Measuring the Just Transition in the European Union: Application of I-distance method

Introduction

Nowadays, all countries around the world are facing environmental problems, i.e. climate change being the most challenging. Hence, all countries are trying to address these problems to achieve transition to a more sustainable future. This transition does not run easily and will for sure have implications on the economy, environment, and it will affect economic actors, but also different groups of society, including marginalized communities. The overall goal is to assure that all actors benefit from the transition following the concept of leaving no one behind. Therefore, this concept in the literature is known as just transition. The concept of just transition is presented as a framework that guides our transformation into ecological society in a socially just and equitable manner. With development of this concept, labor unions and climate movements there is a growing emphasis the need for systemic transformation. Fair transition implies fundamental changes, not only economic branches and consumer systems, but also changes in infrastructure, social values and politics (Heyen, Menzemer, Wolff, Bezneea, & Williams, 2020). Additionally, this concept highlights the need for a global turn towards a humane and fair economic system, with a healthy ecosystem, healthcare, public services, education and culture at its core. In the context of the EU, the transition is lead by the European Green Deal, which aims to reducegreenhouse gas emissions by 55 % by 2030 and to make EU climate neutral by 2050 (Moesker and Pesch, 2022). In January 2020, the Just Transition Mechanism (JTM) was introduced to alleviate the burden of the regions the most affected in the energy transition with strategic support. In addition, within JTM there are three financial opportunities to receive the funding – Just Transition Fund (JTF), InvestEU Dedicated Just Transition Scheme, and Public sector loan facility with the European Investment Bank (EIB). The JTF applies specific monitoring indicators to oversee the Just transition state of play in each region. While the set of indicators are useful for policy practitioners , the EU misses a comprehensive framework allowing better conceptualisation of the JT for regional and EU level monitoring capturing not only economic, social and environmental impact or problem dimensions, but also capabilities of the regions to tackle these problems.

The objective of this study is to improve the conceptual framework of the Just Transition monitoring and evaluation by identify the main themes capturing also the governance dimensions in this framework, in addition to economic, social, environmental. In this paper, we will critically review the exiting frameworks used by the European Commission, and other international organisations and discuss possibilities for more comprehensive coverage. In addition, propose a new monitoring tool: the Just Transition Index, which is a composite index that allows regions to see themselves in ranking. We applied I-distance method to the just transition index to evaluate its weighting scheme and structure.

The contribution of the paper is twofold. First, we will present the concept of just transition, andpropose a comprehensive framework for JT monitoring, including indicators grouped into four main dimensions – economic, social, environmental and governance. The second contribution is methodological, and can be found in performing the two-fold I-distance method to aggregate the sub-domain values to domains and domains to overall I-distance values.

Data and Methodology

In order to obtain empirical results, and the performance ranking of EU member states for just transition process, the I-distance method have been applied. This is a metric distance in an n-dimensional space. It was proposed and defined by Branislav Ivanovic in various publications that have appeared since 1963 (Ivanovic, 1973). It is based on calculating the mutual distance between the entities being processed, whereupon they are compared to one another to create a rank (Jeremic et al., 2011). The ranking of entities, in our case EU member states, in the set is based on the calculated distance from the referent entity (Maricic et al., 2019). The construction of the I-distance is iterative; it is calculated through the following steps:

- Calculate the value of the discriminate effect of the variable X_1 (the most significant variable, that which provides the largest amount of information on the phenomena that are to be ranked (Ivanovic, 1977))
- Add the value of the discriminate effect of X_2 which is not covered by X_2
- Add the value of the discriminate effect of X_3 which is not covered by X_1 and X_2
- Repeat the procedure for all variables (Mihailovic et al., 2009; Jeremic et al., 2011a).

The values of the obtained I-distance then provide information on how far away an entity is from the worst-case scenario. For a selected number of variables (indicators), denoted with k, $X^t = (X_1, X_2, \ldots X_k)$, chosen to characterize the entities, the I-distance between the entity $e_r = (x_1, x_2, \ldots x_{kr})$ and the fictive entity $e_s = (x_{1s}, x_{2s}, \ldots x_{ks})$ is defined as:

$$D(r,s) = \sum_{i=1}^{k} \frac{\left|d_i(r,s)\right|}{\sigma_i} \prod_{j=1}^{i-1}\left(1 - r_{ji.12\ldots j-1}\right) \qquad (1)$$

where $e_r = (x_1, x_2, \ldots x_{kr})$ and $e_f = (x_{1f}, x_{2f}, \ldots x_{kf})$ are values of indicators I, $I = \{1, \ldots k\}$, $i \in I$ of the observed entity e_r and fictive entity e_f;

$d_i(r,s) = x_{ir} - x_{is}$ $i \in \{1,\ldots,\kappa\}$

σi is the standard deviation of indicator i, $i \in I$ and $r_{ji.12\ldots j-1}$ is a partial coefficient of the correlation between indicators i and j where $j<i$, $i \in I$, $j \in I$, while the effects of all other indicators 1,2,…, j-1 are eliminated (Jeremic et al., 2011; Maricic and Jeremic, 2023).

To avoid the problem of a negative correlation coefficient and a negative coefficient of partial correlation, the use of the square I-distance are desirable. The same have been applied in our calculation.

For the purpose of calculating the values of index, and creating the ranking list, the data of Eurostat, i.e. the list of regional and macro indicators that it publishes, were used as the primary source. The observed group of EU countries refers to the already targeted just transition countries based on high level of concentration of emissions and industry defined by European Commission. Table 1 shows variables grouped into four dimensions which are used in the analysed model.

Table 1. Description of the variables

DIMENSIONS	VARIABLE NAME	VARIABLE DEFINITION	SOURCE
ECONOMIC	• Purchasing power standard (PPS, EU27 from 2020), per inhabitant (annual) • Unemployment rates by sex, age and educational attainment level (%) (annual)	• This is an indicator of price level differences across countries. It tell us how many currency units a given quantity of goods and services costs in different countries • This indicator shows the unemployment rates of people according to their education levels	Eurostat
SOCIAL	• People at risk of poverty or social exclusion by NUTS region • Persons living in households with very low work intensity (%) (annual) (population aged 0 to 64) by NUTS region (%) (annual)	• This indicator refers to persons who are at risk of poverty, or in a severe material and social deprivation, or living in a household with a low work intensity. • This indicator refers to persons (aged 0 – 64) living in households with a work intensity lower than 0.2	Eurostat
ENVIRONMENTAL	• Population unable to keep home adequately warm by poverty status • Net greenhouse gas emissions	• The indicator measures the share of population who are unable to keep home adequately warm (%) (annual) • The indicator measures total national emissions (from both ESD and ETS sectors) including international aviation of the so called 'Kyoto basket' of greenhouse gases, including carbon dioxide, methane, nitrous oxide, and the so-called F-gases and	Eurostat

		sulphur hexafluoride from all sectors of the GHG emission inventories (including international aviation and indirect CO_2) (annual)	
GOVERNANCE	• Government effectiveness • Rule of law	• This indicator captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (annual) • This indicator guarantee democracy and citizens' rights and freedoms (annual)	World Bank – Worldwide Governance Indicators

Source: Author's.

All data for the variables are based on annual frequency.

Results

Table 2 shows the values of the I distance and the ranking of the EU member states that are currently in just transition process.

Table 2. The values of I-distance and ranks of EU JT member states

JT Countries	Value of index for each entity	Rank
LUXEMBOURG	32,598	1
CZECH REPUBLIC - Praha	31,978	2
HUNGARY - Budapest	29,967	3
FINLAND - Manner-Suomi	28,346	4
NETHERLANDS - Noord-Brabant	21,298	5
ITALY - Trento	19,984	6
LITHUANIA - Sostinės regionas	19,34	7
SLOVENIA - Zahodna	18,997	8

ROMANIA - Sud-Muntenia	17,036	9
AUSTRIA - Kärnten	15,777	10
POLAND - Sliesia	15,183	11
DENMARK - Sjælland	14,905	12
IRELAND - Eastern and Midland	12,379	13
ESTONIA	11,424	14
SLOVAKIA - Západné Slovensko	11,1	15
GERMANY - Sachsen-Anhalt	9,795	16
FRANCE - Auvergne-Rhône-Alpes	9,039	17
CYPRUS	8,796	18
PORTUGAL - Alentejo	7,779	19
BELGIUM - Hainaut	5,617	20
CROATIA - Jadranska	4,697	21
SPAIN - Leon	3,849	22
BULGARIA - Severen tsentralen	2,941	23
GREECE - West Macedonia	1,091	24

Source: Author's calculation.

Conclusion

When analysing the concept of just transition, it is defined differently in many disciplines and fields of research. Therefore, the literature usually distinguishes between three types of justice – energy justice, environmental justice and climate justice. Each of these three justice frameworks emphasises distributive justice and procedural justice.

Furthermore, based on the I-Distance method for calculating the just transition index for the analysed EU Member States, we wanted to examine the scores and ranking of EU Member States involved in the just transition process. Based on selected dimensions and indicators with the latest publicly available data, the results of the analysis were very interesting. Based on the ranked list of countries and the I-distance values, the best performing countries are Luxembourg, the Czech Republic and Hungary. This can be explained by the fact that these countries are making great efforts (financially and socially) to achieve decarbonisation and involve all stakeholders in society in the just transition process.

Like all research, this one has its limitations. The first limitation is the small number of variables due to methodological constraints, the second is the limited number of EU Member States involved in the just transition process. For further research, we recommend comparing the EU Member States with other countries outside the EU so that more variables can be included in the analysis.

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