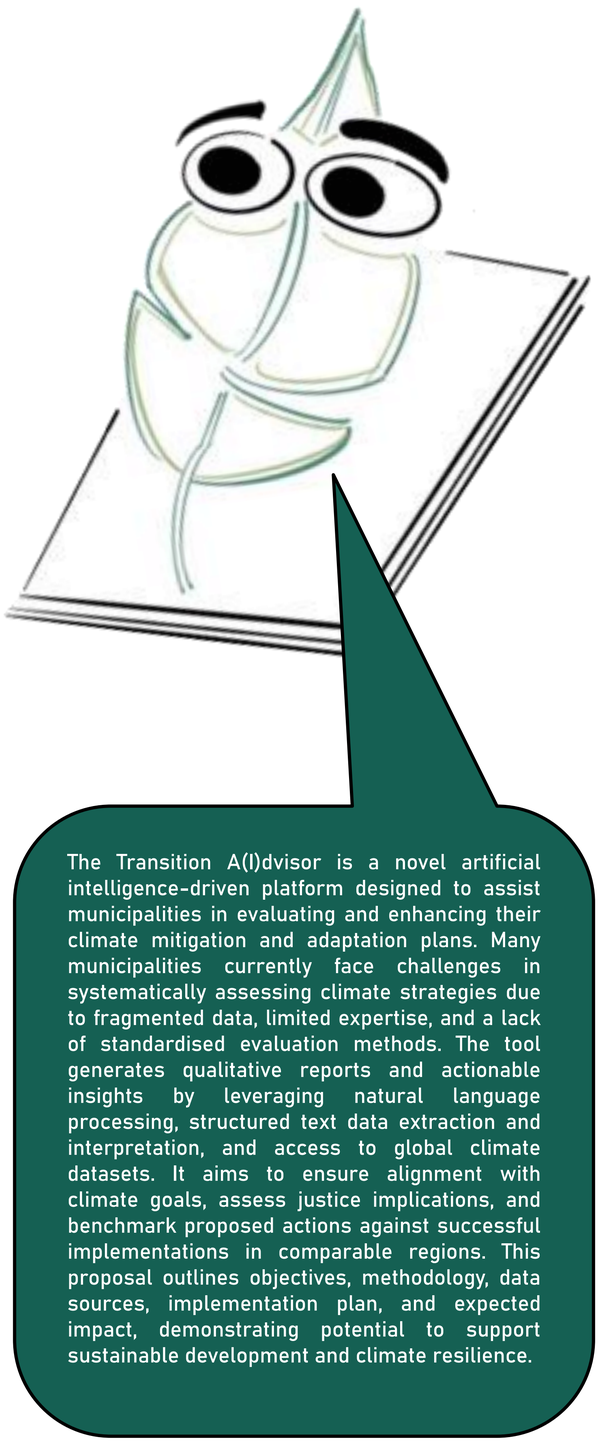
CHAPTER 1: THE GAP

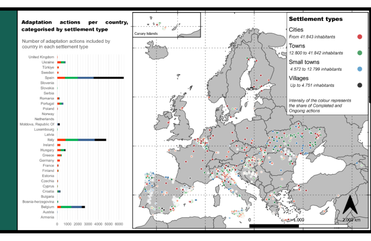


The Transition A(I)dvisor is a novel artificial intelligence-driven platform designed to assist municipalities in evaluating and enhancing their climate mitigation and adaptation plans. Many municipalities currently face challenges in systematically assessing climate strategies due to fragmented data, limited expertise, and a lack of standardised evaluation methods. The tool generates qualitative reports and actionable insights by leveraging natural language processing, structured text data extraction and interpretation, and access to global climate datasets. It aims to ensure alignment with climate goals, assess justice implications, and benchmark proposed actions against successful implementations in comparable regions. This proposal outlines objectives, methodology, data sources, implementation plan, and expected impact, demonstrating potential to support sustainable development and climate resilience.

1. My target

Did you know that municipalities play a vital role in the fight against climate change?

Through localised mitigation and adaptation strategies, cities and towns are at the forefront of turning global goals into local action [1,2]. They design, test, and implement practical solutions that can make a real difference in people's lives, from renewable energy projects to flood management and nature-based solutions.



Adaptation actions per country, categorised by settlement type. While the colour represents the settlement type, the intensity of such colours in the right map represents the percentage of Completed and Ongoing actions in each signatory.

Figures extracted from:

Empirical insights on adaptation implementation in European cities. *Under review. Please do not copy or distribute.*

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2. My gap

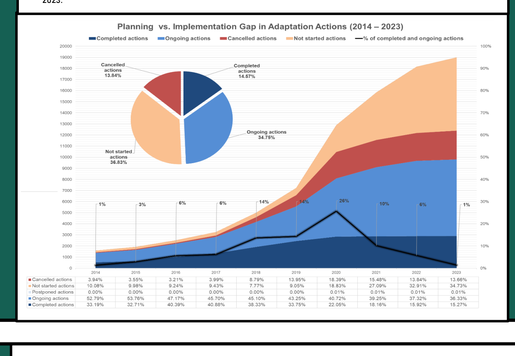
So, why is planning so hard?

The complexity of climate data can be overwhelming, and different frameworks don't always align [3]. Add to that the growing need to integrate justice concerns [4] and the difficulty of aligning local ambitions with national and international targets [2]. It's no surprise that progress can stall.

The Implementation Gap: Plans vs. Reality

Yet, there's a problem, many of these good ideas remain just that: plans on paper. Data from initiatives such as the Global Covenant of Mayors Database show that less than half of the climate actions planned by municipalities are actually implemented (Figure at the right of this text). This "implementation gap" highlights the challenge of moving from intention to action in local climate policy [6].

Planning vs. Implementation Gap in Adaptation Actions (2014–2023). This composite figure illustrates the cumulative gap between planned and implemented adaptation actions from the Global Covenant of Mayors – A complete collection of action plans and monitoring reports from the MyCovenant reporting platform, 4th Release 8. The stacked area chart visualises the cumulative distribution of actions according to their implementation status in 2023 over time (left Y-axis), while the pie chart summarises the total share of actions between 2014 and 2023.



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3. The solution

The need for standardised evaluation

Another obstacle is that many climate plans lack standardised ways to evaluate progress. Without clear indicators and consistent monitoring, it's difficult to know what works and what doesn't [1]. This gap weakens accountability and limits opportunities to learn from successful examples.

Clear goals and monitoring matter

Setting clear goals and measurable targets is crucial. Municipalities that monitor their actions over time, are better positioned to deliver real change [1,5]. These tools not only strengthen mitigation and adaptation outcomes but also help identify synergies and trade-offs with the Sustainable Development Goals (SDGs) and justice concerns [4]. Realistic, data-driven planning also allows cities to assess costs and timelines more effectively.

Learning together

Municipalities learn not only from their own experiences but also from each other [1]. By sharing lessons, they can avoid repeating mistakes and strengthen collaboration.
Real-life cases also reveal how certain actions might unintentionally harm vulnerable groups [7,8], offering important lessons for ensuring fairness, distributional, procedural, and recognitional justice.

4. My role

The balance between systems thinking and simplicity

Systems thinking helps practitioners see how everything, energy, transport, housing, and equity, connects in the big picture. However, it can make planning more complex. That's why planners benefit from frameworks that are not only scientifically sound but also easy to use [9]. Striking this balance is key to translating big ideas into local action.

AI: The bridge between science and practice

This is where artificial intelligence (AI) can make a difference. The proposal envisions an AI-powered assistant that helps municipalities navigate complex climate planning processes (see Figure 1). By combining scientific knowledge with user-friendly design, AI can bridge the gap between theory and practice, helping cities plan smarter, faster, and more justly.

CHAPTER 2: THE TRANSITION A(I)DVISOR

Meet my parents!

Specialised AI Models

The first and most fundamental way AI can help climate planning is, of course, by having an AI model exclusively focused on climate issues.

Let's introduce ClimateBERT as an example!

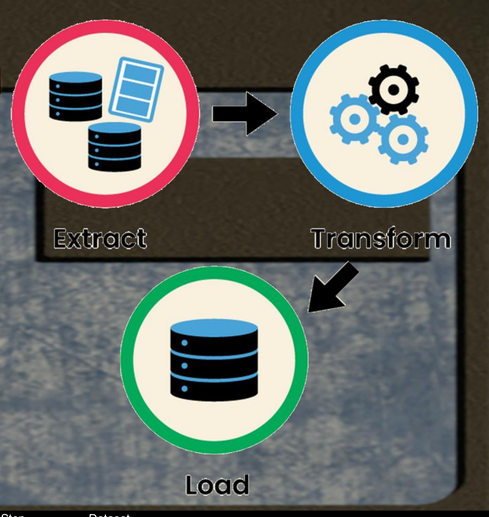
ClimateBERT is a specialised language model designed to *understand and analyse climate-related text*. It has been trained all kinds of climate documents to *recognise patterns*, such as whether a text talks about mitigation, adaptation, or even greenwashing.

It can be used to extract insights from large climate datasets, classify policy content, and track how organisations communicate about climate change.

However, such models can be though to implement, and have a considerable bias.

- Because it's trained mainly on scientific and policy texts, it is less accurately with everyday or informal language, which might be crucial for climate planning. Training a model to identify cross-sectoral issues can be extremely difficult to implement.
- Its training data, mostly from English and Western sources, can introduce regional bias.
- ClimateBERT cannot reason or update its knowledge dynamically, only when re-trained.

Extract, Transform, Load (ETL) Methods



- Rather than building a new specialised LLM Model, using a structured pipeline methodology with existing fine-tuned AI models would have similar effectiveness and ease the implementation.
- Text mining processes proofed effective when analysing climate related documents. Existing applications like DocETL already use this format, showing excellent unstructured text interpretation results [13].
- While relying on GPT-based AI models (or similar), techniques like prompt chaining, in-context learning, or rule-based checks can be used to fine-tune an existing model and to improve the accuracy of the information they extract.
- Several data sources can be perfectly analysed by such metholodogies. In the table below you can find some that might help implement the Transition A(I)dvisor:

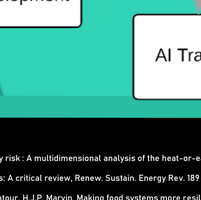
Step	Dataset	Description	Link
Target and Goal evaluation	National Determined Contribution Registry	Repository of countries' climate pledges under the Paris Agreement.	https://unfccc.int/NDCREG
	Inter-sectoral Impact Model Intercomparison Project	Consistent climate impact projections.	https://data.isimip.org/
Justice concerns evaluation	OpenAIRE	Multidisciplinary open-source scientific database.	https://openaire.eu
	DOAJ	Directory of Open Access Journals.	https://doaj.org
Climate action evaluation	Integrated database on adaptation and mitigation measures in Europe	Harmonised database mapping of real-world adaptation and mitigation actions across Europe.	https://doi.org/10.1016/j.dib.2024.110580
	Climate-ADAPT Case study explorer	Database of local and regional adaptation case studies.	https://climate-adapt.eea.europa.eu/#t-database
	EEA database on integrated national climate and energy policies and measures in Europe	European Environment Agency repository of national policies and measures.	http://pam.apps.eea.europa.eu/
	Eurostat	Statistical office of the EU.	https://ec.europa.eu/eurostat/data/database

How do I work?

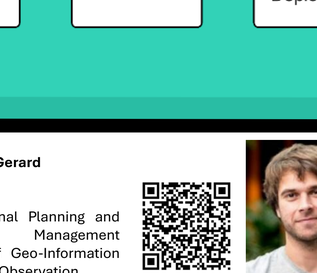
Both AI Specialised Models and ETL Platforms can be combined to enhance climate planning. Here is when I come in. Artificial intelligence offers a transformative opportunity to support decision-making by analysing large datasets, identifying patterns, and generating tailored recommendations [10,11]. My capabilities range from evaluating the goals and targets from climate plans you upload to me to providing their strengths, weaknesses, and recommendations on how to reach them effectively.

Once you upload your plan, I have four primary objectives:

1. Providing structured summaries of local climate plans.



2. Evaluating their alignment with Nationally Determined Contributions (NDCs) and climate impact models.



3. Assessing the feasibility of proposed climate actions, including justice concerns.

4. Benchmarking plans against similar efforts and suggesting improvements.

Also, my Implementation can be quite doable with adequate resources:

REFERENCES:

[1] D. Reckien, A. Buzasi, M. Olazabal, N.-A. Spyridaki, P. Eckersley, S.G. Simoes, M. Salvia, F. Pietrapertosa, P. Fokaides, S.M. Goonesekera, L. Tardieu, M. V. Balzan, C.L. de Boer, S. De Gregorio Hurtado, E. Feliu, A. Flamos, A. Foley, D. Geneletti, S. Grafakos, O. Heidrich, B. Ioannou, A. Krook-Riekkola, M. Matosovic, H. Orru, K. Orru, I. Paspaldzhiev, K. Rižnar, M. Smigaj, M. Szalmáné Csete, V. Viguié, A. Wejs, Quality of urban climate adaptation plans over time, Npj Urban Sustain. 3 (2023) 4–6. https://doi.org/10.1038/s42949-023-00085-1.

[2] G. Melica, P. Bertoldi, A. Kona, A. Iancu, S. Rivas, P. Zancanella, Multilevel governance of sustainable energy policies: The role of regions and provinces to support the participation of small local authorities in the Covenant of Mayors, Sustain. Cities Soc. 39 (2018) 729–739. https://doi.org/10.1016/j.scs.2018.01.013.

[3] G. Martínez Görbig, J. Flacke, M. Keiler, N. Pflugradt, R. Siluzas, D. Reckien, Fitting consistent knowledge into the planning process: An integrated database on adaptation and mitigation measures in Europe, Data Br. 55 (2024). https://doi.org/10.1016/j.dib.2024.110580.

[4] K. Swanson, Centering Equity and Justice in Participatory Climate Action Planning: Guidance for Urban Governance Actors, Plan. Theory Pract. 24 (2023) 207–223. https://doi.org/10.1080/14649357.2023.2189288.

[5] S. Rivas, R. Urraca, V. Palermo, P. Bertoldi, Covenant of Mayors 2020: Drivers and barriers for monitoring climate action plans, J. Clean. Prod. 332 (2022) 130029. https://doi.org/10.1016/j.jclepro.2021.130029.

[6] E. Arteaga, J. Nalau, R. Biesbroek, M. Howes, Unpacking the theory-practice gap in climate adaptation, Clim. Risk Manag. 42 (2023) 100567. https://doi.org/10.1016/j.crm.2023.100567.

[7] D. Reckien, A.K. Magnan, C. Singh, M. Lukas-Sithole, B. Orlove, E.L.F. Schipper, E. Coughlan de Perez, Navigating the continuum between adaptation and maladaptation, Nat. Clim. Chang. 13 (2023) 907–918. https://doi.org/10.1038/s41558-023-01774-6.

[8] G. Martínez Görbig, J. Flacke, R. Siluzas, D. Reckien, Unveiling energy poverty risk : A multidimensional analysis of the heat-or-eat dilemma, Energy Res. Soc. Sci. 125 (2025).

[9] P.D. Aboagye, A. Sharifi, Urban climate adaptation and mitigation action plans: A critical review, Renew. Sustain. Energy Rev. 189 (2024) 113886. https://doi.org/10.1016/j.rser.2023.113886.

[10] W. Mu, G.A. Kleter, Y. Bouzembrak, E. Dupouy, L.J. Frewer, F.N. Radwan Al Natour, H.J.P. Marvin, Making food systems more resilient to food safety risks by including artificial intelligence, big data, and internet of things into food safety early warning and emerging risk identification tools, Compr. Rev. Food Sci. Food Saf. 23 (2024) 1 – 18. https://doi.org/10.1111/1541-4337.13296.

[11] K. Ukoba, K.O. Olatunji, E. Adeoye, T.-C. Jen, D.M. Madyira, Optimizing renewable energy systems through artificial intelligence: Review and future prospects, Energy Environ. 35 (2024) 3833 – 3879. https://doi.org/10.1177/0958305X241256293.

[12] S. Patil, N. Pflugradt, J.M. Weinand, D. Stolten, J. Kropp, A systematic review of spatial disaggregation methods for climate action planning, Energy AI. 17 (2024) 100386. https://doi.org/10.1016/j.egyai.2024.100386.

[13] S. Shankar, A.G. Parameswaran, E. Wu, DocETL: Agentic Query Rewriting and Evaluation for Complex Document Processing, (2024). http://arxiv.org/abs/2410.12189.

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