Rozwój Regionalny i Polityka Regionalna 68: 13–28
https://doi.org/10.14746/rrpr.2024.68.03
2024

Urszula Bronisz

Maria Curie-Skłodowska University
Faculty of Earth Sciences and Spatial Management
Institute of Socio-Economic Geography and Spatial Management
urszula.bronisz@mail.umcs.pl, *https://orcid.org/0000-0002-4755-6060*

Climate proactivity as a factor fostering regional competitiveness and resilience

Abstract: Climate transition affects many social, economic and political processes. With the green transformation and increasing climate change, the competitive paradigm is shifting toward greater impact of environmentally related factors. To improve the competitiveness, economic performance and resilience of regional units, appropriate climate change mitigation action and policy are needed. The strategy to anticipate and cope with the inevitable impacts under various climate change scenarios is referred to as climate proactivity. This paper attempts to describe regional climate proactivity in economic, institutional and social dimensions and to examine the differences in climate proactivity approach among European Union regions (NUTS 2). For this purpose, an original research model of climate proactivity, synthetic Overall Regional Climate Proactivity Index (ORCPI) and a typology of regions in terms of climate proactivity were developed. The result was a ranking of EU regions and a typology containing 4 groups of regions: leaders, progressive, moderate and lagging behind, into which all EU regions were classified. The survey revealed that Scandinavian regions are the leaders in climate proactivity, while regions from Central and Eastern Europe countries represent the largest group of regions lagging behind.

Key words: Climate change, climate proactivity, regional competitiveness, resilience, European Union

Introduction

The literature lists a number of factors that foster the competitiveness of regions and make them more resilient to the ongoing rapid socio-economic changes (Ostrouch, Sługocki 2018, Rusu, Roman 2018, Stiglitz et al. 2018, Ketels, Porter 2020, Pyankova et al. 2021). The concept of competitiveness has evolved from single to multi-factor (Annoni, Dijkstra 2019, Schwab 2019). Initially, only results were considered as expression of competitiveness, and later the theory was expanded to include the inputs of social, political or economic nature required to achieve outcomes (Bhawsar, Chattopadhyay 2015, Alonso et al. 2020). With the green transition and advancing climate change, the paradigm of competitiveness is shifting (Zhang et al. 2020, Karman et al. 2021). The need to adapt to the consequences of climate transformation makes it necessary to broaden the determinants of competitiveness of environmentally related factors (Porter et al. 2015). The uncertainty resulting from climate transformation is causing regional competitiveness to be increasingly linked to the concept of proactivity and resilience, seen as multi-faceted, involving different actors, interests and capabilities as part of a continuous process of change (Vallance, Carlton 2015, Heininen, Exner-Pirot 2020). The idea of proactive approach and resilience involves an ongoing process of anticipation, investigation, reflection and learning, requiring new perspectives and multi-aspects methods and the potential need for radical change (Kizos et al. 2018). Predominantly the climate adaptation effort focused on mitigation-reducing greenhouse gas (GHG) emissions to prevent dangerous climate change (Jiang et al. 2019). The next phase was about adaptation, or coping with impacts that cannot be avoided. Proactive approach is understood as the adjustment of practices to reduce, protect and resist climate change hazards (UNDP 2002). Proactivity refers to all strategies which alter economic and social infrastructure to better fit the unavoidable and irreversible climate change (Karman et al. 2021). A proactive approach seeks ways to reduce the risk of undesirable climate change impacts occurring in the future (Grant et al. 2017). Proactivity involves also anticipating future events or challenges under conditions of high uncertainty, the possibility of non-linear, rapid or abrupt changes that may affect the environment. The concept of climate proactivity is described as a process with a different adaptive character than the strategies implemented so far (Murphy 2007). The literature lists a number of approaches. One of them provides a classification using different scopes: timing (reactive and proactive adaptation), temporal (strategic adaptation with long-term adjustments and tactical adaptation with short-term adjustments) and spatial (localized adaptation with single action and widespread adaptation with systemic approach) (Khan et al. 2018). Zilberman et al. (2012) identified incremental adaptation versus transformative adaptation and reactive versus proactive. In the literature the most common distinction is between reactive and proactive adaptation, where reactive adaptation takes place after the negative effects of climate change have already been felt, while proactive adaptation aims to anticipate possible damage from climate change (Shalizi, Lecocq 2010, Fazey et al. 2015, McDonald et al. 2019). Mitigating the negative effects of climate change is expected to improve the competitiveness and resilience of territorial units. A regional approach to adaptation can significantly help reduce climate vulnerability. Integration of economic resources, relevant institutional structures and community cooperation strengthens the adaptation potential of individual territorial units. Accelerating climate change affects the living environment of people, resulting in damages to ecosystems, infrastructure, public health, causing lower agricultural productivity, and a decline in both labor supply and worker productivity. Climate transformation changes economic conditions in the regions and, as a result, influences their attractiveness and competitiveness.

The importance of climate proactivity as a driver of competitiveness has received little attention in the literature and remains unexplored (Moldan 2012). Thus there is a need to look at regional competitiveness from a new perspective, with greater consideration for climate change. The paper's novelty derives from recognizing climate proactivity as a key important factor, "game changer" for concept of regional competitiveness. The aim of the article is to describe regional climate proactivity in economic, institutional and social dimensions and to examine differences in climate proactivity among European Union regions (NUTS 2). For this purpose the Overall Regional Climate Proactivity Index (ORCPI) was developed, and a typology of regions in terms of climate proactivity was proposed. The paper makes several contributions. First, many previous studies have concentrated mainly on reactive approach to climate transition, while this article focuses on climate proactivity and considers it from economic, institutional and social dimensions. The second, refers to the regional level of the research. Previous studies on climate change have focused primarily on the macro level, i.e. individual countries, or the micro level, i.e. referring to economic entities. This study focuses on a regional perspective and covers all EU NUTS 2 regions. The third, concerns methodological aspects, i.e. both in terms of the original method of examining and creating the typology of regional climate proactiveness. Finally, this paper supports the discussion on impacts of climate changes on regional performance and competitiveness. The article is structured as follows. After an Introduction including a literature review, the following sections are presented: Materials and Methods, Results, Discussion and Conclusion.

Materials and Methods

To assess the regional climate proactivity of EU regions NUTS2 level, an original research model was developed, covering 3 dimensions of climate proactivity (economic, institutional and social) (Fig. 1). Each of them was described by a group of diagnostic factors and characterized by indicators with appropriate spatial variability and information value (Table 1).

The economic dimension focuses on factors that are key for improving economic performance and competitiveness, and are significantly related to climate change. Economic dimension refers to the labor market, the market of goods and services and the volume of consumption and greenhouse gas emissions. Institutional dimension concerns factors linked with the climate policy issue, in particular

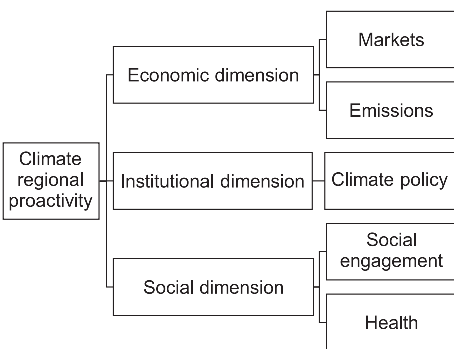

Fig. 1. Model of climate regional proactivity
Source: own study.

the creation of conditions for implementing climate policy and achieving climate goals. Concentrates on climate protection (through the creation and monitoring of plans, analysis of good practices) and the financial resources. Social dimension focuses on factors like social engagement and health. In this case the awareness and attitude toward climate change are crucial, they help to understand the phenomenon and its consequences, and thus support government action in the field of climate protection. The strong link between perceptions and adaptation had been proved in literature (Taylor 2014, Antronico et al. 2020, Arnout 2022). Economic and institutional factors explain engaging in adaptation to climate change, while social factors act as drivers boosting proactive adaptation. Future policies should focus on promoting proactive attitude by developing social connections and access to information, as well as on economic and institutional mechanisms for efficient and effective adaptation (Engler et al. 2021). Each of the analyzed dimensions of proactivity was described by a set of relevant factors. The primary source of data was the Eurostat database. The detailed, diagnostic indicators assigned to each dimension are shown in the Table 1.

Table 1. Dimensions of climate regional proactivity

Dimension	Diagnostic indicator
Economic	x1 – Eco-innovations
	x2 – Share of green jobs in the total number of jobs
	x3 – Employment in sectors sensitive to climate change
	x4 – A market for organic products
	x5 – Annual greenhouse gas emissions
	x6 – Material circularity index
	x7 – Resource efficiency
	x8 – Domestic material consumption
	x9 – Production capacity of energy from RES
	x10 – Newly registered electric cars
	x11 – Volume of production of environmental goods
Institutional	x12 – Outlays on fixed assets for air and climate protection
	x13 – Regions declaring having a climate policy
	x14 – The greenhouse gas emission gap
	x15 – The gap in the production of energy from RES
	x16 – The energy efficiency gap
	x17 – Advancement of the process of withdrawing from the coal-based economy
Social	x18 – Environmental awareness of residents
	x19 – Pro-ecological attitudes of residents
	x20 – Premature mortality due to air pollution
	x21 – Participation in volunteer activities

Source: own study.

The research procedure included the following stages:

1. Calculation of indicators for 3 dimensions of proactivity, i.e. economic, institutional and social. They were computed as the mean of the variables describing a given dimension, after the necessary transformation and standardization of data. The problem that arose in the calculations was missing data. In the case of a low percentage of missing data, a median-based positional

imputation was used. The missing value was replaced by the median determined on the group of observations of the closest objects-regions belonging to the same country. In the situation of a significant number of missing values for a country, in order not to distort the results of the survey, missing data were not replaced. The lack of data occurred for variable: x1 (for Latvia, Lithuania, Luxembourg), variable x2 (for Greece, Hungary and Slovakia), variable x3 (for Lithuania and Ireland), variable x8 (for the United Kingdom), variable x12 (for Greece, the Netherlands, Finland, Sweden, the United Kingdom).
2. Calculation of the synthetic index of climate proactivity of regions. It was computed as the mean of the three distinguished dimensions (all have the same weight).
3. Clustering of regions using the k-means clustering algorithm. The basis for grouping was the calculated synthetic index. As a result, 4 groups of regions were distinguished:
   - regions lagging behind (with the lowest scores),
   - moderate regions (with moderate scores),
   - progressive regions (with higher medium scores),
   - regional leaders (with the highest scores).

The outcomes of applied research were individual rankings of EU regions relating to economic, institutional and social dimensions of climate proactivity, overall ranking of climate proactivity, and a typology of regions according to their level of climate proactivity.

Results

From the conducted research the following results were obtained. In the ranking of the economic dimension of climate proactivity the highest position were taken by the Dutch regions. Well ranked were also regions from Germany (Oberbayern, Düsseldorf, Köln), while the lowest places were held by regions from the

Table 2. Regions with the highest and lowest values of the index of climate proactivity of the economic dimension

NUTS2	Region	Value	NUTS2	Region	Value
NL33	Zuid-Holland	1.052	PL62	Warmińsko-mazurskie	−1.680
NL32	Noord-Holland	0.992	SK01	Bratislavský kraj	−1.220
NL41	Noord-Brabant	0.985	HU11	Budapest	−1.097
NL22	Gelderland	0.968	HU22	Nyugat-Dunántúl	−1.092
NL21	Overijssel	0.832	HU31	Észak-Magyarország	−1.089
NL42	Limburg (NL)	0.748	HU21	Közép-Dunántúl	−1.080
NL31	Utrecht	0.727	HU12	Pest	−1.072
NL11	Groningen	0.676	HU23	Dél-Dunántúl	−1.041
NL12	Friesland (NL)	0.654	HU33	Dél-Alföld	−1.040
NL13	Drenthe	0.649	HU32	Észak-Alföld	−1.024

Source: own study.

countries of Central and Eastern Europe, in particular from: Poland, Slovakia and Hungary (Table 2).

The economic advantage of Dutch regions was due to active employment policies, including the creation of so-called "green jobs", i.e. jobs that are created by integrating sustainability into the consumption and production model. This means an increase in the number of jobs, but also a change in the structure of the market, towards environmentally friendly sectors. This applies in particular to public transportation, renewable energy sources, construction or waste management. Dutch regions had the highest resource productivity among EU regions. They led in implementing a circular and resource-efficient economy that responds to environmental challenges. They were also intensively engaged in developing low-carbon transportation (electric cars). Highly ranked German regions had the largest market for organic products and a good labor market. Among the EU regions, the Scandinavian regions had the best performance in the eco-innovation area. The source of their climate competitiveness can also be the energy sector, as was most evident in Sweden. The country's energy policy is well integrated with

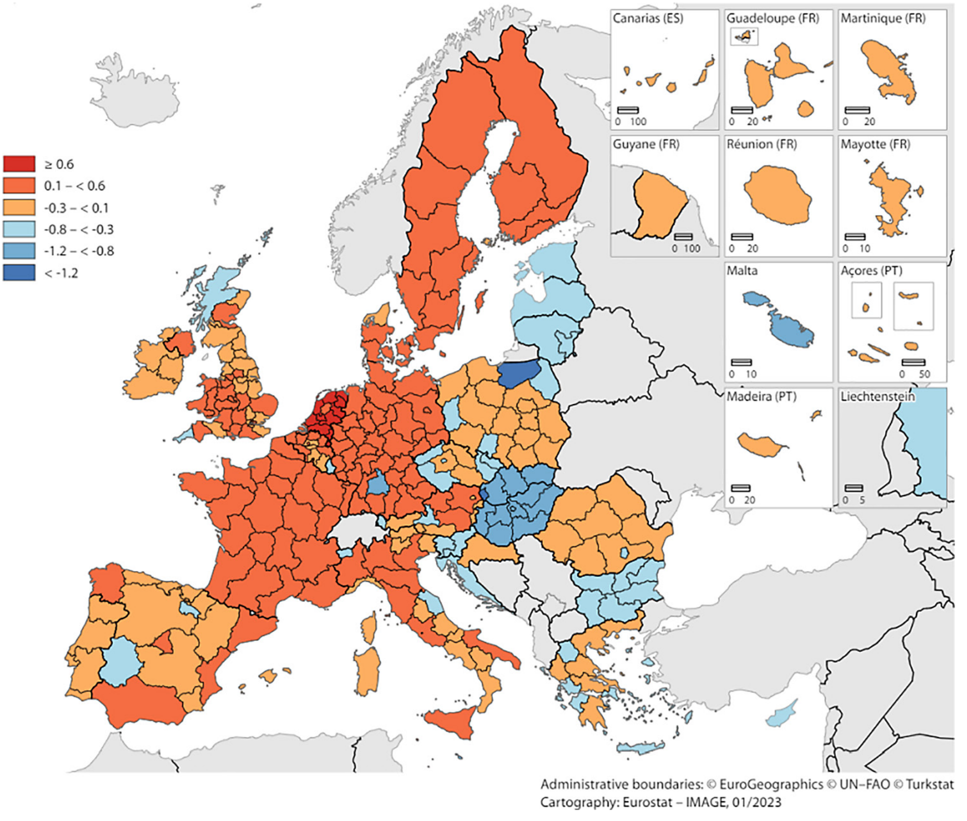

Fig. 2. Index of Economic dimension of Regional climate proactivity
Source: own study.

its climate goals and the energy transition made the country a world leader in the low-carbon economy. The least carbon-intensive regions were the Greek ones, due to the economy's reliance on service sectors (maritime transport, tourism, trade, finance) and agriculture.

In the ranking of climate proactivity in the institutional dimension, the highest positions were taken by the Latvia, Cyprus, Estonia, regions from Spain (Comunidad-de-Madrid, Cataluna, Andalucia, Pais-Vasco) and Greece (Attiki, Voreio Aigaio, Notio Aigaio). The lowest values were observed for Malta and Polish regions (Lubuskie, Opolskie, Świętokrzyskie, Warmińsko-Mazurskie, Podlaskie, Zachodniopomorskie, Mazowiecki regional, Lubelskie).

Table 3. Regions with the highest and lowest values of the index of climate proactivity of the institutional dimension

NUTS2	Region	Value	NUTS2	Region	Value
LV	Latvia	0.849039	MT00	Malta	−2.01062
CY	Cyprus	0.663070	PL43	Lubuskie	−0.87201
ES30	Comunidad de Madrid	0.650927	PL52	Opolskie	−0.86194
ES51	Cataluna	0.639156	PL72	Świętokrzyskie	−0.86071
EE	Estonia	0.562557	PL62	Warmińsko-mazurskie	−0.85656
ES61	Andalucía	0.544779	PL84	Podlaskie	−0.85124
ES21	País Vasco	0.542691	PL42	Zachodniopomorskie	−0.83521
EL30	Attiki	0.539772	PL92	Mazowiecki regional	−0.82549
EL41	Voreio Aigaio	0.539772	PL61	Kujawsko-pomorskie	−0.80999
EL42	Notio Aigaio	0.539772	PL81	Lubelskie	−0.78611

Source: own study.

The efficiency of achieving climate goals was highest in the regions of Sweden and in Luxembourg, Cyprus, Latvia, Estonia, i.e. the countries that are phasing out the coal-based economy most rapidly. Sweden remains a coal-free country, while Latvia and Estonia have made significant progress toward climate neutrality. The lowest climate efficiency was found in Poland, Lithuania and Malta, with the latter two countries undertaking intensive decarbonization work in recent years. The highest expenditures on climate protection were observed in the German region (Stuttgart), whereas the lowest were reported in the regions of Portugal (Região Autónoma dos Açores, Algarve). At the same time Italy was the country with the fewest regions declaring a climate policy. The energy efficiency gap was relatively most problematic in Lithuania and the greenhouse gas emissions gap in Belgium. The lowest advancement of the process of withdrawing from the coal-based economy was noted for Poland, Bulgaria and Romania.

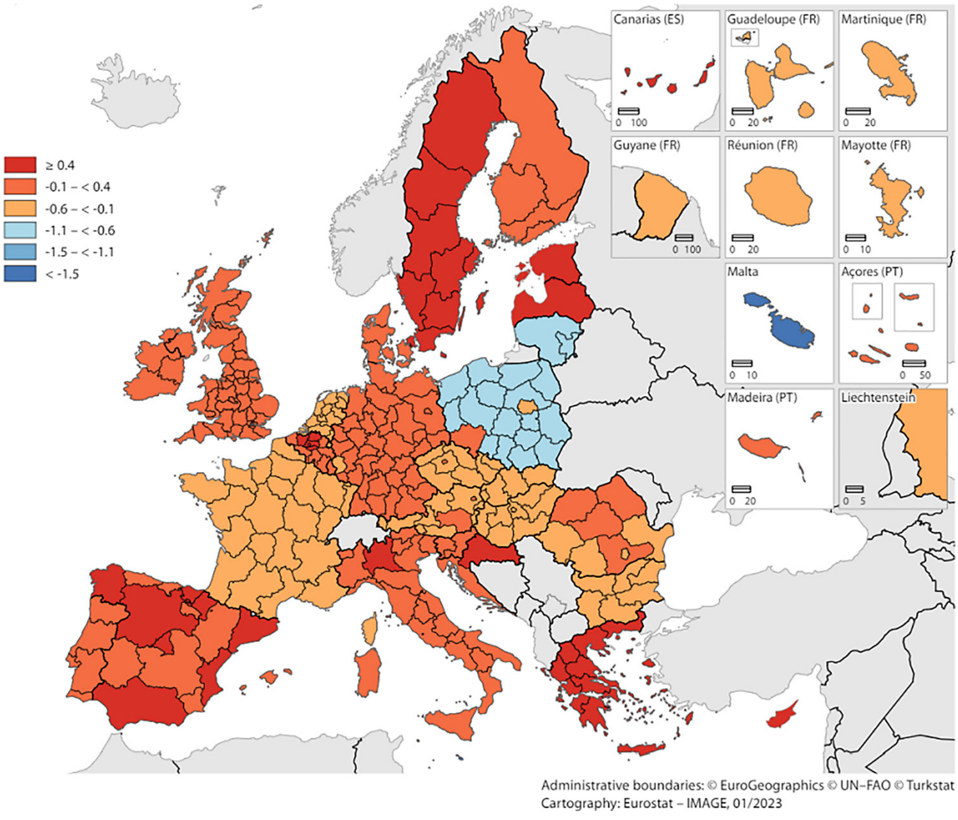

Fig. 3. Index of Institutional dimension of Regional climate proactivity
Source: own study.

In the ranking of climate proactivity in the social dimension, the highest positions were taken by Malta, all regions from Sweden and region from Denmark

Table 4. Regions with the highest and lowest values of the index of climate proactivity of the social dimension

NUTS2	Region	Value	NUTS2	Region	Value
MT00	Malta	1.195602	FRI2	Limousin	−2.69807
SE32	Mellersta Norrland	1.193883	HR03	Jadranska Hrvatska	−2.32673
SE33	Övre Norrland	1.177585	RO21	Nord-Est	−1.95902
SE21	Smaland med öarna	1.145240	RO31	Sud-Muntenia	−1.87670
SE31	Norra Mellansverige	1.139601	RO22	Sud-Est	−1.84423
SE22	Sydsverige	1.060820	RO11	Nord-Vest	−1.83187
SE12	Östra Mellansverige	1.047965	RO12	Centru	−1.81538
SE23	Västsverige	1.000401	RO42	Vest	−1.76508
SE11	Stockholm	0.997608	RO32	Bucuresti - Ilfov	−1.70992
DK05	Nordjylland	0.889373	RO41	Sud-Vest Oltenia	−1.67769

Source: own study.

(Nordjylland). In the group of regions with the lowest index value were regions from France (Limousin), Croatia (Jadranska Hrvatska) and all Romanian regions.

The most environmental awareness and pro-environmental attitudes were declared by residents of Malta and Sweden, Finland and Greece, and the least of regions of Bulgaria and Romania, post-communist countries with lower levels of socio-economic development. In terms of participation in volunteering, the highest values were obtained in the regions of the Netherlands, the lowest in the regions of Bulgaria and Romania. Social attitudes toward climate change are generators of social and business initiatives in the area of environmental change. A proactive attitude reduces the costs of mitigating and adapting a region to climate change. In turn, the increase in public interest in environmentally friendly innovations generates demand for products from the so-called green economic sectors.

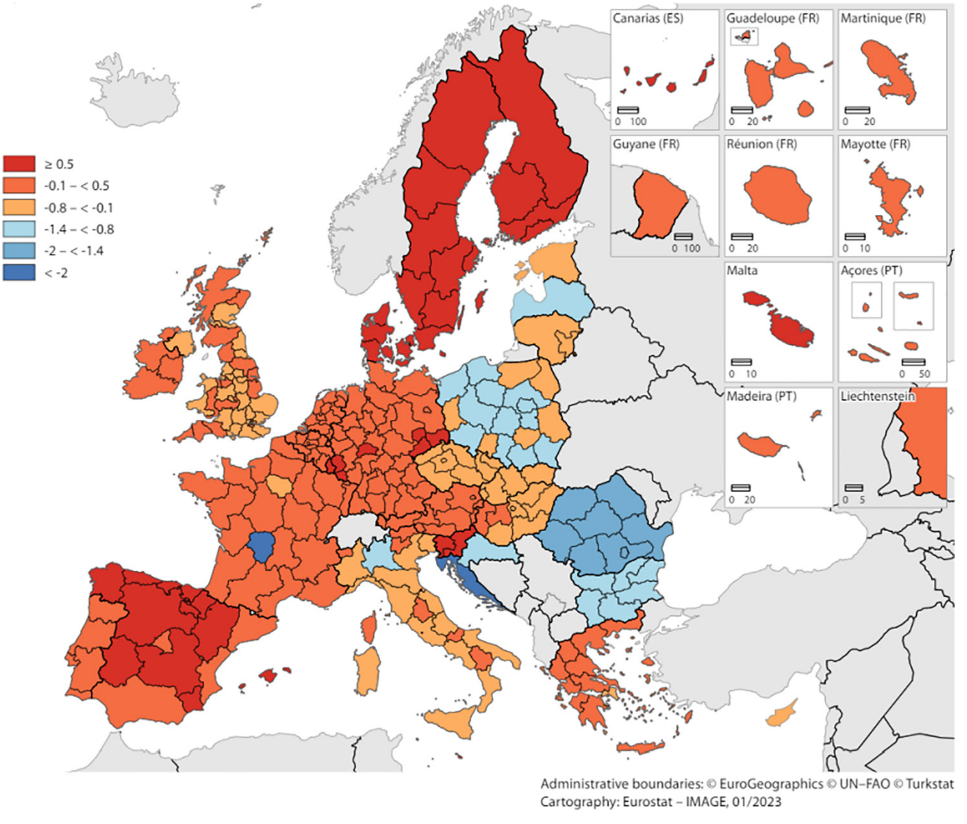

Fig. 4. Index of Social dimension of Regional climate proactivity
Source: own study.

In the ranking of Overall Regional Climate Proactivity Index the highest locations were taken by all regions from Sweden, and regions from Denmark (Hovedstaden, Midtjylland). The regions with the lowest score were from Poland (Warmińsko-Mazurskie), France (Limousin), Croatia (Jadranska Hrvatska), Romania (Bucuresti – Ilfov, Sud-Est, Nord-Est, Sud-Muntenia) and Bulgaria (Yugoiztochen, Yugozapaden, Severozapaden).

Table 5. Regions with the highest and lowest values of the Index of overall regional climate proactivity

NUTS2	Region	Value	NUTS2	Region	Value
SE33	Övre Norrland	0.627636	PL62	Warmińsko-mazurskie	−1.10511
SE12	Östra Mellansverige	0.622178	FRI2	Limousin	−0.87657
SE22	Sydsverige	0.612931	RO32	Bucuresti – Ilfov	−0.82010
SE21	Smaland med öarna	0.610784	HR03	Jadranska Hrvatska	−0.79871
SE23	Västsverige	0.608768	RO22	Sud-Est	−0.73640
SE31	Norra Mellansverige	0.591659	BG34	Yugoiztochen	−0.72509
SE32	Mellersta Norrland	0.583654	BG41	Yugozapaden	−0.71835
SE11	Stockholm	0.582381	BG31	Severozapaden	−0.71096
DK01	Hovedstaden	0.514922	RO21	Nord-Est	−0.70809
DK04	Midtjylland	0.486922	RO31	Sud-Muntenia	−0.70658

Source: own study.

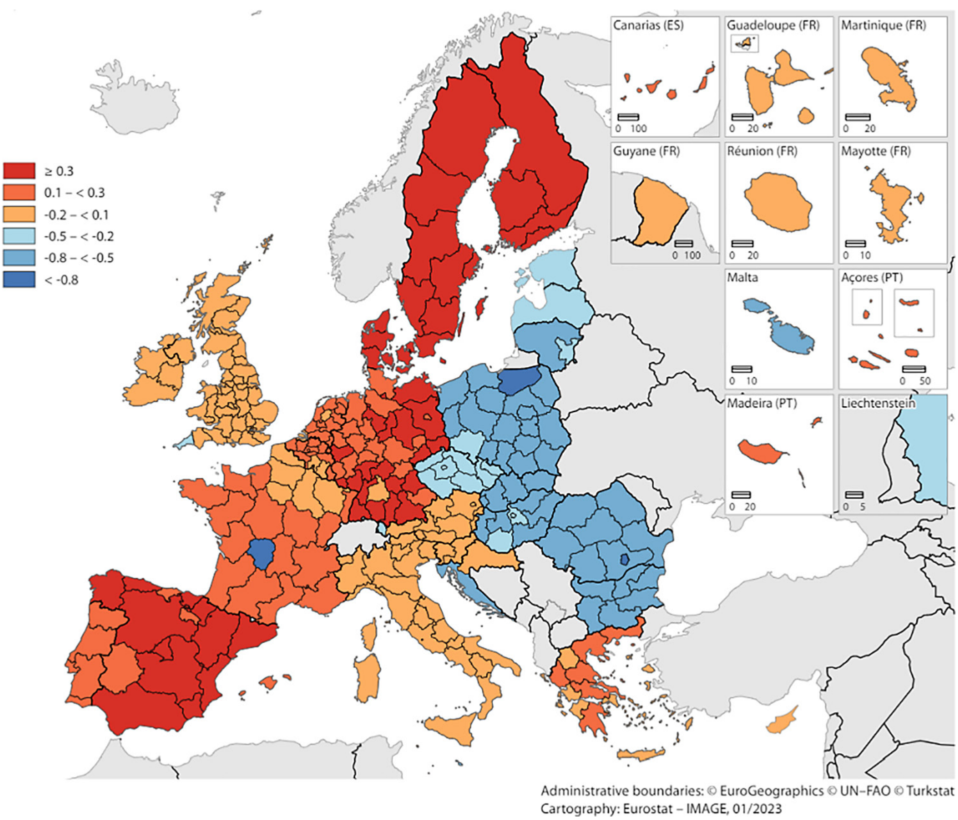

Fig. 5. Overall Regional Climate Proactivity Index
Source: own study.

The most favorable results in terms of climate proactivity were recorded by the Scandinavian regions. These regions have achieved high values for economic, institutional and social dimension of climate proactivity and are playing a leading role in mitigation and adaptation to climate change. They aim to achieve climate resilience by reducing emissions, increasing in the share of renewable energy and implementing environmentally friendly solutions in economy. Regions from Central and Eastern Europe (Poland, Romania and Bulgaria) have the lowest level of overall regional climate proactivity. The main challenges are unambitious progressive climate policies, emission reductions and the slow introduction of renewable energy sources.

The clustering of regions based on the Overall Regional Climate Proactivity Index allowed to divided all EU regions NUTS 2 into 4 coherent groups. The regions with the lowest index value were grouped as "regions lagging behind". These were the 56 regions with the lowest level of advancement in terms of climate proactivity. The second, most numerous group of so-called "moderate regions" clustered 105 regions with moderate scores. The third group gathered

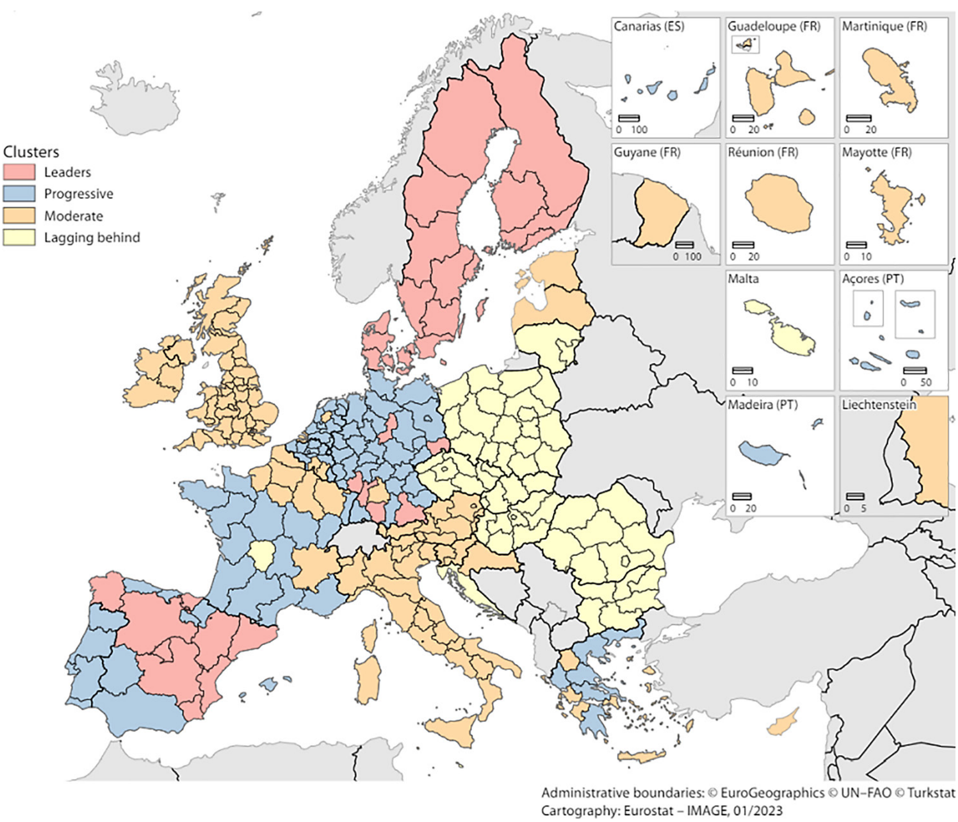

Fig. 6. Clusters of regional climate proactivity
Source: own study.

85 “progressive regions with higher medium scores. The fourth, least numerous group clustered 35 regional leaders with the highest scores (Table 6, 7).

Table 6. Results of cluster analyses

Cluster	Means of clusters (k-means method); number of cases 281		
	RCPI	Number of cases	Percent (%)
1	−0.5896	56	19.9
2	−0.0156	105	37.4
3	0.2258	85	30.2
4	0.4417	35	12.5

Source: own study.

Table 7. Clusters of regional climate proactivity

Cluster	Types of regions	Regions
1	Lagging behind	BG31, BG32, BG33, BG34, BG41, BG42, CZ01, CZ02, CZ03, CZ04, CZ05, CZ06, CZ07, CZ08, FRI2, HR03, HU11, HU12, HU21, HU22, HU23, HU31, HU32, HU33, LT01, LT02, MT00, PL21, PL22, PL41, PL42, PL43, PL51, PL52, PL61, PL62, PL63, PL71, PL72, PL81, PL82, PL84, PL91, PL92, RO11, RO12, RO21, RO22, RO31, RO32, RO41, RO42, SK01, SK02, SK03, SK04
2	Moderate	AT11, AT12, AT13, AT21, AT22, AT31, AT32, AT33, AT34, BE34, BE35, CY, DE11, EE, EL30, EL41, EL42, EL43, EL53, EL62, EL63, FR10, FRD2, FRE1, FRE2, FRF2, FRF3, FRK2, FRM0, FRY1, FRY2, FRY3, FRY4, FRY5, HR04, IE04, IE05, IE06, ITC1, ITC2, ITC3, ITC4, ITF1, ITF2, ITF3, ITF4, ITF5, ITF6, ITG1, ITG2, ITH1, ITH2, ITH3, ITH4, ITH5, ITI1, ITI2, ITI3, ITI4, LV, NL23, NL34, SI03, SI04, UKC1, UKC2, UKD1, UKD3, UKD4, UKD6, UKD7, UKE1, UKE2, UKE3, UKE4, UKF1, UKF2, UKF3, UKG1, UKG2, UKG3, UKH1, UKH2, UKH3, UKI3, UKI4, UKI5, UKI6, UKI7, UKJ1, UKJ2, UKJ3, UKJ4, UKK1, UKK2, UKK3, UKK4, UKL1, UKL2, UKM5, UKM6, UKM7, UKM8, UKM9, UKN0
3	Progressive	BE10, BE21, BE22, BE23, BE24, BE25, BE31, BE32, BE33, DE13, DE22, DE23, DE24, DE25, DE26, DE27, DE30, DE40, DE50, DE60, DE71, DE72, DE73, DE80, DE92, DE93, DE94, DEA1, DEA2, DEA3, DEA4, DEA5, DEB1, DEB2, DEC0, DED4, DED5, DEE0, DEF0, DEG0, EL51, EL52, EL54, EL61, EL64, EL65, ES12, ES13, ES22, ES23, ES43, ES53, ES61, ES70, FRB0, FRC1, FRC2, FRD1, FRF1, FRG0, FRH0, FRI1, FRI3, FRJ1, FRJ2, FRK1, FRL0, LU00, NL11, NL12, NL13, NL21, NL22, NL31, NL32, NL33, NL41, NL42, PT11, PT15, PT16, PT17, PT18, PT20, PT30
4	Leaders	DE12, DE14, DE21, DE91, DEB3, DED2, DK01, DK02, DK03, DK04, DK05, ES11, ES21, ES24, ES30, ES41, ES42, ES51, ES52, ES62, ES63, ES64, FI19, FI1B, FI1C, FI1D, FI20, SE11, SE12, SE21, SE22, SE23, SE31, SE32, SE33

Source: own study.

Cluster of “regions lagging behind” groups regions for which climate change is the greatest challenge in terms of institutional, economic and social action. They are characterized by a low level of innovation in climate proactivity and climate transformation activities, which may result in a widening of existing disparities. Cluster of "moderate regions" includes a significant group of regions for which climate change issues are important, but actions are being implemented at a moderate level. Cluster of "progressive regions" comprises regions implementing a diverse package of institutional and socioeconomic programs and actions to ensure better adaptation to the changes brought about by the climate transition. Cluster of "leaders" groups regions whose leading position is due to their prioritized approach to climate change, as well as the broad catalog of tools used to stimulate a proactive approach to climate change. This translates into innovative measures to address environmental change at the institutional, economic and social levels, and to anticipate and counteract the negative effects of climate change.

Discussion

The debate on climate change distinguishes two general response options. The first is mitigation by reducing the emissions of harmful greenhouse gases. The second option is adaptation, which aims to reduce the vulnerability of human and natural systems to a shift in climate regime. The approach to climate action that combines mitigation with adaptation is climate proactivity. We argue that climate adaptation should have proactive nature, and thus foster regional competitiveness and resilience. Our findings suggest that most of the literature focuses on the mitigation and adaptation measures rather than anticipating the effects of ongoing climate change. Climate change policies are usually meant to reduce the negative impacts associated with anthropogenic climate transformation (Patt 2012). However, climate change mitigation strategies are insufficient and inadequate (Darjee et al. 2023). Previous studies have identified different types of climate change adaptation, but have tended to focused on a selected sectoral or territorial area (Cunningham et al. 2016, Kunapo et al. 2018, Kythreotis et al. 2020, Ulibarri et al. 2022). We believe that climate change transformation is a social, economic and political process and requires different but integrated actions at the political, economic and social levels. This holistic approach can overcome the structural, financial limitation, and social constraints (Boyer et al. 2017). It is also more relevant in the face of highly erratic climate risks and their impacts. Proactive adaptation may, however, be hampered by uncertainty about the outcome and nature of expected changes. Undoubtedly, the most promising approaches are future-oriented, combining technological innovation, institutional change and changes in social and economic behavior, aiming not only to adapt to climate change that has already occurred, but also to be proactive in nature. This can be transformational adaptation, defined as actions leading to the adoption of new behaviors and functions that take place across a broad spatial or sectoral scope and imply profound systemic change (de Coninck et al. 2018). Efforts to enhance climate adaptation and resilience must include social equity considerations and be locally endowment to be effective, and sustainable (von Hedemann et al. 2023).

Conclusion

Adaptation to climate change is one of the key challenges, but it is necessary to take into account the specific characteristics of individual territories, differences in demographics, economic structures, geographical context, and environmental and climatic conditions. Unsustainable use of the environment causes many socio-economic consequences, such as higher human mortality, widespread deterioration of ecosystem structure and function, and environmental destruction.

A one-size-fits-all approach to building climate resilience in diverse regions is not effective. The effects of climate change vary from region to region, so most adaptation measures should be implemented at the regional or local level. This requires integrated economic, institutional and social long-term and proactive measures. The above findings are important from the programming and implementation of regional climate change adaptation policies. Climate change adaptation should also not prioritize only actions aimed at immediate risk reduction, marginalizing long-term transformational changes. What is needed is an appropriate climate policy implemented not only at the national level, but at the level of individual regions. The scope of implemented measures is derived from the regions' socio-economic development, public awareness and institutional commitment. It is important to have adequate knowledge, a sense of urgency, access to adequate resources and legal capacity (Runhaar et al. 2012). Therefore, further analysis of specific regional and local conditions and multifunctional adaptation strategies targeting the specific problems of individual regions are needed to support and develop climate proactivity approaches. Mitigating the negative effects of climate transformation through proactive action will also improve the competitiveness of regional entities. Climate change is often seen as the macro-driver of competitiveness (Heininen, Exner-Pirot 2020) but it is necessary to fully recognize its importance at the regional level as well.

References

Alonso J.A., Garcimartin C., Kvedaras V. 2020. Determinants of institutional quality: an empirical exploration. Journal of Economic Policy Reform, 23(2): 229–247. https://doi.org/10.1080/17487870.2020.1719102

Annoni P., Dijkstra L. 2019. The EU Regional Competitiveness Index. Publications Office of the European Union, Luxembourg (https://ec.europa.eu/regional_policy/sources/docgener/work/2019_03_rci2019.pdf, 1–42).

A Climate Risk Management Approach to Disaster Reduction and Adaptation to Climate Change; UNDP Expert Group Meeting. Integrating Disaster Reduction with Adaptation to Climate Change Havana, June 17–19, 2002.

Antronico L., Coscarelli R., De Pascale F., Di Matteo D. 2020. Climate Change and Social Perception: A Case Study in Southern Italy. Sustainability 12(17): 6985. https://doi.org/10.3390/su12176985

Arnout BA. 2022. Climate values as predictor of climate change perception in the Kingdom of Saudi Arabia. Front. Psychol. 13: 1044697. https://doi.org/10.3389/fpsyg.2022.1044697

Bhawsar P., Chattopadhyay U. 2015. Competitiveness Review, reflections and directions. Global Business Review, 16(4): 665–679. https://doi.org/10.1177/0972150915581115

Boyer M.A., Meinzer M., Bilich A. 2017. The climate adaptation imperative: Local choices targeting global problems? Local Environment, 22(1): 67–85. https://doi.org/10.1080/13549839.2016.116037

de Coninck H., Revi A., Babiker M., Bertoldi P., Buckeridge M., Cartwright A., Dong W., Ford J., Fuss S., Hourcade J.C., Ley D., Mechler R., Newman P., Revokatova A., Schultz S., Steg L., Sugiyama T. 2018. Strengthening and Implementing the Global Response. In Global warming of 1.5°C: Summary for policy makers, 313–443. IPCC – The Intergovernmental Panel on Climate Change.

Cunningham R., Cvitanovic C., Measham T., Jacobs B., Dowd A.-M., Harman B. 2016. Engaging communities in climate adaptation: The potential of social networks. Climate Policy, 16(7): 894–908. https://doi.org/10.1080/14693062.2015.1052955

Darjee K.B., Neupane P.R., Köhl M. 2023. Proactive Adaptation Responses by Vulnerable Communities to Climate Change Impacts. Sustainability, 15(14): 10952. https://doi.org/10.3390/su151410952

Engler A., Rotman M.L., Poortvliet P.M. 2021. Farmers' Perceived Vulnerability and Proactive versus Reactive Climate Change Adaptation in Chile's Maule Region. Sustainability, 13(17): 9907. https://doi.org/10.3390/su13179907

Fazey I., Wise R., Lyon C., Campeanu C., Moug P., Davies T. 2015. Past and future adaptation pathways. Climate and Development, 8(1): 26–44. https://doi.org/10.1080/17565529.2014.989192

Grant P.R., Grant B.R., Huey R.B., Johnson M.T., Knoll A.H., Schmitt J. 2017. Evolution caused by extreme events. Philos. Trans. R. Soc., B, 372: 20160146.

Heininen L., Exner-Pirot H. 2020. Climate Change and Arctic Security Searching for a Paradigm Shift. Palgrave Macmillan.

Jiang Y.G., Zhang J., Asante D., Yang Y. 2019. Dynamic evaluation of low-carbon competitiveness (LCC) based on improved Technique for Order Preference by similarity to an Ideal Solution (TOPSIS) method: A case study of Chinese steelworks. Journal of Cleaner Production, 217: 484–492.

Khan M.J., Roberts T., Huq S., Hoffmeister V. 2018. The Paris Framework for Climate Change Capacity Building. Routledge/Taylor and Francis, London and New York.

Karman A., Miszczuk A., Bronisz U. 2021. Regional Climate Change Competitiveness –Modelling Approach. Energies, MDPI, 14(12): 1–17.

Ketels C., Porter M.E. 2020. Rethinking the role of the EU in enhancing European Competitiveness. Competitiveness Review, 31(2): 189–207. https://doi.org/10.1108/CR-08-2020-0100

Kizos T., Verburg P.H., Bürgi M., Gounaridis D., Plieninger T., Bieling C., Balatsos T. 2018. From concepts to practice: combining different approaches to understand drivers of landscape change. Ecology and Society, 23(1): 25. https://doi.org/10.5751/ES-09910-230125

Kunapo J., Fletcher T.D., Ladson A.R., Cunningham L., Burns M.J. 2018. A spatially explicit framework for climate adaptation. Urban Water Journal, 15(2): 159–166. https://doi.org/10.1080/1573062X.2018.1424216

Kythreotis A.P., Jonas A.E.G., Howarth C. 2020. Locating climate adaptation in urban and regional studies. Regional Studies, 54(4): 576–588. https://doi.org/10.1080/00343404.2019.1678744

McDonald K.S., Hobday A.J., Thompson P.A., Lenton A., Stephenson R.L., Mapstone B.D. 2019. Proactive, reactive, and inactive pathways for scientists in a changing world. Earth's Future, 7: 60–73. https://doi.org/10.1029/2018EF000990

Moldan B., Janouvikov S., Hunk T. 2012. How To Understand And Measure Environmental Sustainability: Indicators And Targets. Ecological Indicators, 17: 4–13. https://doi.org/10.1016/j.ecolind.2011.04.033

Murphy B.F., Timbal B. 2007. A review of recent climate variability and climate change in southeastern Australia. International Journal of Climatology, 28: 859–879. https://doi.org/10.1002/joc.1627

Ostrouch T., Sługocki W. 2018. Space and population – competitiveness determinants of countries in the age of globalization. Management, 22(2): 121–140.

Patt A. 2012. Multi-level climate adaptation policy and causation narratives. Geografisk Tidsskrift – Danish Journal of Geography, 112(2): 174–182. https://doi.org/10.1080/00167223.2012.742967

Porter J.J., Demeritt D., Dessai S. 2015. The right stuff? Informing adaptation to climate change in British Local Government. Global Environmental Change, 35: 411–422.

Pyankova S., Troyanskaya M., Tyurina Y. 2021. Digital development and its impact on regions' competitiveness. Global Economy Journal, 21, 02.

Runhaar M., Mees H., Wardekker A. 2012. Adaptation to climate change – related risks in Dutch urban areas: stimuli and barriers. Regional Environmental Change, 12: 777–790. https://doi.org/10.1007/s10113-012-0292-7

Rusu V.D., Roman A. 2018. An empirical analysis of factors affecting competitiveness of C.E.E. Countries. Economic Research – Ekonomska Istraživanja, 31(1): 2044–2059. https://doi.org/10.1080/1331677X.2018.1480969

Shalizi Z., Lecocq F. 2010. To Mitigate or to Adapt: Is that the Question? Observations on an Appropriate Response to the Climate Change Challenge to Development Strategies. The World Bank Research Observer, 25(2): 295–321. http://www.jstor.org/stable/40891377

Schwab K. 2019. The Global Competitiveness Index. World Economic Forum, Switzerland (https://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport 2019.pdf).

Stiglitz J.E., Fitoussi J.-P., Durand M. 2018. Beyond GDP. Measuring What Counts for Economic and Social Performance. OECD Publishing, Paris.

Taylor A.L., Dessai S., Bruine de Bruin W. 2014. Public perception of climate risk and adaptation in the UK: A review of the literature. Climate Risk Management, 4–5: 1–16. https://doi.org/10.1016/j.crm.2014.09.001

Ulibarri, N., Ajibade, I., Galappaththi, E. K., Joe, E. T., Lesnikowski, A., Mach, K. J., Musah-Surugu J.I., Nagle Alverio G., Segnon A.C., Siders A.R., Sotnik G., Campbell D., Chalastani V.I., Jagannathan K., Khavhagali V., Reckien D., Shang Y., Singh C., Zommers Z. The Global Adaptation Mapping Initiative Team. 2022. A global assessment of policy tools to support climate adaptation. Climate Policy, 22(1): 77–96. https://doi.org/10.1080/14693062.2021.2002251

Vallance S., Carlton S. 2015. First to respond, last to leave: communities' roles and resilience across the '4Rs'. International Journal of Disaster Risk Reduction, 14(1): 27–36. https://doi.org/10.1016/j.ijdrr.2014.10.010

von Hedemann N., Breidenbach T., Carney C.P., Carr Childers L., David-Chavez D.M., Havrilla C.A., Hill M., Mahmoud H., Mueller N.D., Schultz C.A., Stevens-Rumann C.S. 2023. Climate adaptation research priorities and funding: A review of US federal departments' climate action plans. Climate Policy, 23(10): 1288–1301. https://doi.org/10.1080/14693062.2023.2242313

Zhang H., Geng Z., Yin R., Zhang W. 2020. Regional differences and convergence tendency of green development competitiveness in China. Journal of Cleaner Production, 254: 119–922.

Zilberman D., Zhao J., Heiman A. 2012. Adoption Versus Adaptation, with Emphasis on Climate Change. Annual Review of Resource Economics, 4, 1: 27–53.

Proaktywność klimatyczna jako czynnik wspierający regionalną konkurencyjność i odporność

Zarys treści: Zmiany klimatu wpływają na szereg procesów społeczno-gospodarczych. Wraz z zieloną transformacją i postępującymi przeobrażeniami klimatu zmienia się także paradygmat konkurencyjności, uwzględniający większy wpływ czynników związanych ze środowiskiem. Aby poprawić konkurencyjność, wyniki gospodarcze i odporność jednostek regionalnych, potrzebne są odpowiednie działania i polityka łagodzenia zmian klimatu. Strategia przewidywania i radzenia sobie z nieuniknionymi skutkami w ramach różnych scenariuszy zmian klimatu określana jest jako proaktywność klimatyczna. W niniejszym artykule podjęto próbę opisania regionalnej proaktywności klimatycznej w wymiarze ekonomicznym, instytucjonalnym i społecznym. Zbadano także różnice w poziomie proaktywności klimatycznej regionów Unii Europejskiej (NUTS 2). W tym celu opracowano: model badawczy proaktywności klimatycznej, syntetyczny wskaźnik regionalnej proaktywności klimatycznej oraz typologię regionów dotyczącą proaktywności klimatycznej. Wyróżniono 4 kategorie regionów: liderzy, regiony progresywne, umiarkowane i zapóźnione. Badanie wykazało, że liderami w zakresie proaktywności klimatycznej są regiony skandynawskie, natomiast regiony z krajów Europy Środkowo-Wschodniej stanowią największą grupę jednostek zapóźnionych, doświadczających największych problemów.

Słowa kluczowe: zmiany klimatu, proaktywność klimatyczna, konkurencyjność regionalna, Unia Europejska