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A Framework for Assessing the Readiness and Vulnerability of the Romanian Territories Affected by the Just Transition Process

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Abstract. *The paper consists of an exploratory study which seeks to build a multi-criteria index to assess the vulnerability and the readiness of regions affected by the energy transition, based on data collected from six Romanian affected regions (Dolj, Gorj, Hunedoara, Mureș, Galați and Prahova). Literature points out both the distributional and the procedural dimension of the just energy transition process, emphasizing that the current energy transition process is distinct from previous ones due to the complex actors constellation and to the policy planning behind it. The current research is a first attempt to use various socio-economic and demographic indicators towards developing composite indexes that allow for a better understanding of the just transition processes across Europe, testing enablers and disablers of a successful transition process. The exploratory study examines two premises: that coal regions are more vulnerable than emissions-intensive regions which are not relying on coal and that the readiness of regions to embark on a transition process is directly proportional to their average GDP/ capita. I use several indicators as proxies to assess the vulnerability level (unemployment, GDP/ capita, the average monthly salary, the technological intensity of the local economies, the share of the workforce employed in industry) and others to assess the readiness level (the share of employees in transition-affected large enterprises in the total share of employees, the level of interest and engagement of local stakeholders, EU funds absorption capacity at local level). Data analysis shows surprisingly high variance of the same indicator between affected regions and unexpected correlations, such as a negative correlation between regional wealth and local authorities' capacity to attract EU funds. It also underlines the need for a larger number of cases and more indicators in the index, to make the results statistically significant and to compensate for the high variance among indicators.*

Keywords: energy transition, just transition, multicriteria index, Romania, coal regions, local economic development

Introduction

This paper aims to explore the construction of an index on assessing both the readiness and the vulnerability of territories involved in the Just Transition Mechanism (JTM). It exemplifies the process with data from the six Romanian territories (counties) involved formally in this process. To support territories most affected by the energy transition process in the European Union, a three-pillar mechanism was set up at the level of European institutions and deployed in 17 EU Member States, one of them being Romania. In Romania the six counties that together account for 65% of the country's greenhouse gas (GHG) emissions are Galați, Prahova, Mureș, Dolj, Gorj and Hunedoara. Local County Councils (CCs) in these six territories, coordinated by the Ministry of European Investments and Projects (MEIP), were invited in 2020 to draft so-called Territorial Just Transition Plans (TJTPs) outlining the counties' energy transition pathways and assessing the social, environmental and economic impact of the transition, while also proposing clear measures for mitigating in particular the negative social consequences of the transition.

Based on data collected from national databases for each of these territories, in this paper I aim to build a framework for assessing both the readiness of the regions to embark on a transition

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process and the degree of vulnerability of each affected territory. This framework, if robust enough, can be expanded to further affected territories so that a large-N research can be made. The research question I am trying to answer is which are the key characteristics in carbon-intensive regions which affect, positively or negatively, the just transition process. I propose a multi-indicator composite index and try to assess, based on the actual data for the indicators that compose the proposed index, the following premises. Firstly, that coal regions (i.e. Gorj, Dolj, Hunedoara) are more vulnerable to the negative consequences of the energy transition than other exposed counties which rely not on coal mining and coal-fired electricity production, but on other carbon-intensive industries (refining in Prahova, steel production in Galați and fertilizer production in Mureș). Secondly, that the readiness of the regions to embark on a transition process is directly proportional to their average GDP/ capita.

The Just Transition Process is a policy development in an early stage everywhere in the European Union, although the political and policy-commitment to a diversified, low-carbon European economy is not new and the decarbonization process has been set in motion since 2008, with the adoption of the 2020 energy package, that resulted in several transformation processes in the energy sector and in energy-intensive industries. Still, the last leg of the process is still ahead of most EU Member States, which are now confronted with the prospects of final closure of industries in the transition towards climate neutrality. In this process, an accessible index to assess, comparatively, the readiness and vulnerability of transition regions is a useful instrument for national and regional policy planning, so I hope the proposed composite index will be useful not only to Romanian policy-makers, but to other EU policy-makers involved in the just transition process.

Literature review

Vandenbussche (2021) points out that the concept of "just transition" actually entails two dimensions of justice – on the one hand "distributional justice" (i.e. whether the energy transition guarantees a fair outcome for workers and their communities) and on the other hand "procedural justice" (i.e. whether the affected communities are informed and consulted with regards to the transition pathway and planned actions), but literature in general is not yet taking justice elements into account broadly enough when analyzing past and current energy transition processes (Williams and Doyon, 2019). The energy transition is straightforward from a technical perspective, yet complex (Garcia-Garcia et. al, 2020) but the "socio-economic aspects […] remain both emergent and essential to an equitable transition to a low-carbon energy system" (Henry et. al, 2020). Other authors place "the just energy transition" at the intersection between "energy transitions and socioeconomic concerns" (Garcia-Garcia et. al, 2020). Unlike past energy transitions that were involuntary (Garcia-Garcia et. al, 2020) slow-paced and driven by technological progress (though empirical evidence does not always back this generally shared perspective – Sovacool, 2016), the current one is centrally planned, market-driven (Vandenbussche, 2021), policy-led (Garcia-Garcia et. al, 2020), fast-paced and prioritizes "secure, family-sustainaing jobs and healthy communities" (Henry et. al, 2020). From a stakeholder constellation perspective, the concept started with labor movements in the US in the 70s and brought together alliances of environmental organisations and labor movements starting in the 90s – social justice and climate justice became in time intertwined (Jasanoff, 2018). However, the range of actors has gradually diversified and now comprises "civil society groups, the media, local residents, city authorities, political parties, advisory bodies, and government ministries" (Geels et. al, 2017).

Literature points out success factors for just energy transition wealth, education levels, bureaucratic capacity and political leaders' passion towards clean energy policies (Bayulgen, 2020), as well as the innovation capacity of the local ecosystem (Geels et. al, 2017). Furthermore, decentralization of policy planning and implementation is another success driver (Allen, 2012). At the same time, because this energy transition is „driven by policies that must be sustained over a long time", it depends heavily on the support of citizens and stakeholders (Vandenbussche, 2021). Other authors point out that the so-called „absorptive capacity" of the regional labor market and its industrial ecosystem „to absorb" workers that change jobs due to the transition (Bluestone, 1984). Not least, some authors (P.-Y. Oei et. al, 2019) claim that not only unemployment levels, resilience of local economies, the state of the local energy system, but also the local infrastructure, universities, research facilities and soft location factors matter when it comes to ensuring a just energy transition process.

In my opinion, largely due to the fact that the current energy transition is ongoing, while there is abundant literature which defines the process and comments on its different dimensions, there isn't a comprehensive study of the enabling (or, conversely, the disabling) vectors of the transition process and there aren't many models that describe which factors contribute greatest to a successful transition process. The paper will attempt to build a multi-indicator composite index which assesses the readiness of affected regions to embark on the (just) energy transition process, as well as their vulnerability and will use data collected from affected regions in Romania to show how such an index might work and what its limitations may be. It it will be the role of future research to determine, ex post, which of the factors led to higher or lower success elements in the transition process and to test the validity of such an index using a large enough number of observations.

Methodology

The methodology I use in this research is descriptive statistics, coupled with stakeholder interviews.[1] This research is a first attempt to use various socio-economic and demographic indicators towards developing composite indexes that allow for a better understanding of the just transition processes across Europe. While developing composite indexes through statistical means require a larger number of cases and more variation than what the limited sample of six Romanian counties can offer, such exploratory research can pave the way by establishing some theoretically-backed variables which can make up such indexes.

Within the index building process, I am seeking to explore two premises. Firstly, that coal regions are more vulnerable to the negative consequences of the energy transition than carbon-intensive regions not reliant on coal. In this context, I use several indicators as proxies to assess the vulnerability level (unemployment, GDP/ capita, the average monthly salary, the technological intensity of the local economies, the share of the workforce employed in industry). Secondly, that the readiness of the regions to embark on a transition is directly proportional to their average GDP/ capita. In this context, I measure the readiness based on a mix of several indicators: the local economies' dependency on emissions-intensive companies (because, consequently, the "weaning"

[1] The interviews were conducted as part of a Technical Assistance project where I acted as Team Leader (Framework ID SRSS/2018/FWC/002, Specific Contract: Reform/SC2020/109, Support to the Preparation of Territorial Just Transition Plans in Romania, a project funded by the Structural Reform Support Programme of the European Union and implemented in cooperation with the AARC consortium and the European Commission, implemented implemented by Frankfurt School of Finance & Management (as part of the AARC Consortium) in cooperation with Eurom, MKBT: Make Better and Cambridge Econometrics – further referred to as the SPTJTP project.

of those local economies from the carbon-intensive companies would be harder in case the dependency was higher), the level of interest and engagement of local stakeholders (measured throughout the qualitative questions asked in the questionnaires deployed and through the participation rate in the workshops organized within the framework of the SPTJTP project) in climate action and the green energy transition agenda, the EU funds absorption capacity at the county level.

Table 1 sums up the data sources for the multi-indicator indices I am developing in the paper. I am also proposing weights for each of the indicators that form the composite variables, and in the "Results and Discussion" section I am showing some methodological limitations of the weighted approach.

Table 1: Indicators collected to assess the vulnerability of affected regions vis-à-vis the energy transition

Variable	Indicator	Measurement Unit	Weight in variable	Data Source
Vulnerability level	Unemployment rate	%	20%	National Institute of Statistics (NIS), 2020
	GDP/ capita	EUR	10%	National Commission for Strategy and Prognosis, estimations for 2019-2021 made in Dec. 2019 and Feb. 2021
	Average monthly salary	RON	10%	NIS, 2020
	Workforce employed in industry	Share of workforce employed in industry out of total employment at county level (%)	30%	NIS, Tempo database, 2019
	Share of turnover generated by high and medium knowledge-intensive manufacturing out of total turnover generated by manufacturing at county level (2020)	%	30%	National Trade Register Office data, based on EC high tech classification of NACE codes
Readiness to embark in the green transition	Local economies' dependency on emissions-intensive companies	Share of employees in energy transition-affected large enterprises from the total share of employees at county level[2]	40%	National Trade Register Office

[2] We looked only at the top ten large enterprises (over 250 employees) registered in each county. Although imperfect, the calculation is a solid proxy for the vulnerability of the affected regions.

Variable	Indicator	Measurement Unit	Weight in variable	Data Source
	Level of interest and engagement of stakeholders	Total number of participants in regional workshops and in the working groups at county level	10%	Data reported in the SPTJTP project
	Level of capacity for project development at local level	Total number of project ideas submitted by stakeholders in the county[3]	20%	Data collected in the SPTJTP project
	EU funds absorption capacity	RON/ capita attracted of EU and other external funds (2016 – 2019)	30%	Direction for Local Fiscal and Budgetary Policies[4]

Source: Authors' own contribution.

There are several expert judgments I made when selecting the indicators and when choosing their weights. I will explain them in this paragraph. To assess the vulnerability of the affected regions in the face of the transition-induced shocks I chose classical economic indicators that measure the strength of the local economies, such as employment levels, GDP/ capita and average salary. At a first glance, giving a higher weight to unemployment levels makes sense because, as literature indicates, one of the most important consequences in a transition process are the social/ labor market ones: in other words, the higher the pre-transition unemployment, the more vulnerable the region will be to further waves of lay-offs. At the same time, I propose to give relatively high weights to two less used indicators that measure the complexity and sophistication of the local economies and their performance in a knowledge-intensive, integrated economy due to the fact that the energy transition will require the diversification of the local economy and the creation of well-paid jobs to compensate for the employment losses incurred. These two indicators are the share of people employed in the industry at the county level – the idea being that the more services-/ agriculture-based the local economy, the more resistance to shocks generated by industrial layoffs there will be – and the share of mid- to high-tech manufacturing in the local manufacturing landscape – the assumption here being that the higher the knowledge intensity is, the easier the reskilling/ upskilling process, which is an inevitable consequence of transition processed. This approach reflects also on some of the elements that I summed up in the Literature Review section above which present how innovation and the resilience of local economies are critical success factors in energy transitions. I assessed the readiness of the counties to embark on the energy transition pathway via several indicators. The one I propose the highest weight to is the local economies' dependency on emissions-intensive industries. There are several ways to calculate this dependency, but one of the most straightforward ones is to count the number of employees directly employed by energy-intensive large enterprises and who will be, inevitably, at risk of losing their

[3] As part of the SPTJTP project County Councils in each of the six affected regions collected project ideas from stakeholders at the level of the county, to be potentially financed from the Just Transition Fund, via a questionnaire distributed on the County Councils' websites.

[4] http://www.dpfbl.mdrap.ro/sit_ven_si_chelt_uat.html.

jobs in the next five to ten years. The calculation is less than perfect due to the ways employment is reported at the National Trade Register Office – a company headquartered in a certain county reports all employees it has at national level, not only the ones at the level of the county. However, this is also the reason why I believe taking all the employees of these companies into account (although not all will be exposed to a transition risk due to their high reskilling potential), as a general proxy for vulnerability compensates for the data collection limitation. I also did not look at all the companies in the county, but only at the top ten employees in each county, due to limitations in the capacity to accurately assess the carbon risk exposure of all companies in the county. Nonetheless, looking at the top ten employees in each country as a sample, given that they account for 40-50% of all regional employment, is an accurate picture of the employment vulnerability at county level. Annex 1 presents which companies are counted in the indicator used for each county. The assumption with this indicator is that the higher the share of people employed by emissions-intensive companies in the total employment at county level, the less readiness of the county to embark on a transition pathway, due to risks of job losses, social costs, etc. To calculate the stakeholders' interest in the transition agenda, we calculated how many stakeholders are members of the Working Groups on the Just Transition set at the level of each county plus how many stakeholders attended the regional workshops organized within the framework of the SPTJTP project, in April – May 2021. To further gauge the capacity of the stakeholders to generate project ideas, we use as indicator the number of projects submitted by each county as part of the process steered in each affected region by the County Councils, using similar outreach methods (i.e.: questionnaire published on the website of the County Councils, disseminated at the level of the Working Groups and in social media). However, a more relevant indicator that looks at the de facto capacity to generate viable project ideas and to attract external investment at the levels of the counties is represented by the actual funds attracted at the level of each county (expressed as RON/ capita) by both city halls/ mayoralties, and county councils. The assumption with these latter two indicators is that the higher the external funds absorption capacity and the higher the capacity and willingness of the local ecosystem to generate project ideas, the higher the bureaucratic capacity at county level, which, literature points out, is a critical success factor in the energy transition.

The data collected is summarized in the tables below:

Table 2: Indicators collected to assess the vulnerability of affected regions vis-à-vis the energy transition

County	Unemployment rate	GDP/ capita (EUR)	Average monthly salary (RON)	Share of workforce employed in industry out of total employment at county level	Share of high knowledge-intensive manufacturing out of total manufacturing
Galati	5.7%	8524	2809	19.2%	2.2%
Mures	2.3%	9740	2975	25.6%	45.7%
Prahova	2.7%	12609	3021	28.6%	31.4%
Hunedoara	3.7%	9526	2617	28.7%	25.1%
Gorj	3.10%	11896	2858	23.4%	14.2%
Dolj	7.10%	9235	2967	18.10%	83.2%

Source: Data collected by the author from various sources (see Table 1).

Table 3: Indicators collected to assess the readiness of affected regions to embark on the the energy transition

County	Share of employees in energy transition-affected large enterprises from the total share of employees at county level	Total number of participants in regional workshops and in the working groups at county level	Total number of project ideas submitted by stakeholders in the county	RON/ capita attracted of EU and other external funds (2016 – 2019)
Galati	9,65%	94	73	422.92
Mures	3,50%	74	90	458.58
Prahova	6,70%	58	39	222.97
Hunedoara	8,01%	114	205	510.56
Gorj	30,32%	60	268	389.48
Dolj	6,47%	65	120	653.91

Source: Data collected by the author from various sources (see Table 1).

Results and discussions

This section analyzes the data presented above and explores it in relationship to the two premises proposed in the methodological part of the paper.

With regards to the first premise, that regions/ counties which are integrated in the coal economy (in Romania's case Dolj, Gorj and Hunedoara) are less vulnerable than emissions-intensive regions/ counties which are not integrated in the coal economy (Galați, Mureș and Prahova), it is interesting to notice that average monthly salary levels display little variance between the two clusters of regions. As a matter of fact, the average monthly salary level is just 4% higher in coal regions in transition than in non-coal ones. Using unemployment as a proxy for vulnerability is even a more sensitive choice, due to the large variation in the sample and due to the fact low unemployment values hide, as evidenced in the stakeholder interviews, deeper economic vulnerabilities. Dolj and Hunedoara make a point in case. Unemployment in Dolj is twice higher than in other affected regions (7.1% vs. 2.7% in Prahova). Yet, the average hides great sub-regional polarity, with unemployment in county seat Craiova being almost negligible and unemployment in rural areas in Dolj exceeding 10% in some sub-regions, due to long-term structural unemployment and/ or informal employment in the subsistence agriculture sector. Thus, given that lay-offs as a result of the energy transition process will affect most likely factory workers with medium and high education, the booming economy in county seat Craiova will most likely cushion the shock, while the reverse can be said about regions with much lower unemployment rates, that are nonetheless highly vulnerable to shocks. Thus, low unemployment in Hunedoara or Gorj (an apparent strength vis-a-vis transition vulnerabilities) hides the fact that the working age population in these regions has migrated abroad in proportions significantly higher than the national average. When it comes to the indicator represented by the share of the workforce employed in industry out of the total employment at county level, it is worth discussing whether vulnerability is marked by high or low values of this indicator. Arguably, due to the fact lay-offs will happen in industry, a high share of the population employed in industry might mean that industry-to-industry reskilling processes could absorb the shocks, while it would be more difficult to reskill people from industry to services. At the same time, a high share of people employed in industry means low levels of diversification of the local economy. No matter how we interpret this indicator there is little homogeneity between the coal regions (compared to Hunedoara, for

instance, Dolj has almost 40% less people employed in industry, although it has exposure both with regards to the automotive sector and to coal-fired electricity production), as well as between the non-coal regions (Galați, despite having a local economy which relies only on four major sector, isn't as dependent on employment in industry as Mureș – which has a much more diversified economy, nonetheless – and Prahova). The share of high knowledge-intensive manufacturing in total manufacturing is an indicator which indeed is an excellent proxy for the level of sophistical, resilience and innovation of the local economy and yet, in a similar manner to previous indicator, it displays such a high variance that clustering regions is a very difficult mission. For instance, Galați has less than 3% of its manufacturing concentrated in mid to high knowledge-intensive types of manufacturing, while Dolj has over 80% of its manufacturing at this level of sophistication. There is little homogeneity even between mining and coal-fired electricity production counties of Gorj and Huendoara, with Hunedoara having almost a 70% higher share of local manufacturing concentrated in mid to high knowledge intensive areas. Thus, the first premise, that coal-based regions are more vulnerable than non-coal based ones, by using the composite index proposed in this paper, is disproved. One can notice homogeneity between coal regions only in terms of GDP/ capita, which is definitely not a robust enough indicator to assess vulnerability. To compensate for the shortcomings of a multi-indicator composite index one could do two things: increase the number of observations by collecting data from other European regions in transitions and add further indicators that are good proxies for vulnerability. This way an index would gain more robustness by having the large number of indicators and/ or observations compensate for the high variance. Furthermore, the statistical relevance of such a model would also be able to determine the weights's calibration – as the table shows, with such high variance and a small number of observations, giving certain weights to certain indicators would completely manipulate the data.

With regards to the second premise, that the readiness of the regions to embark on a transition is directly proportional to their average GDP/ capita, a careful data examination shows the following things. Firstly, there is great variance between the regions in terms of the share of employees in energy transition-affected large enterprises from the total share of employees at county level. Gorj is by far the most exposed (with 30% of its employees working in large enterprises that will be directly affected by the energy transition), while Mures is the least exposed, with ten times less employees (percentage-wise) employed in such industries. How should one interpret low, respectively high values of this indicator begs an interesting discussion: on the one hand, a high percentage of employees in exposed large enterprises might mean the county is transition resistant and would not want to be actively involved in the agenda. On the other hand., in the counties with such high exposure, awareness raising on the imminence of the transition has been higher, so you would expect that local stakeholders are eager to jump on the opportunity to access funding to cushion the negative effects of the transition and to diversify their economy. For the purpose of this exploratory study, we aim to investigate the premise that the higher the share of employees exposed in transition-affected large enterprises, the lower the eagerness of local stakeholders to engage in the transition process. There is, nonetheless, little correlation between this indicator and GDP/ capita. Regions with a relatively high GDP/ capita (like Gorj) are also very exposed, due to the fact almost a third of the working force in the region is employed in transition-exposed large enterprises. If Gorj is taken out of the sample, however, one can indeed notice that counties with small shares of the population employed in transition affected large enterprises (e.g.: Prahova, Mures) also have relatively high GDP/ capita. When it comes to the total number of participants in both the workshops and the Working Groups established in the SPTJTP project, there is again a high variance between the counties, with Hunedoara exhibiting twice more

stakeholders engaged than most other counties, including neighboring Gorj and Dolj. Thus, in a relatively poor region in terms of GDP/ capita (Hunedoara has 9526 EUR/ capita, lower values being recorded only in Galați and Dolj), there is almost double the eagerness/ readiness to embark in the transition process than in much "richer regions" like Prahova and Gorj. Perhaps even more telling is the indicator on the total number of project ideas submitted by stakeholders in the affected regions, where Gorj dwarfs all other regions, with almost eight times more projects submitted than affluent Prahova and almost three times more than in Mureș. An even more interesting perspective can be gauged from examining the indicators relating to local authorities' capacity to attract external funding, where the richer the region (e.g.: Prahova), the lower the capacity to attract external funding (Prahova attracted three times less money per capita than Dolj, which has a GDP/ capita that is almost 30% higher). One would assume that the higher the bureaucratic capacity to absorb funds, the richer the county, but this premise is contradicted by data collected on the ground. As in the case of the first premise, the exploration of building the composite index shows both that more observations needs to be made to have a statistically significant examination, but also that the variable of "eagerness/ readiness" must be assessed through many more indicators, as only a handful generates erratic results, due to regions' hectic behavior in terms of certain indicators (proved by the high variance). With regards to the weights, the same observation holds true, that one must not build the weights ex ante based on literature examination, but have a more robust index determine such weights ex post.

Conclusion

Exploratory studies such as this one are complementary to ongoing qualitative research endeavors aimed at understanding how the narratives stemming from the EU level on just transition translate into policies which must transform realities on the ground, in communities across Europe. Robust statistical measurements must shed light on the variation with respect to the context in which transitions occur, as well as to their speed and outcomes. The paper has attempted to make an exploratory build-up of a multi-indicator composite index to assess both the vulnerability and the readiness to embark on the transition process of the regions affected by the energy transition, with data collected from the six affected regions in Romania.

Surprising relations between variables were found, such as the very low administrative capacity of certain regions to attract external funding despite their relative wealth, expressed in GDP/ capita and, most importantly, huge variances of the same indicator between regions – e.g.: some affected regions have fifteen times more people (percentage wise) employed in energy-intensive, transition-exposed large enterprises than others (e.g.: Gorj vs. Galați). To build a robust index that can compensate for this huge variance, many more indicators that express a certain variable are needed, but also more observations. European joint research projects that look at different regions in transition, particularly because all the regions are now united by the same policy and support framework (the Just Transition Mechanism) could take this exploratory composite index as a starting point to assess the vulnerability and readiness of regions toward the just energy transition process. Furthermore, contrasting the current data on the ground with evidence from past, less managed, transition processes could show the strength of policy instruments in addressing deep structural economic and social changes in Europe.

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