



Political positioning of Recovery and Resilience Facility (RRF) discourse – The loss of green objectives

László Kökény^{a,d,*}, Zoltán Kmetty^{b,c}, Olivér Hortay^{d,e}

^a Corvinus University of Budapest, Institute of Sustainable Development, Hungary

^b HUN-REN Centre for Social Sciences, CSS-Recens Research group, Hungary

^c Eötvös Loránd University, Faculty of Social Sciences, Sociology Department, Hungary

^d Századvég Foundation, Hungary

^e Budapest University of Technology and Economics, Hungary

ARTICLE INFO

Keywords:

Green transition

Green deal

RRF

EU

Social media

ABSTRACT

Although decarbonisation and sustainability goals are marked in the post-COVID-19 and polycrisis recovery efforts of all European Union Member States, the communication space around the issue is still fluid. In this paper, we use natural language processing and text-mining methods to map key EU-level actors' discourse regarding green transition and the recovery fund. We collect the social media posts of European Parliament members, key representatives of national governments, and relevant institutes (like European Commission Directorate-Generals) from 2019 to 2023. We use Large Language Model-based classification and topic modelling to identify the main discourse frames, present the dynamics of the issue evolving, and map how different actors participate in the debate. Our approach makes it possible to understand how the energy and climate policy and recovery dialogue were developing within the European political space. Our results show that the green transition theme in the Recovery and Resilience Facility (RRF) was almost entirely lost by 2021 after its initial low profile. It has given way to purely political and legal debates, and raising funds from the Member States has also become central to the RRF theme. The political parties, as were ENVI and DGs on the policy communication levels, were responsible for this. The RRF has been placed in the public space not by focusing on and further promoting the green transition but by making it the arena for economic recovery and political debates.

1. Introduction

Ambitious targets underpin the EU's green transition. This ambition is mainly reflected in reducing carbon emissions, as declared by the European Commission in the Paris Agreement and the Green Deal [1,2]. Policymakers blame carbon emissions as the primary cause of global warming, alongside greenhouse gas emissions, increased transport and intensive heating and cooling of buildings [3]. Some researchers argue that developed countries [4] and their households can play an active role in improving the efficiency of the green transition [5]. They therefore suggest that policy should play a role in increasing the engagement of residents [5]. A critical tool for this could be the development of a green economy in the housing sector [6]. However, others argue that the economy itself and its associated policies should be structured and adequately regulated to protect residents [7].

The European Union's green transition plan has set a binding target of achieving climate neutrality by 2050 [8]. An intermediate target has been set within this longer time horizon, aiming for emission reductions of 40 % by 2030 and 55 % from 2021 onwards [9]. This package has been dubbed „Fit for 55". Its primary purpose is to review and update EU climate, energy and transport legislation to achieve the intermediate target of 2030 and the final climate neutrality target of 2050. On 17 December 2020, the Council decided to adopt the next long-term EU budget for the period 2021–2027 [10]. On 18 December 2020, the European Parliament and the Council agreed on the Recovery and Resilience Facility (RRF), the centrepiece of the Next Generation EU [10]. Subsequently, in the spring of 2021, Member States were able to submit their Recovery and Resilience Plans, setting out a coherent package of reforms and investment projects [10].

RRF is a temporary recovery tool. The Commission can provide the

* Corresponding author at: Institute of Sustainable Development, Corvinus University of Budapest, Fővám Tér 8, Budapest 1093, Hungary, Századvég Foundation, Budapest, Hungary.

E-mail address: laszlo.kokeny2@uni-corvinus.hu (L. Kökény).

<https://doi.org/10.1016/j.sfr.2025.101068>

Received 23 February 2025; Received in revised form 23 May 2025; Accepted 25 July 2025

Available online 2 August 2025

2666-1888/© 2025 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Member States with a backup fund [10]. Half of this is loans and half grants [11]. Its fundamental objective is to promote the achievement of climate neutrality further, i.e. to facilitate the green transition and support the digital transition and job creation. It will allow the work to start before the coronavirus outbreak continues. The instrument will also support the green transition by promoting a circular economy. The Commission plans to support the Member States on the priority themes until 31 December 2026. Furthermore, the Directorate-General for Economic and Financial Affairs is responsible for the European Union's policies that promote economic development and recovery, high employment and a stable financial environment [12]. Similarly, this DG is responsible for alleviating the stagnation and crisis caused by the coronavirus by mobilising the instruments provided, thus supporting the green and digital transition for the Member States of the European Union. After lengthy technical discussions, EU decision-makers and policy-makers laid the foundations before the coronavirus pandemic broke out [13].

As the Covid-19 pandemic has subsided, the „Fit for 55“ package of measures has also triggered new questions for academia, particularly public price perception and price sensitivity [14]. However, the considerable policy debate has been over the RRF, which was set up to mitigate the damage after the pandemic and create livelihoods for future generations [15]. The RRF would provide financial support for investment and reform, including the green and digital transition and the resilience of national economies, and link them to EU priorities [10]. Overall, the main fault lines have been clustered around policy themes such as energy efficiency, low-carbon energy supply, optimisation of energy systems and, most recently, decarbonisation of transport over the last decade [1]. In the policy battles behind these issues, we can see and expect that the primary goal of EU policies is to achieve the fastest and most immediate CO₂ emission reductions possible while maintaining economic and social stability and the goal and targets in a way that builds the most remarkable possible political consensus around them [16,17].

From 2022 some recent studies were measuring the international and national management of RRF's goals [17,18]. Due to the Russian invasion of Ukraine, increase in energy prices generated more challenges in the EU [19]. The EU member states responded to the crisis with sanction policy which also touched the energy and financial situation in the continent [20]. This phenomenon has challenged the further expansion of renewable resources and the development of the green transition, meanwhile the EU citizens' perceptions on green energy and green transition were positive and supportive [15,21]. Based on these antecedents, there is a need to support green transition from EU's policies, green financing and recovery strategies, like RRF program [22,23]. However, competing topics and discourses in recovery strategies have not yet been grouped together in the theoretical literature.

The number of studies examining the green transition, environmental protection, and the results of reconstruction strategies has steadily increased over the past decade [24]. The impact of the challenges of recent years has also been examined in terms of whether the green transition can be carried out effectively, whether carbon neutrality can be achieved or how recovery strategies can help to ensure continuity of environmental ambition [25]. However, there has been limited work published in the recent years that has examined how recovery strategies and responses to parallel challenges have shaped the themes, directions and content of green transitions and environmental ambitions. A research gap has emerged where it is worth exploring how recovery strategies such as the RRF have generated discourses on content in challenging times, and how the programme has undergone a content transformation in its development around the themes of green transition and environmental ambition. There is a lack in assessing how the debates around the RRF brought about changes in the priority themes and how these themes competed with each other in the relevant period 2019–2023 [26]. With the use of Large Language Model and Natural Language Processing it could be mapping the place and

relationships between existing relevant contents, debates, topics and keywords [27]. This approach will make it possible to describe and map the changes in discourses and content affecting the goals of the RRF, from the green transition and environmental ambitions point of view.

First goal of this study to analyse how actors of the European Union and the European States discuss the recovery strategies and efforts and the Recovery and Resilience Facility (RRF) until the end of 2023. The study also aims to map the place of the green transition and environmental ambitions place during the debates and discourses of RRF planning. Advanced text mining methods were used to map the main discourse frame around the topic on Twitter (currently X). We measured 813 key actors (Members of European Parliament, chairs and presidents of the EP, representatives, parties and political groups. Our results show that the discussion was mainly around the political aspects of RRF funding like budgeting and laws or crisis debates. While green transition ambitions and environmental goals were rarely mentioned in this discussion, especially during the Covid-19 pandemic and Russian invasion of Ukraine. The topic of green transition and environmental ambitions were measured mainly in the level of representatives, directors, commissioners, and the official channels of related DGs, while EP members or political parties were mainly focusing on the political debates and general topics of RRF. This kind of research can help analysing and mapping the focus point or possible misroutes, turns or directions during such a long-term debate about an international program, like it was in the debates of RRF.

In the following section, the methodology, sampling and analytical techniques used are described. The results section presents our primary research analysis answering our research questions. Finally, with the results in mind, we conclude the final chapter by referring back to the literature and policy background that underpins our research and draw conclusions and policy implications.

2. Data and methods

In this paper, we use natural language processing (NLP) and text mining methods to map the discourse on RRF and green transition of key actors in the field. The study analyses the Twitter feed of key European politicians and the representatives of the main decision-making organizations. We manually checked the homepage of all EP members and saved their Twitter (X) account names. We added the Twitter account of the party group and parties and the European Parliament Committee on the Environment, Public Health and Food Safety (ENVI) representatives to this list. To cover the EU institutions potentially dealing with RRF and the green deal, we also listed the "Climate action", the Energy and the Environment DG, and their deputies' Twitter accounts. We identified 813 key actors in the field of European politics with valid Twitter account between [28] and 2023. Table 1 contains the key actors.

If a MEP was a member of ENVI, we classified them to the ENVI group. In the case of other politicians, we tried to map all those actors in the EU countries who could have an essential role in the GD-related decisions. This consisted of the main parties' leaders, the prime ministers, the presidents of the republics, the chancellors, and the ministers of

Table 1
Summary of the sample.

Key actors' groups	Number of measured key actors
Members of the European Parliament (MEP)	583
Chairs and presidents of the EP	51
Representatives of European Parliament Committee on the Environment, Public Health and Food Safety (ENVI)	54
Political groups	7
Parties	34
Other Politicians	70
Other	15

energy and environmental. The other category consisted of the directors and commissioners and the official channels of related DGs. In the database, we collected the country and political parties of all the accounts where it was relevant.

For collecting Twitter (currently X) data, we used the database of a Social Listening company, Sentione. Sentione provided access to all the public tweets of the listed actors. The general EP elections were held at the end of May 2019, so we defined the start of the data collection at 1st of June 2019, as we wanted to focus on this EP cycle. The last collected day was the 31st of December 2023. We downloaded all the tweets of the listed account within this period. We also downloaded the metadata of these tweets (likes, comments, retweets). The 813 actors had 714 041 tweets in the selected period. An average actor had 877,2 tweets (0.52 tweets per day), and the mean daily tweet number was around 425. The most active actors were the Spanish, Italian, and Polish accounts on a country level.

We did some basic data preprocessing on the tweets. We removed the links and the tags from the tweets and all the emojis. The tweets were in different languages; only 10 percent of the tweets were written in English. In the first step of the data curation process we translated all the tweets to English with the Google translator API.

For the analysis, we had to identify tweets related to energy and green transformation and content associated with RRF. The latter could naturally appear in tweets that did not mention energy and green transition. We used a Large Language Model (LLM) for classification. LLMs are currently the state-of-the-art solutions for this kind of task. LLMs encompass many different models, but most frameworks are built on a transformer approach consisting of an encoder and a decoder. The encoder processes an input sequence of tokens and produces a continuous representation, which the decoder then uses to generate the output text. There are different classification approaches in the case of LLMs, too. Huge models are capable of classifying without training data or with minimal training data. However, fine-tuned encoder models could provide a great classification result even with smaller LLMs [29]. First, we have to create training data for fine-tuned encoder model. For the classification, we selected 2000 tweets and manually coded them according to whether or not they were energy or green transition-related tweets. Since we assumed that tweets in the topic area under study would be under-represented in the overall discourse, we followed a two-step process for selecting tweets for annotation. Based on a word frequency analysis of the tweets, we selected 45 keywords and hashtags. These keywords were all related to green (energy) transformation and environmental protection. For manual classification, we selected 1000 tweets that included one of the keywords and 1000 tweets that did not. The more balanced selection of tweets for annotation made the classification model easier to predict for the outcome categories. A BERT-based language classification model was fitted to the annotated tweets [30]. BERT is currently the most frequently used LLM for classification tasks, as it can be run on a desktop computer, and with a fine-tuned approach, it can reach high classification performance [29]. The model's accuracy on the test data was 97 percent, with an F1 value of 0.94.

In the next part of the data preprocess, RRF-related tweets were identified. Based on the manual review of tweets, a dictionary-based solution was chosen. We used three phrases, "recovery," "resilience fund," and "RRS," for this classification. After that, we fitted a topic model for the tweets we identified as RRF-related by the keywords. Topic modelling facilitates understanding large texts by uncovering the hidden thematic structure within a corpus [31]. The most widely used approach for topic modelling is Latent Dirichlet Allocation (LDA) [32], which assumes that words symbolize significant semantic meaning and that documents with similar content tend to use similar groups of words. LDA is based on a hierarchical Bayesian probabilistic model, treating topics and their distributions across documents as latent variables. As a result, each document can be represented as a mixture of multiple topics, each with its own probability. This paper employs a special LDA model

called Structural Topic Modelling (STM - [33]). STM extends traditional topic models by incorporating document-level metadata. Unlike LDA, which assumes topics are uniformly distributed across documents, STM allows metadata to influence topical prevalence and topical content. We used the Political Group categorization, the type of the actor, and the green-transition classification as covariates in the structural topic modelling. Before the topic modelling, we lemmatized the tweets (but not the hashtags of the tweets). We tested different topic numbers. We selected a nine-topic solution based on semantic coherence [34] and exclusivity [35] metrics. The result of the topic model showed that one topic contains out-of-context tweets. These tweets were about recovery from accidents or health issues. We coded this topic as not RRF-related and focused on the rest of the eight topics in the analysis phase.

3. Results

3.1. Energy and environmental transition tweets

As described in the Data and methods section, we identified the energy and green transition-related tweets with a LLM based classification. Around 9.05 percent of the tweets were classified into the topic of our broad interest. The frequency of tweets was between 4 and 14 percent monthly in the whole period (see Fig. 1). There was relatively high volatility on a monthly basis, but tweets on energy and green transformation were slightly more frequent in proportion at the beginning of the EP cycle and at the end of 2022.

An average tweet had 94 retweets, while the energy and green transition-related tweets only had 45 retweets, so this topic was less engaging than the average tweets. However, that is also important to mention that accounts more often tweeted energy and green transition-related tweets with a smaller follower basis.

There was a big difference in the average of the topic-related tweets per type of the actors. We measured the highest rate (66.3 percent) in the Other category, which consisted of the directors, commissioners, and the official channels of related DGs. This result is followed our expectations. The second-highest rate was measured in the ENVI category, while the lowest was the Party category.

In the case of party groups, we measured the highest rate in the Greens-European Free Alliance party group (28.3). At the same time, the lowest was in the Identity and Democracy group (just 3.8 percent). The difference was huge on the country level too. The three northern countries (Sweden, Denmark, and Finland) had the highest topic-related tweets ratio (22–25 percent). On the other side of the scale, we found Italy, Estonia and Poland (3–4 percent).

Besides the descriptive statistics, we run several regression models to test the result more robustly. We used binomial logistic regression as the dependent variable had two values. We used the number of retweets and the number of followers, the account type, and the year of tweet (categorical) as independent variables. The regression model confirms the results of the descriptive statistics. The number of retweets and the number of followers correlated negatively with the probability that the tweet was energy and environment-focused, and the accounts in the "Other category" tweeted energy and environmental transition posts with higher probability. We tested the interaction effect of the independent variable. We only found one remarkable result here. Although in every year, the energy and environmental transition tweets got fewer retweets, but in 2019 this effect was smaller than in the following years.

3.2. The RRF discourse

During the entire period under review, 0.9 percent of tweets were about the RRF and EU plans to help the EU countries out of the crisis. However, the dynamics of the topic over time were very marked (see Fig. 2). After the spread of the RRF, leading European politicians and parties will quickly start to address the issue as early as April 2020. The peak appearance of the topic is in May and July 2020. In both months,

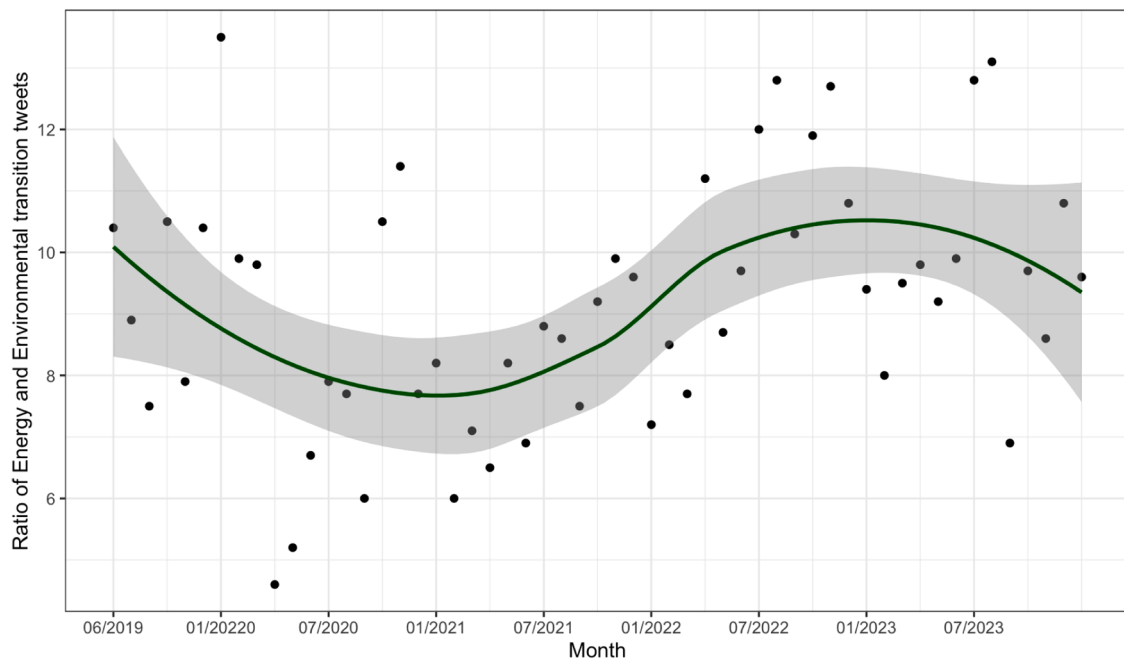


Fig. 1. Ratio of Energy and environmental transition tweets.

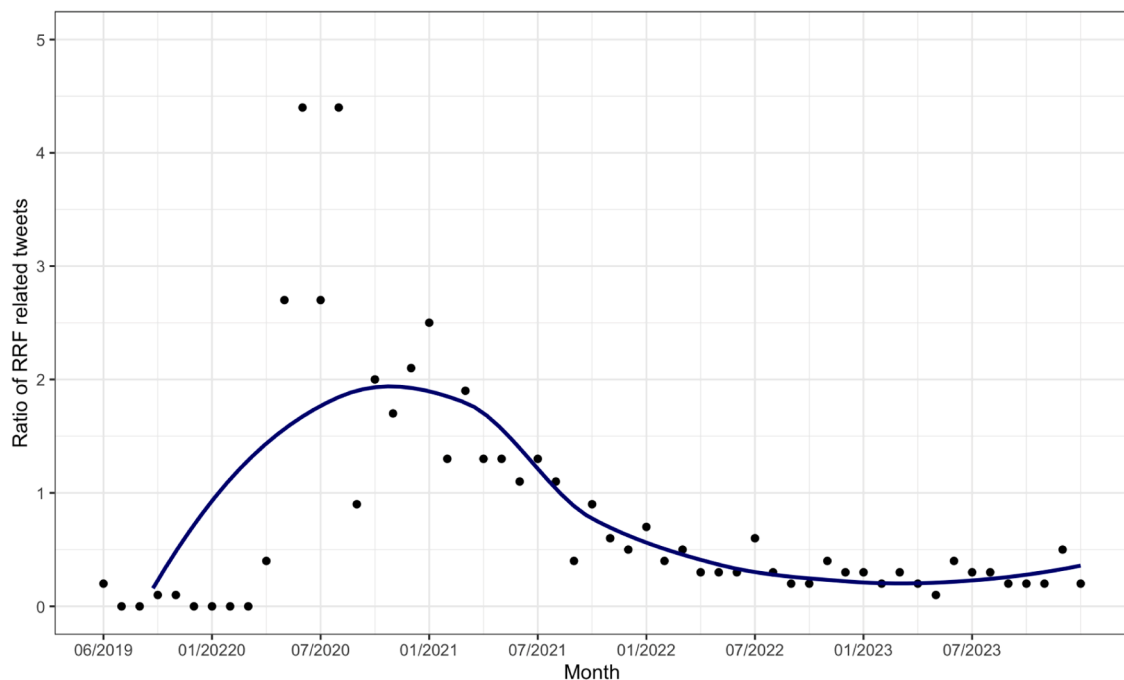


Fig. 2. Ratio of RRF related tweets.

>4 percent of tweets addressed the issue. Although the topic's share of the discourse declined somewhat afterward, it still occupied 1.5 - 2 percent of the discourse until the second half of 2021. However, by the end of 2021, the topic disappears almost entirely from the public discourse of Europe's leading politicians and parties, practically failing to reach half a percent.

Among the party families, SD and Renew stood out, tweeting more than their weight on the RRF. The differences in the types of issues examined were less pronounced, with parties showing less interest in this issue and party families showing more. This can be attributed to the fact that the parties' tweets were more focused on national issues,

including domestic policy matters, which naturally led to less discussion about the RRF. The RRF was more a topic of European-level discussion, although as we will see in the later analysis, it also found its way into national discourse. In terms of country breakdown, it's worth noting which countries had less discussion about the issue. Poland, Estonia, Austria, the Czech Republic, and Germany were the leaders in this respect. On the other end of the spectrum were Romanian parties and politicians, whose tweets on the topic accounted for >6 percent of their total tweets (Table 2).

A structural topical model was used to identify eight topics within the RRF discourse, which were grouped into four thematic clusters.

Table 2
RRF discourse topics.

	Topic name	Featured words	Percent	Political Group	Actor Type	Country
Budget and Law	Rule of Law (Hungary, Poland)	money, law, rule, say, Poland, want, right, Hungary, spend, commission	13.90 %	Conservatives, G/EFA, ID	Chairs - presidents	Hungary, Italy, Poland
	Financial background of recovery and its possible burden	billion, #recoveryfund, tax, country, Italy, euro, resource, year, use	19.20 %	ID	MEP	Italy,
	Budget agreement	budget, parliament, agreement, commission, vote, proposal, council, package, important, finance	10.30 %	Renew, SD	MEP	Belgium, Portugal
(Political) Debates and Communication	(Political) debates on recovery plans	national, resilience, state, member, #rrf, week, debate, live, MEP, conference	9.60 %	EPP	Chairs - presidents, PG	Croatia, Portugal, Poland, Romania, Slovenia
	Recovery plan is a “must” to overcome the crisis	must, crisis, need, work, Europe, time, pandemic, make, can, now	9.70 %	SD	Politician	Belgium, Spain
	Announcement on recovery plans	meet, #covid19, discuss, support, #nextgenerationeu, thank, #eu, #mff, talk, #recovery	11.20 %		Other, PG	Croatia
National level discourse	Recovery plan on country level	economy, social, job, investment, health, measure, sector, transformation, project, public	13.90 %	SD	Parties	Spain
Green discourse	Green recovery	green, climate, energy, transition, sustainable, #eugreendeal, #greenrecovery, ecological, digital, economy	12.3 %	G/EFA	ENVI, Politician	Denmark, Finland, France, Netherlands

Three topics dealt with the budgetary and legal parts of the RRF. Within these, the most significant - occupying nearly 20 percent of the total discourse - dealt with the financial background of the RRF and the tax burden that would subsequently be placed on residents as a result. This group of topics also included the threads on the RRF budget vote and the content that dealt with the link between RRF disbursement and compliance with EU core values (rule of law). The latter mainly concerned Poland and Hungary.

The second major group of topics, which we have identified, underscores the diversity of the RRF discourse. It covers a range of debates, conferences, and announcements surrounding the RRF. Under this theme, we have identified three distinct topics. The first one focuses on the political discussions around the RRF, the second one focuses on the

necessity of the recovery plan to overcome the crisis, and the third one provides more general announcements about the RRF.

The last two groups of topics consisted of 1–1 topics. A prominent element of the discussion was the transposition of the RRF into a national context, mainly regarding how RRF resources will be used in national level. The last topic covered the RRF’s tweets on the green transition. 12.3 percent of the total RRF discourse was devoted to this topic, with members of the G/EFA party family being the most active, as well as ENVIs and national politicians (which included national energy and green ministers), and Denmark, Finland, France, and the Netherlands among the countries.

The temporal dynamics of the issues reveal a significant shift in the discourse, with the emergence of the RRF funding landscape and its vote

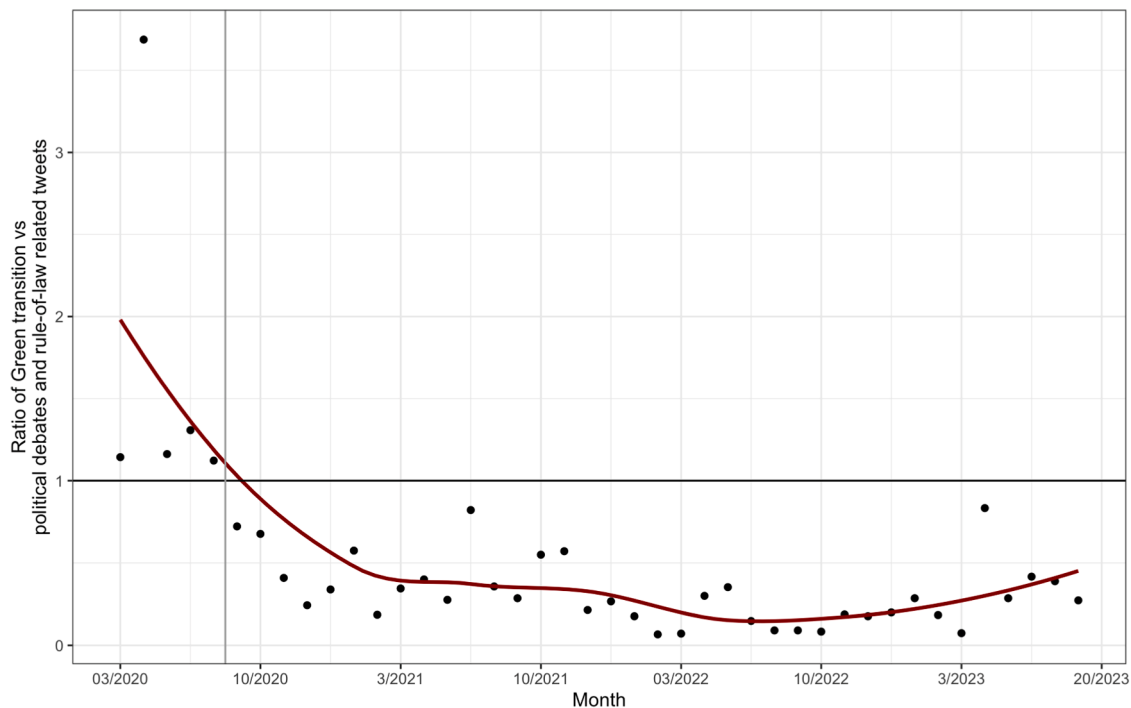


Fig. 3. Ratio of green recovery tweets vs politicized tweets within RRF discourse.

as a pivotal point in spring 2020 (see Fig. A1 in the appendix). This shift, however, does not overshadow the ongoing discussions on the green transition topic, nor does it diminish the relevance of political debates and the application of the rule of law in the Hungarian and Polish contexts. As we move into 2021, with the RRF transitioning into the implementation phase, the topic gains more prominence in the national context, and the proportion of highly politicized tweets escalates, marking a clear shift in the prominence of discourse topics over time.

The relationship between the proportion of tweets on the green transition and the political dimension of the RRF within the RRF discourse illustrates the disappearance of the green element. The latter group includes the political discussion topic and the rule-of-law application topic. Fig. 3 shows the relative proportions of these two groups of tweets. Where we see a value above 1, there were more tweets related to the green transition than the politicized one in the period. In practice, it is only for the first five months of the discourse starting in March that tweets related to the green transition more than the political aspect of RRS, and from August 2020, this trend reversed, and we do not see any change until the end of 2023.

We fit a binomial logistic regression model to find which variables are the most important in distinguishing between the political and environmental RRS tweets. We used the number of retweets and the number of followers, the account type, and the year of tweet (categorical) as independent variables. The model has a high explained variance (R^2 Tjur: 0.386), although only the account type was significant in the model. Those in the “Other category” (mainly the DGs are here) had a much higher probability of tweeting about green recovery within the RRF discourse than politicized tweets. Thirty-four percent of the tweets were about green recovery compared to 66 percent of politicized tweets. But in the other category, close to 100 percent of the tweets were about green recovery, but this value for the MEPs was around 10 percent based on the marginal prediction of the model. If we narrow down this analysis to the MEPs’ tweets, we do not see any temporal shift; the political tweets were overrepresented throughout the period. Based on this, the green recovery narrative was mainly represented by the DGs and only for a short period, but overall, the elected European politicians instead focus on the political part of the RRF.

3.3. Energy and environmental transition tweets vs RRF tweets

Our paper’s primary focus is the green objectives within the RRF discourse. However, as our results show so far, only part of the RRF mentions green recovery, and the environmental discourse is mainly outside of the RRF topic. In the last part of the analysis, we analyse the differences between green tweets within and outside the RRF discourse. Ten percent of tweets in the period under review were dedicated to the crucial topics of energy and the green transition. While some of the RRF discourse touched on the green transition, most RRF-related tweets were unrelated to this aspect. Within the RRF discourse, there was a distinct topic that focused specifically on the green transition, but there were also tweets within other topics that mentioned energy and the green transition. Notably, the topic was most frequently tweeted about in the national context, with a significant share of almost 20 percent. In contrast, tweets related to the green transition in the rule-of-law topics accounted for only three percent. One in five tweets within the RRF discourse was also about the green transition.

In the final part of our analysis, we divided the tweets into three groups, which were:

- Energy and green transition tweets that do not mention the RRF
- Energy and green transition tweets that mention the RRF
- RRF tweets that do not mention the energy and green transition

During the period under review, we observed around 70,000 tweets about the green transition and/or the RRF. The temporal dynamics of the three groups show that even in the most intense period within the

overall green and energy transition, only a small part of the discourse on green transition was taken up by the RRF (see Fig. 4). From 2021 onwards, this proportion has practically shrunk to barely visible despite a more active dialogue on RRF. However, our previous analyses have shown that in this period, RRF appeared mainly at the level of political/legal battles.

We still see interesting patterns if we narrow our analysis to this group of tweets. At the party family level, RENEW and SD members tweeted significantly more about RRF and the RRF and Green transition. By type, proportionally, it was the Chair and Presidents who tweeted a lot about RRF without mentioning green transition. At the same time, other politicians and other actors (e.g., DG leaders) posted more often than average about RRF in the green transition dimension. This is not surprising for the latter, as these groups included politicians involved in national or EU-level green transition. At the country level, the differences were even more marked, with a high proportion of Romanian and Croatian actors (above 30 percent) addressing the recovery issue without green transition, as well as high proportions of Hungarian, Italian, and Greek actors. The Nordic actors - especially from Sweden - who tweeted a lot about the green and energy transition tweeted almost hardly at all about RRF, neither without nor with the green transition. Poland is also worth highlighting in this respect. Although Poland was prominently featured in one of the RRF topics due to the rule of law procedures, Poland was underrepresented in the whole discourse field of RRF.

4. Discussion

As our research has shown, the debate on funding options has been stuck in the political arena. In many cases, domestic political fault lines emerged in the international arena, and many countries were not concerned with the technical use of specific measures. We see many policy linkages when examining our findings. The first finding is the significant variations in the number of tweets and retweets related to the green transition issue in the political arena. On the one hand, tweets showed a lower engagement among users than the average, and on the other hand, accounts with a smaller follower base were mainly engaged with the topic. Thirdly, there were also significant differences between parties in the amount of engagement with green transition in their tweets. The Greens-European Free Alliance party had the highest proportion (28.3 percent), while the Identity and Democracy group had the lowest (3.8 percent). It suggests that this was not the primary issue in the period under review and that it was typically only the party most concerned with the issue (the Greens). There was also significant variation by region, with the Nordic countries (Sweden, Denmark and Finland) addressing the issue, with almost 22–25 % of tweets. At the same time, the Mediterranean and eastern countries (Italy, Greece, Spain, Estonia, Poland) accounted for a low 2–3 percent. It also highlights that attitudes toward the green transition may differ across developed countries, explained by the increasing income gaps within and between countries [2,18]. Furthermore, in the Mediterranean countries, tourism revenues represent a significant share of GDP (up to 20–30 %), so due to the Covid-19 pandemic, these countries are likely to expect support in this area (job creation, economic recovery) with the adoption of the RRF. Thus, it may be worthwhile to improve the engagement of even less committed countries and regions in the green transition.

The second result is that the main themes of the RRF tweets examined in the study do not include the green transition, clean energy or other environmental ambitions. Instead, more general aspects such as budgeting, laws, recovery, resilience, crisis and Covid-19 emerged. It also reflects our previous policy finding that a minority of European Member States that see the adoption of the RRF as an incentive for the green transition see it more as a means to develop and regenerate their economies. The issue is stuck at the level of committees, and budgetary issues, not linked to any technical aspect. It is not directly linked to any critical environmental topics that can be seen, but even the distances are

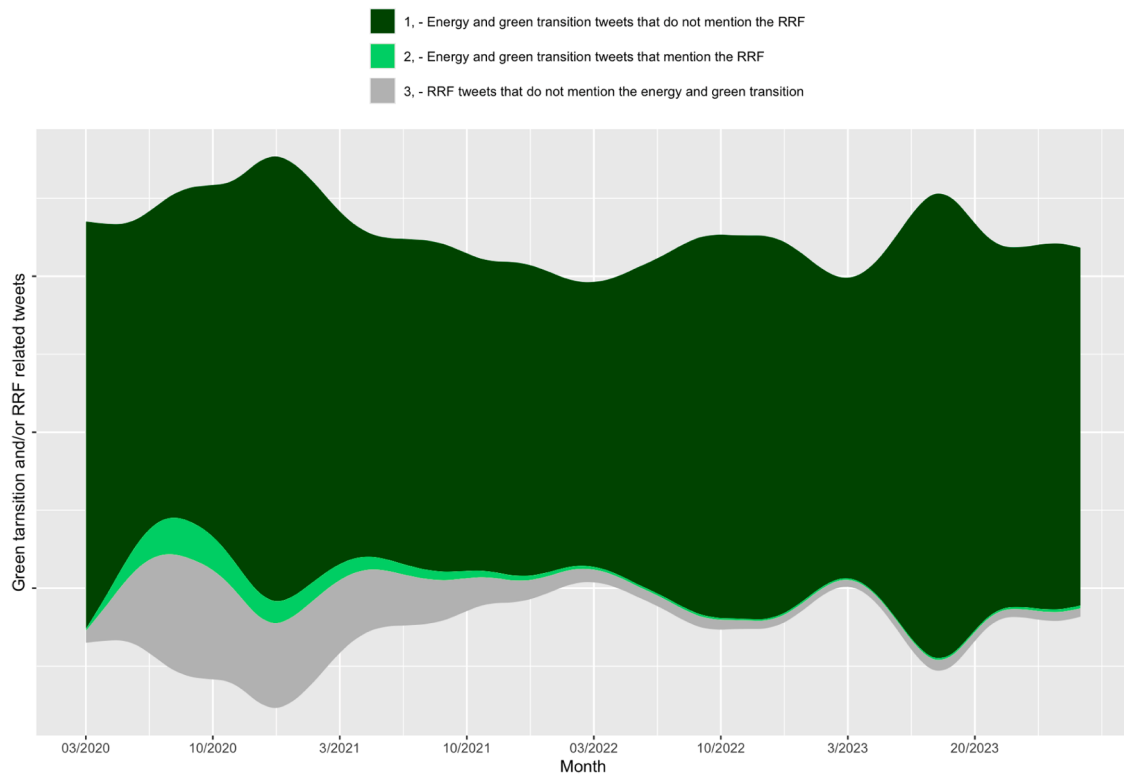


Fig. 4. Temporal dynamic of green transition and/or RRF related tweets.

big. Thus, it can be said that in the public space, the RRF has emerged in a purely political sense, and the relevant foundations for a green transition have not emerged. RRF did not become a theme encompassing a green transition but rather related to areas that came to the fore before the outbreak of the Covid-19 pandemic. And even then, from a political rather than a technical perspective. Moreover, our findings are supported by the fact that politicians discussed the green transition and RRF separately in tweets. It seems from this that the two topics were never really linked. It was also the case in the Nordic countries, where, although they tweeted significantly more about the RRF than other countries in the region, they tweeted much more about the green transition per se than about the RRF.

The final finding is about the complexity of the RRF instrument. The RRF is not just about the green transition per se but also about digital transformation, job creation and recovery of European Member States' economies. However, our results show that even if the green transition was not addressed, the other topics did not cause controversy. The share of tweets dealing with RRF that could be linked to the green transition accounted for <15 %. Instead, technical policy issues, Member State access, payment timing, and legal disputes took up a larger slice, and political debates over these issues. Interestingly, the initial share of green transition issues in the discourse declines over time, disappearing entirely after just over a year. It could be because the coronavirus pandemic has peaked in several waves of outbreaks in Europe, and vaccine procurement has become critical in early 2021 and the attentions were finite [36]. These have all imposed additional costs on the Member States and have further marginalised the issue of the green transition, which was not a central theme from the start of the RRF discourse.

5. Conclusions and further research opportunities

In the last decade, policies have introduced several economic measures and supportive or regulatory financial packages to achieve the goals of the green transition. Some directly penalise emissions (ETS), but

others try to stimulate decarbonisation through development and innovation. Some legs act as a direct incentive for households (e.g. EU Green Deal programmes to support energy efficiency) and elements that may impose additional costs on the population (transport taxation, carbon tax under the „Fit for 55“). These instruments have in common the constant technical discussions and the parallel implementation of the plans.

Moreover, the polycrisis in recent years has raised further questions about the green transition for countries in an economic recession. The stimulus programmes launched over the last ten years could be stalled. The European Commission has therefore adopted a stimulus programme (Next Generation EU) worth more than €800 billion, the bulk of which (€723.8 billion) is being provided by the Recovery and Recovery Facility (RRF) to ensure that the Member States do not stop developing the green transition and that the economic and social damage caused by the pandemic is repaired as quickly as possible. A central element of the Facility is to encourage the Member States to continue the green transition, develop plans and start the tasks.

Overall, it can be concluded that the green transition theme in the RRF is almost entirely lost by the end of 2021, after its initial low profile. It has given way to purely political and legal debates, and the issue of raising funds from the European Member States has also become central to the RRF theme. The political parties were responsible for this at ENVI's and DG's levels. The RRF has been placed in the public space not by focusing on and further promoting the green transition but by making it the arena for economic recovery and political debates. It may be exacerbated by the prolonged nature of the coronavirus pandemic and the Russian invasion of Ukraine, and the fact that it caused much more damage than expected. However, it can be seen that even at the beginning of the negotiations, the green transition was not the primary focus of the RRF in the political arena, even though the RRF's design made this the most critical element. Meanwhile through the RRF there will be available funds for the EU member states until the end of 2024 [37,38].

The green transition has played a secondary role in the

implementation and discourse of the RRF, despite its formal prioritization within EU policy. To realign the RRF with its green transition and environmental ambitions targeted and systemic policy actions are needed. These include embedding climate objectives more firmly in national recovery plans, improving regional and political communication, coordinating green and economic strategies, building capacity in lower-engagement countries, enhancing transparency, and incentivizing political commitment. Together, these steps can ensure that the RRF or other similar recovery programs can become a true driver of Europe's green transition, not just a tool for short-term economic stabilization.

To enhance the RRF effect, during the debates and discourses the policymakers could introduce recognition programs or awards for national and regional leaders who demonstrate commitment to green RRF implementation. In parallel, supporting civil society organizations to monitor and advocate for green recovery measures would strengthen democratic oversight and sustain public pressure on political actors to prioritize climate objectives. Moreover, the European Union should expand its monitoring and reporting mechanisms for green spending under the RRF. Publicly accessible dashboards, country comparisons, and progress reports can help build accountability and foster public and political engagement. Such transparency mechanisms could serve as a soft enforcement tool, encouraging countries to meet their green commitments due to reputational concerns. Finally, as we discussed earlier most tweets and political discussions focused on budgetary and legal issues, with little reference to climate or clean energy goals. This fragmentation reduces the policy coherence needed for an effective green transition. EU institutions and national governments should promote a unified policy narrative that links green transition initiatives with broader economic and social recovery strategies. One possible mechanism is the creation of inter-ministerial working groups that coordinate between environmental and economic portfolios to align priorities and funding decisions.

The political divisions may have influenced our research findings within the country between the different parties and party families. Not all tweets are primarily aimed at the international arena, so it is easy to imagine that populist motivations may have played a role in bringing some issues to the fore and pushing others to the background. To shed some light on the results, it is worth examining the official attitudes of

the parties in the European Member States towards the RRF and the green transition. Putting our research results in context may help measure similar results in subsequent more extensive programmes, whether on the environment or other topics. Our results may also be explained by the fact that international researchers have also pointed out the adverse effects of green transition instruments, as presented in the introduction to the literature, which may have influenced policymakers. It is also worth examining questions of European Member States' attitudes towards instruments to support the green transition in the future.

A comparative analysis of national recovery plans and their implementation outcomes could reveal best practices and structural barriers to integrating green and sustainable priorities. Case studies of both high- and low-committing countries (like Sweden vs. Greece) could be particularly useful. There is a need for empirical research evaluating the environmental and economic impact of RRF-funded green projects [39]. This could involve both quantitative performance metrics (e.g. emissions reductions, job creation) and qualitative assessments (e.g. stakeholder interviews). Finally, it would be worth to measure in further academic studies the influence of political ideology on RRF-related environmental policy, examining why some parties systematically neglect green issues or sustainable policies and how framing or incentives might change that dynamic.

CRediT authorship contribution statement

László Kökény: Writing – review & editing, Investigation, Writing – original draft, Project administration, Supervision, Conceptualization. **Zoltán Kmetty:** Writing – review & editing, Supervision, Formal analysis, Validation, Methodology, Conceptualization, Writing – original draft, Software, Data curation. **Olivér Hortay:** Visualization, Formal analysis, Writing – original draft, Investigation, Writing – review & editing, Project administration, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

Table A1

Table A1
Keywords of the topic.

EuropeanGreenDeal, greentransition, CircularEconomy, ClimateAction, SDGs, climate, 26 COP, GreenFiscalDeal, ClimateChange, environment, renewableenergy, disasterriskreduction, biodiversity, climatefinance, CleanCities, GreenGrowth, Agenda2030, Fitfor55, EnergyEfficiencyFirst, InvestEU, COP26Glasgow, GreenRecovery, Energy, nature, NextGenerationEU, Recovery, Resilience, EnergyPoverty, RenewEurope, RRF, ESF, EURecovery, renewable, renewables, EnergyTransition, SolarEnergy, WindEnergy, FutureWontWait, sustainableenergy, sustainability, ActNow, GlobalWarming, forests, fossil, ActOnClimate

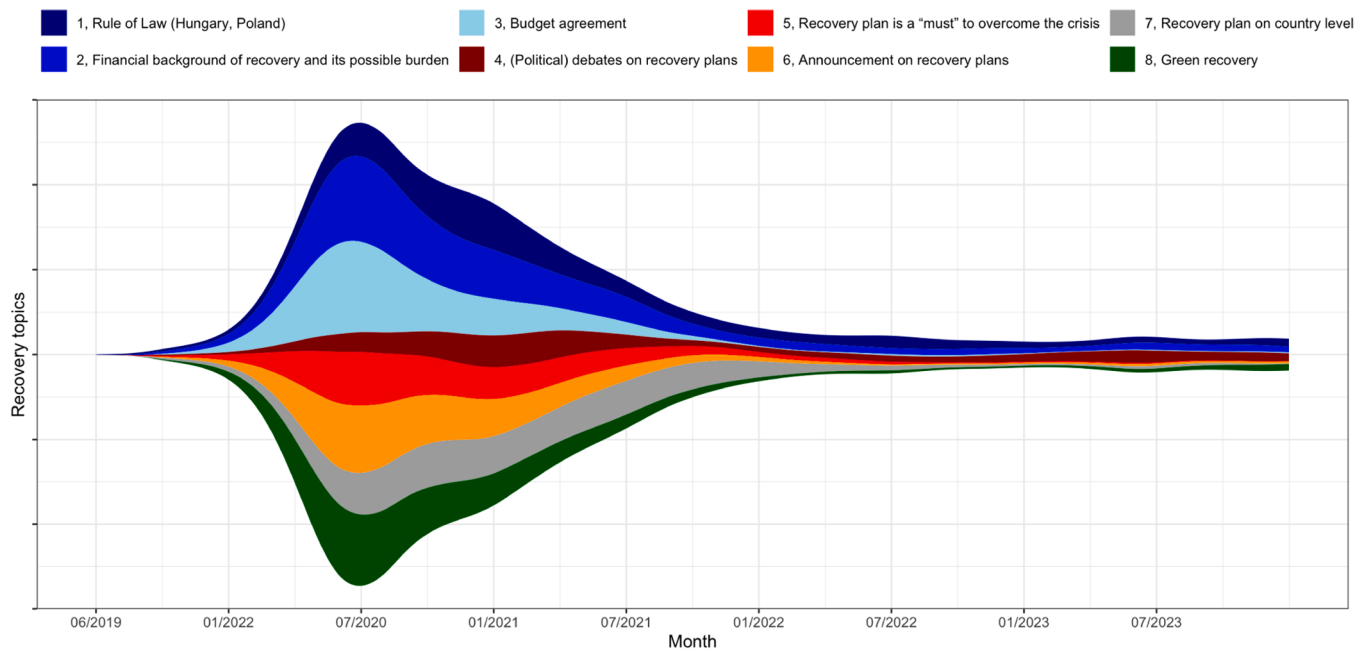


Fig. A1. Temporal variation of RRF topics.

Data availability

Data will be made available on request.

References

- [1] L. Ingeborgrud, S. Heidenreich, M. Ryghaug, T.M. Skjølsvold, C. Foulds, R. Robison, K. Buchmann, R. Mourik, Expanding the scope and implications of energy research: a guide to key themes and concepts from the Social Sciences and Humanities, *Energy Res. Soc. Sci.* 63 (2020) 101398, <https://doi.org/10.1016/j.erss.2019.101398>.
- [2] J. Ignjatović, S. Filipović, M. Radovanović, Challenges of the green transition for the recovery of the Western Balkans, *Energy Sustain. Soc.* 14 (1) (2024) 2, <https://doi.org/10.1186/s13705-023-00421-4>.
- [3] S. Wynes, K.A. Nicholas, The climate mitigation gap: education and government recommendations miss the most effective individual actions, *Environ. Res. Lett.* 12 (7) (2017) 074024, <https://doi.org/10.1088/1748-9326/aa7541>.
- [4] S. Stoll-Kleemann, U.J. Schmidt, Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: a review of influence factors, *Reg. Env. Change* 17 (5) (2017) 1261–1277, <https://doi.org/10.1007/s10113-016-1057-5>.
- [5] A. Terzi, Crafting an effective narrative on the green transition, *Energy Policy* 147 (2020) 111883, <https://doi.org/10.1016/j.enpol.2020.111883>.
- [6] D. Gibbs, K. O'Neill, Building a green economy? Sustainability transitions in the UK building sector, *Geoforum* 59 (2015) 133–141, <https://doi.org/10.1016/j.geoforum.2014.12.004>.
- [7] T. Schittekatte, L. Meeus, T. Jamasb, M. Llorca, Regulatory experimentation in energy: three pioneer countries and lessons for the green transition, *Energy Policy* 156 (2021) 112382, <https://doi.org/10.1016/j.enpol.2021.112382>.
- [8] European Union, b, Delivering the European Green Deal (2021), https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en.
- [9] European Union, c, Climate change: what the EU is doing (2021), <https://www.consilium.europa.eu/en/policies/climate-change/>.
- [10] European Union, a, Recovery plan for Europe (2021), https://ec.europa.eu/info/strategy/recovery-plan-europe_en.
- [11] European Union, e, Recovery and Resilience Facility (2021), <https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility>.
- [12] European Union, a, Economic and Financial Affairs (2022), https://ec.europa.eu/info/departments/economic-and-financial-affairs_en.
- [13] K. Koasidis, A. Nikas, D.-J. Van De Ven, G. Xexakis, A. Forouli, S. Mittal, A. Gambhir, T. Koutsellis, H. Doukas, Towards a green recovery in the EU: aligning further emissions reductions with short- and long-term energy-sector employment gains, *Energy Policy* 171 (2022) 113301, <https://doi.org/10.1016/j.enpol.2022.113301>.
- [14] T. Szöke, O. Hortay, R. Farkas, Price regulation and supplier margins in the Hungarian electricity markets, *Energy Econ.* 94 (2021) 105098, <https://doi.org/10.1016/j.eneco.2021.105098>.
- [15] S. Baute, The distributive politics of the green transition: a conjoint experiment on EU climate change mitigation policy, *J. Eur. Public Policy* 32 (1) (2025) 52–80, <https://doi.org/10.1080/13501763.2024.2304609>.
- [16] C. Roberts, F.W. Geels, M. Lockwood, P. Newell, H. Schmitz, B. Turnheim, A. Jordan, The politics of accelerating low-carbon transitions: towards a new research agenda, *Energy Res. Soc. Sci.* 44 (2018) 304–311, <https://doi.org/10.1016/j.erss.2018.06.001>.
- [17] H. Zhu, S. Jiang, X. Zhao, Spatial-temporal evolution and determinants of green economy efficiency: an integrated analytical approach, *Sustain. Futures* 8 (2024) 100359, <https://doi.org/10.1016/j.sfr.2024.100359>.
- [18] A. Bănică, R. Țigănașu, P. Nijkamp, K. Kourtir, Institutional Quality in Green and Digital Transition of EU Regions – A Recovery and Resilience Analysis, *Glob. Chall.* 8 (9) (2024) 2400031, <https://doi.org/10.1002/gch.2.202400031>.
- [19] P. Kotek, A. Selei, B. Takácsné Tóth, B. Felsmann, What can the EU do to address the high natural gas prices? *Energy Policy* 173 (2023) 113312, <https://doi.org/10.1016/j.enpol.2022.113312>.
- [20] K. Szulecki, I. Overland, Russian nuclear energy diplomacy and its implications for energy security in the context of the war in Ukraine, *Nat. Energy* 8 (4) (2023) 413–421, <https://doi.org/10.1038/s41560-023-01228-5>.
- [21] D. Panarello, A. Gatto, Decarbonising Europe – EU citizens' perception of renewable energy transition amidst the European Green Deal, *Energy Policy* 172 (2023) 113272, <https://doi.org/10.1016/j.enpol.2022.113272>.
- [22] G. Fifi, A serious crisis that didn't go to waste? The EU, the Covid-19 pandemic and the role of ambiguity in crisis-management, *J. Eur. Public Policy* 32 (1) (2025) 128–151, <https://doi.org/10.1080/13501763.2024.2303504>.
- [23] S.O. Ogbu, C.V. Okolo, B. Agan, The role of debt burden, green financing, and energy efficiency in reducing carbon footprints in MINT & BRICS economies: new evidence from panel QARDL method, *Sustain. Futures* 9 (2025) 100417, <https://doi.org/10.1016/j.sfr.2024.100417>.
- [24] B. Li, E. Fu, S. Yang, J. Lin, W. Zhang, J. Zhang, Y. Lu, J. Wang, H. Jiang, Measuring China's policy stringency on climate change for 1954–2022, *Sci. Data* 12 (1) (2025) 188, <https://doi.org/10.1038/s41597-025-04476-0>.
- [25] A. Stefkovics, C. Ágoston, E. Bukovenszki, A. Dóll, O. Hortay, A. Varga, Climate change worry in the times of the COVID-19 pandemic. Evidence from two large-scale European surveys, *Clim. Risk Manag.* 44 (2024) 100599, <https://doi.org/10.1016/j.crm.2024.100599>.
- [26] Y. Steinebach, M. Hinterleitner, C. Knill, X. Fernández-i-Marín, A review of national climate policies via existing databases, *Npj Clim. Action* 3 (1) (2024) 80, <https://doi.org/10.1038/s44168-024-00160-y>.
- [27] K. Petersen, J.M. Gerken, On the road to interactive LLM-based systematic mapping studies, *Inf. Softw. Technol.* 178 (2025) 107611, <https://doi.org/10.1016/j.infsof.2024.107611>.
- [28] European Union, European Council conclusions (2019), 12 December 2019, <http://www.consilium.europa.eu/en/press/press-releases/2019/12/12/european-council-conclusions-12-december-2019/>.

- [29] Y. Chae, T. Davidson, Large language models for text classification: from zero-shot learning to instruction-tuning, *Sociol. Methods Res.* (2024), 00491241251325243.
- [30] J. Devlin, M.W. Chang, K. Lee, K. Toutanova, Bert: pre-training of deep bidirectional transformers for language understanding, in: *Proceedings of the 2019 conference of the North American chapter of the association for computational linguistics: human language technologies long and short papers 1*, 2019, pp. 4171–4186.
- [31] B. Liu, *Sentiment Analysis—Mining opinions, sentiments, and Emotions*, Cambridge University Press, Cambridge, UK, 2020.
- [32] D.M. Blei, A.Y. Ng, M.I. Jordan, Latent dirichlet allocation, *J. Mach. Learn. Res.* 3 (2003) 993–1022. Jan.
- [33] M.E. Roberts, B.M. Stewart, E.M. Airoidi, A model of text for experimentation in the Social sciences, *J. Am. Stat. Assoc.* 111 (515) (2016) 988–1003, <https://doi.org/10.1080/01621459.2016.1141684>.
- [34] D. Mimno, H. Wallach, E. Talley, M. Leenders, A. McCallum, Optimizing semantic coherence in topic models, in: *Proceedings of the 2011 conference on empirical methods in natural language processing*, Association for Computational Linguistics, Edinburgh, Scotland, UK., 2011, pp. 262–272. <https://mimno.infosci.cornell.edu/papers/mimno-semantic-emnlp.pdf>.
- [35] M.E. Roberts, B.M. Stewart, D. Tingley, C. Lucas, J. Leder-Luis, S.K. Gadarian, B. Albertson, D.G. Rand, Structural topic models for open-ended survey responses, *Am. J. Pol. Sci.* 58 (4) (2014) 1064–1082, <https://doi.org/10.1111/ajps.12103>.
- [36] W. Botzen, S. Duijndam, P. Van Beukering, Lessons for climate policy from behavioral biases towards COVID-19 and climate change risks, *World Dev.* 137 (2021) 105214, <https://doi.org/10.1016/j.worlddev.2020.105214>.
- [37] European Commission, The Recovery and Resilience Facility (2024). https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en.
- [38] U.K. Pata, Assessing the eco-effectiveness of energy R&D technologies and environmental patents: a comparison between Portugal and Spain, *Sustain. Futures* 8 (2024) 100352, <https://doi.org/10.1016/j.sfr.2024.100352>.
- [39] M. Köhl, S. Linser, K. Prins, A. Talarczyk, The EU climate package “fit for 55”—A double-edged sword for Europeans and their forests and timber industry, *For. Policy Econ.* 132 (2021) 102596, <https://doi.org/10.1016/j.forpol.2021.102596>.