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Polish Adaptation Policy to Climate Change vs. EU Countries' Adaptation Policies

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Abstract

The purpose of this study is to compare the advancement of Poland's adaptation policy with the policy of other EU countries. Benchmarking was used, and the research was preceded by comparing the degree of climate change impact on the economies of individual EU countries. The study used 12 comparative quantities, forecast to 2100 for 27 countries. The added value of the analysis is the diagnosis that indicates whether the advancement of the adaptation policy of individual countries is appropriate for the projected climate change, together with the indication of the level of the adaptation policy in Poland compared to other member states. It was determined that, compared to Western countries, Poland has the lowest projected impact of climate change, as represented by selected indicators in the study, but it also has the lowest degree of adaptation policies. However, comparing Poland with the other countries that joined the EU in 2004 shows the opposite trend. The survey is a starting point for further analysis of adaptation in its broadest sense, at national, EU, and global levels. It indicates that despite the high rate of increase in the negative consequences of climate change, the implementation of adaptation policies is still insufficient and often at an early stage of planning.

Keywords: climate change, adaptation, adaptation policies

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Introduction

Climate change, in itself, is natural. However, the intensification of the greenhouse effect, caused by an imbalance of greenhouse gases in the atmosphere, has negative consequences for both humans and the environment (Hoegh-Guldberg et al. 2018). Man contributes to this imbalance, and in 2022, the New York Times reported alarming levels of human greenhouse gas emissions in 2021. This happened even though the Paris Agreement was adopted in 2015.

The following questions should therefore be asked: Why are we seeing this negative upward trend? Are countries across the globe failing to take appropriate action despite their declarations? Are these actions mitigating or adaptive, or perhaps both? The Intergovernmental Panel on Climate Change (IPCC) defines them as: "Mitigation: An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases (Watson and the Core Team 2001); Adaptation: Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (Klein et al. 2007, p. 750). These mitigation and adaptation actions are implemented using appropriate policies. According to the US Department of the Interior Bureau of Land Management (BLM): "The BLM Mitigation Policy establishes consistent principles and procedures for applying mitigation to address reasonably foreseeable impacts to resources and their values, services and/or functions, and directs the Bureau to consider mitigation well in advance of making decisions about anticipated public land uses" (BLM n.d.). In terms of adaptation policy, the United Nations Development Programme has developed the Adaptation Policy Framework, based on four principles (Lim and Spanger-Siegfried 2004):

- Adapting to short-term climate variability and extreme events is a starting point for reducing vulnerability to longer-term climate change;
- Adaptation occurs at different levels in society, including the local level;
- Adaptation policy and measures should be assessed in a development context; and
- The adaptation strategy and the stakeholder process by which it is implemented are equally important.

The purpose of this paper is to indicate how advanced Poland's adaptation policy is compared to other EU countries. The advancement of Poland's adaptation policy was verified against the background of the member states admitted after 2004 (hereinafter: new member states) and the EU countries from 2015. The following hypothesis was adopted: Despite the negative impact of climate change on the economy and society in Poland, the adaptation policy is at a low level compared to other EU member states.

As a research method, benchmarking was used. It is a management method that can be defined as a creative comparison with best practices. It involves learning from leaders in the field of best practices, not copying ready-made solutions but imitating and improving ways of dealing with them. The idea of benchmarking is to seek ideas and set standards for organizations and business entities by comparing and looking for good practices. The research was preceded by comparing the degree of climate change's impact on the economies of individual EU countries. A limitation of this study, however, is the lack of data for Croatia, Malta, Cyprus, and Luxembourg. Therefore, these countries were not included in the analysis.

Comparative analysis of adaptation measures to climate change – methodological assumptions

Two benchmarking studies were carried out to compare the degree of climate change impact on the economies of individual EU countries and to determine how advanced Poland's climate change adaptation actions are compared to other EU countries: 1) Poland and countries that joined the EU after 2004, and 2) Poland and EU–15 countries (Croatia, Malta, Cyprus, and Luxembourg were excluded due to the lack of data).

The comparative analysis presented below uses the following comparative quantities:

1) Projected climate change from 2071 to 2100 (compared to 1961 to 1990);
2) Projected changes in temperatures during the summer months (June–August) from 2000 to 2100;
3) Projected changes in temperatures during the winter months (December–February) from 2000 to 2100;
4) Projected changes in rainfall from 2071 to 2100 (compared to 1961 to 1990);
5) Total cost per capita of weather events from 1980 to 2015 (including three types of events: meteorological, i.e., storms; climatological, i.e., extreme temperatures and droughts; hydrological, i.e., floods, creek floods, storms, and lake freezing;
6) Projected annual GDP loss in millions of euros due to climate change by 2080;
7) Projected annual change in agricultural crops due to climate change by 2080;
8) Climate change vulnerability index;
9) Level of reported willingness to develop policies and take adaptation actions at the national level;
10) Increased level of public awareness of the need for adaptation;

11) Stage in the adaptation policy development process;

12) Recognition of the need to put climate change adaptation on the national policy agenda.

The unpredictability of weather conditions and the intensity and effectiveness of prevention efforts contribute to the lack of a single scenario for change progression (PESETA 2009, pp. 32–35). This study uses the breakdown of possible scenarios identified by the European Commission (PESETA, Projection of Economic impacts of climate change in Sectors of the European Union based on boTtom-up Analysis) and the IPCC.

The benchmark data in rows one and four are presented for the four climate change scenarios extracted in the PESETA II report (PESETA 2009):

- *Reference Simulation* – a simulation that represents the main features of the entire set of 12 A1B simulations, not including the conduct of significant mitigation actions (it includes simulations A1B KNMI-RACMO2-ECHAM5, A1B ECHAM5-UKMO).
- Reference Variant 1 – warmer and drier than average values for the direction of climate change (it includes simulations A1B METO-HC-HadRM3Q0-HadCM3Q0, A1B ECHAM5-DMI).
- Reference Variant 2 – colder and wetter than average values for the direction of climate change (it includes simulations A1B DMI-HIRHAM5-ECHAM5, A1B EGMAM2006-FUB).
- 2°C – a simulation based on the E1 scenario, used to illustrate future climate change impacts if global mitigation actions are pursued (it includes simulations MPI-REMO-E4, E1 ECHAM5.4-MPI).

The IPCC has distinguished the following climate change scenarios from 2071 to 2100 (rows 6–10 Tab. 1, 2a, 2b) (Christensen, Carter, and Rummukainen 2007):

- B2 – Global model HadAM3H/HadCM3, Regional model – HIRHAM, concentration C02 561 ppm, temperature increase 2.5°C.
- A2 – Global model HadAM3H/HadCM3, Regional model – HIRHAM, concentration C02 709 ppm, temperature increase 3.9°C.
- B2 – Global model ECHAM4/OPYC3, Regional model – RCAO, concentration CO2 561 ppm, temperature increase 4.1°C.
- A2 – Global model ECHAM4/OPYC3, Regional model – RCAO, concentration CO2 709 ppm, temperature increase 5.4°C.

Croatia was omitted from the analysis due to the selectivity of available data. The lack of data for Malta, Cyprus, Luxembourg, and Croatia is explained by the fact that these countries are not single regions in the economic model.

GEM-E3 is a dynamic and computational general equilibrium model that includes interactions between the economy, the energy system, and the environment. It is designed to evaluate energy, climate, and environmental policies. The GEM-E3 model is used to assess the distributional and macroeconomic effects of policies on different economic sectors across countries (European Commission 2017). For changes in temperature and precipitation, due to their geographical locations, Malta is expected to experience changes similar to Italy, Luxembourg to France, and Cyprus to Greece.

The data collection process began with a comparative analysis of secondary sources, including, but not limited to, Polish and foreign publications, reports, materials, and internet sources. The collected data are presented in Tables 1 (EU countries that joined in 2004 and later), 2a, and 2b (EU–15). The following country designations (according to ISO 3166–1) were used: Austria – AT, Belgium – BE, Bulgaria – BG, Cyprus – CY, Czech Republic – CZ, Denmark – DK, Estonia – EE, Finland – FI, France – FR, Germany – DE, Greece – GR, Hungary – HU, Ireland – IR, Italy – IT, Latvia – LV, Lithuania – LT, Luxembourg – LV, Malta – MT, Netherlands – NL, Poland – PL, Portugal – PT, Romania – RO, Slovakia – SK, Slovenia – SL, Spain – ES, Sweden – SE, UK – GB.

Benchmarking results of the new EU member states

Table 1 presents the results of benchmarking for twenty-two variables listed above, obtained for the new EU member states (Croatia is not included due to a lack of data).

Table 1. Benchmarking results for new EU member states

Benchmarking size	PL	CY	CZ	EE	LV	LT	MT	SK	SL	HU	BG	RO
1a) Increase by [°C]	2.8	3.2	3.0	3.8	3.8	3.8	3.2	3.0	3.0	3.0	3.2	3.0
1b) Increase by [°C]	3.7	3.7	3.8	4.8	4.8	4.8	3.7	3.8	3.8	3.8	3.7	3.8
1c) Increase by [°C]	2.0	2.4	2.0	3.4	3.4	3.4	2.4	2.0	2.0	2.0	2.4	2.0
1d) Increase by [°C]	2.1	2.3	2.1	3.2	3.2	3.2	2.3	2.1	2.1	2.1	2.3	2.1
2) Change by [°C]	3.3–3.7	4.1–4.9	3.3–3.7	3.3	3.3–3.5	3.3–3.5	4.1–4.9	3.3–3.7	3.7–4.1	3.9–4.1	4.1 –4.3	3.7–4.1
3) Change by [°C]	3.4–3.8	2.2–3	3.4–3.8	4.6	4.2	4.2	–0.2 – + 2.6	3.4–3.8	1.8–2.6	3–3.4	1.8 –2.9	3
4a) Change by [%]	2.8	– 19	0	18	18	18	– 19	0	0	0	– 19	0
4b) Change by [%]	3.7	– 14	– 7	16	16	16	– 14	– 7	– 7	– 7	– 14	– 7
4c) Change by [%]	2.0	– 14	5	21	21	21	– 14	5	5	5	– 14	5
4d) change by [%]	2.1	– 14	– 3	11	11	11	– 14	– 3	– 3	– 3	– 14	– 3
5 [euro per capita]	376	514	940	71	149	270	156	308	738	556	288	486
6a) [bln euro]	15	6	– 2	– 6	– 6	– 6	6	– 2	– 2	– 2	6	– 2
6b) [bln euro]	19	18	0	– 6	– 6	– 6	18	0	0	0	18	0
6c) [bln euro]	12	8	3	– 5	– 5	– 5	8	3	3	3	8	3
6d) [bln euro]	22	42	9	– 9	– 9	– 9	42	9	9	9	42	9
7a) [%]	– 1	0	5	37	37	37	0	5	5	5	0	5
7b) [%]	– 3	– 12	5	39	39	39	– 12	5	5	5	– 12	5
7c) [%]	2	– 4	3	36	36	36	– 4	3	3	3	– 4	3
7d) [%]	– 8	– 27	– 3	52	52	52	27	– 3	– 3	– 3	27	– 3
8	0.21–0.37	0.37–0.52	0.3–0.37	0.26–0.3	0.26–0.3	0.21–0.26	=>0.52	0.21–0.37	0.21–0.26	0.37–0.52	0.37–0.52	0.26–0.52

Benchmarking size	PL	CY	CZ	EE	LV	LT	MT	SK	SL	HU	BG	RO
9	Average	High	Low	Average	Average	Average	High	Average	Low	Average	High	Average
10	Lack of growth	Growth	Lack of growth	Lack of growth	Lack of growth	Growth	Growth	Growth	Growth	Lack of growth	Growth	Growth
11	Decision phase	formulating phase	formulating phase	formulating phase	formulating phase	monitoring and evaluation	implementation	formulating phase	formulating phase	Decision phase	formulating phase	Decision phase
12	YES	YES	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES

Source: own work based on: European Commission 2009, p. 24; PESETA 2009, pp. 32–35; Ciscar, Iglesias, and Soria 2011, p. 2681; Norwegian Meteorological Institute 2013, p. 83; Eurostat 2014, pp. 24–27.

The projected average temperature increase for the EU countries, depending on the scenario, varies from 2.4 to 3.9°C. In the new member states, the highest increases, for all scenarios, will occur in Estonia, Latvia, and Lithuania. Changes in temperature in Poland (like the countries of Central and Southern Europe) are below the EU average.

Breaking down the months into summer and winter, June–August will see the highest increases in Cyprus and the lowest in Estonia, while December–February will see the highest increase in Estonia and the lowest in Malta. In Poland, the projected temperature changes in summer increased from 3.3 to 3.7°C, and in winter, from 3.4 to 3.8°C. The same increase is expected in the Czech Republic and Slovakia. Poland takes sixth place among new EU members in the projected temperature changes of the winter months.

The analysis of precipitation intensity for the new member countries indicates a change in precipitation ranging from a decrease of 2% to an increase of up to 6% (depending on the scenario). A shift from south to north will be observed. Accordingly, in the new member states, the greatest increases in precipitation will occur in Estonia, Latvia, and Lithuania, followed by Poland; the greatest decreases will be in Cyprus, Malta, and Bulgaria.

In the new member states, the highest level of per capita losses due to weather events from 1980 to 2015 occurred in the Czech Republic and Slovenia, with the lowest in Estonia. Poland, with a loss of €376 per person, ranked sixth.

The largest increases in annual GDP loss by 2080 are expected in Poland (between €12 billion and €22 billion), Cyprus, Malta, and Bulgaria (between €8 and €41 billion). In Estonia, Lithuania, and Latvia, annual GDP growth as a result of climate change is expected to be between €1 and 9 billion (ceteris paribus). In these countries, the beneficial impacts of climate change can be expected in agriculture, where climate change-induced increases in crops are projected to be between 36 and 52% by 2080, with agricultural GDP growth between 0.08 and 0.9%. In the remaining countries, a 2.5°C increase in temperatures will not result in significant changes. However, if the other scenarios come true, it will result in a clear northward shift in agricultural sector revenues. In Cyprus, Bulgaria, and Malta, declines will range from 4 to 27%. Polish agriculture may record a 2% increase with an increase in average temperatures of only 4.1°C; in other cases, decreases of between 1% and 8% are estimated.

Analyzing the changes in atmospheric conditions in the new member states, the following common features can be observed:

- Lithuania, Latvia, and Estonia: there will be an increase in temperature well above the global average, a decrease in ice cover (including lake and river ice), an increase in river flow, the northward movement of species, an increase in crop yields, a decrease in energy demand for heating, an increase in hydropower potential, the risk of increased damage from winter storms, and an increase in summer tourism.

- Poland, Slovakia, Slovenia, Hungary, Bulgaria, and Romania: there will be an increase in extreme temperatures, a decrease in summer precipitation, an increase in water temperature, an increased risk of forest fires, and a decrease in the economic value of forests.
- Cyprus, Malta, and Croatia: there will be an increase in temperature well above the European average, a decrease in annual precipitation and annual river flow, an increase in the risk of biodiversity loss, an increased risk of desertification, decreasing agricultural yields, an increased risk of forest fires, an increase in heatwave mortality, and a decrease in summer tourism income and a potential increase in other seasons.

Climate change impacts on European countries are presented in the form of a synthetic index. This climate change index combines information on drought vulnerability, populations affected by river flooding and exposed to coastal erosion, and the agriculture, fisheries and tourism sectors' exposure to climate change. The index shows an asymmetric peripheral core pattern for the EU. The regions under greatest pressure tend to be in the south and east of Europe. This is mainly due to changes in rainfall and rising temperatures, which affect vulnerable economic sectors. Among the new member states, the highest values were indicated for Malta, followed by Cyprus, Bulgaria, and Romania. The value of the index has been presented in ranges because it may differ within one country. Thus, the southern part of Poland has the same value as the northern part of Bulgaria, Romania, and the north-western part of the Czech Republic.

The adaptation policies of the new EU member states

The *National Adaptation Strategy* (NAS) and *National Adaptation Programs of Action* (NAPA) provide a general and non-binding policy framework for guiding the adaptation efforts of state authorities and non-state actors. At the national level, they play a key role in creating the "right environment" for planning and implementing specific actions. At this level, mid-term adaptation objectives are formulated, political support is obtained, and coordination mechanisms are established to ensure the involvement of key actors. In general, the development of a national adaptation policy (strategy and/or plan) is an instrument to provide the necessary framework for adaptation and/or adaptation to climate change by coordinating the consideration of climate change across different sectors, latitudes, and levels of decision-making (World Bank 2010, p. 334).

Critics of NAS and NAPA point to three main problems that must be overcome. First, NAPA introduces similar projects in different countries without considering their other specific adaptation needs. Second, many adaptation projects are hard to distinguish from standard development projects. Third, NAPA is not linked to ministries in individual countries, focusing mainly on local institutions. The reasons for these problems include insufficient funding to prepare adaptation plans, an emphasis on the impor-

tance of adaptation in sectors that are most vulnerable to the negative impacts of climate change around the world, i.e., agriculture and natural resources, and the assumption that adaptation actions are more effective when carried out at the local and regional levels, thus reaching a wider audience (World Bank 2010, p. 334).

A survey conducted by *The European Environment Agency* (EEA) showed that a decline in "willingness to develop policies and take adaptation measures at the national level" was observed in EU member states. "Low readiness" was indicated by the Czech Republic and Slovenia, "medium readiness" was declared by Poland, Estonia, Lithuania, Latvia, Hungary, and Romania, and "high readiness" by Cyprus, Bulgaria, and Malta (Eurostat 2014, pp. 24–27).

The adaptation plans of the seven new member countries are in the early stages of "formulation" (although the first phase of the study is "scheduling"). Poland, along with Hungary and Romania, is at the "decision" stage. Malta and Latvia declared the most advanced phase, implementing planned adjustment measures. Seven countries declared an increase in public awareness of the need for adaptation measures; however, Poland, the Czech Republic, Estonia, Latvia, and Hungary were among the countries where public awareness remained unchanged at a low level (Eurostat 2014, pp. 24–27).

All of the countries recognize the problem of gradual climate change, but their adaptation plans and strategies are at different stages of implementation. The Czech Republic, Hungary, Bulgaria, Lithuania, and Estonia have limited adaptation to mitigating and reducing carbon emissions (e.g., a low-carbon economy, a reduction in energy consumption, and using alternative energy sources). The adaptation strategies in Cyprus, Latvia, Malta, Slovakia, Slovenia, Romania, and Poland assume the need for preventive action and adaptation in key sectors of the economy. The strategies of these countries indicate the need for adaptation measures not only at the central level, but also at the local level. In addition, actions are needed in vulnerable sectors such as agriculture, forest protection, fisheries, and coastal management.

Moreover, the strategies of Latvia, Poland, Slovenia, and Romania emphasize the importance of education and dialogue between all economic actors. It is possible to implement a national climate change adaptation strategy through inter-ministerial cooperation. Therefore, appropriate joint actions of ministries or departments to adapt to the new climate reality can bring tangible benefits. The countries that will be most negatively affected by climate change are Cyprus, Malta, Bulgaria, and Poland. These countries have the highest rates of climate change, the largest losses in estimated GDP, and the highest income declines in the agricultural sector. Among the most vulnerable countries, only Bulgaria's plan focuses on mitigation with adaptation.

Member State benchmarking results for the EU–15

Tables 2a and 2b present the results of the collection of respondents obtained for the EU–15.

Table 2a. Benchmarking for the EU–15 compared to Poland

Benchmark volume	PL	AT	BE	DK	FI	FR	LU	GR	ES
1a) Growth by [°C]	2.8	3.0	2.8	3.8	3.8	3.0	3.0	3.2	3.2
1b) Growth by [°C]	3.7	3.8	3.7	4.8	4.8	3.8	3.8	3.7	3.7
1c) Growth by [°C]	2.0	2.0	2.0	3.4	3.4	2.0	2.0	2.4	2.4
1d) Change by [°C]	2.1	2.1	2.1	3.2	3.2	2.1	2.1	2.3	2.3
2) Change by [°C]	3.3–3.7	3.3–3.7	3.3–3.7	3.3–3.7	3.3–3.7	3.3–4.1	3.3–4.1	4.1–4.9	4.1–4.9
3) Change by [°C]	3.4–3.8	3.4–3.8	3.4–3.8	3.4–3.8	4.2–5.8	1–2.6	1–2.6	2.2–3	–0.2 – +2.6
4a) Change by [%]	2.8	0	8	18	18	0	0	– 19	– 19
4b) Change by [%]	3.7	– 7	1	16	16	– 7	– 7	– 14	– 14
4c) Change by [%]	2.03	5	15	21	21	5	5	– 14	– 14
4d) Change by [%]	2.1	– 3	3	11	11	– 3	– 3	– 14	– 14
5 [euro per capita]	376	1535	364	1815	352	948	1519	677	812
6a) [billion euro]	15	– 2	15	– 6	– 6	– 2	– 2	6	6
6b) [billion euro]	19	0	19	– 6	– 6	0	0	18	18
6c) [billion euro]	12	3	12	– 5	– 5	3	3	8	8
6d) [billion euro]	22	9	22	– 9	– 9	9	9	42	42
7a) [%]	– 1	5	– 1	37	37	5	5	0	0
7b) [%]	– 3	5	– 3	39	39	5	5	– 12	– 12
7c) [%]	2	3	2	36	36	3	3	– 4	– 4

Benchmark volume	PL	AT	BE	DK	FI	FR	LU	GR	ES
7d) [%]	– 8	– 3	– 8	52	52	– 3	– 3	– 27	– 27
8	0.21–0.37	0.26–0.37	0.26–0.37	0.26–0.37	0.21–0.26	0.21–0.37	lack of data	0.37–0.52 and more	0.37–0.52 and more
9	Average	High	Average	High	Average	High	lack of data	average	High
10	lack of growth	growth	growth	growth	growth	growth	Lack of data	growth	Growth
11	decision phase	imple-menta-tion	imple-menta-tion	imple-menta-tion	moni-toring and eval-uation	moni-toring and eval-uation	lack of data	schedul-ing	imple-menta-tion
12	YES	NO	YES	YES	YES	YES	lack of data	NO	YES

Source: own work based on: European Commission 2009, p. 24; PESETA 2009, pp. 32–35; Ciscar, Iglesias, and Soria 2011, p. 2681; Norwegian Meteorological Institute 2013, p. 83; Eurostat 2014, pp. 24–27.

Table 2b. Benchmarking EU–15

Benchmark volume	PL	NL	IR	DE	PT	SE	GB	IT
1a) Growth by [°C]	2.8	2.8	2.1	2.8	3.2	3.8	2.1	3.2
1b) Growth by [°C]	3.7	3.7	2.9	3.7	3.7	4.8	2.9	3.7
1c) Growth by [°C]	2.0	2.0	1.7	2.0	2.4	3.4	1.7	2.4
1d) Growth by[°C]	2.1	2.1	1.4	2.1	2.3	3.2	1.4	2.3
2) Change by [°C]	3.3–3.7	3.3–3.7	3.3–3.7	3.3–3.7	4.1–4.9	3.3–3.7	3.3–3.7	4.1–4.9
3) Change by [°C]	3.4–3.8	3.4–3.8	1.4–3	3.4–3.8	–0.2 – +2.6	4.2–5.8	1.4–3	–0.2 – + 2.6
4a) Change by [%]	8	8	8	8	– 19	18	8	– 19
4b) Change by [%]	1	1	2	1	– 14	16	2	– 14
4c) Change by [%]	15	15	12	15	– 14	21	12	– 14
4d) Change by [%]	3	3	7	3	– 14	11	7	– 14

Benchmark volume	PL	NL	IR	DE	PT	SE	GB	IT
5 [euro per capita]	376	412	1009	1159	579	466	976	1129
6a) [billion euro]	15	15	6	15	6	– 6	6	6
6b) [billion euro]	19	19	7	19	18	– 6	7	18
6c) [billion euro]	12	12	2	12	8	– 5	2	8
6d) [billion euro]	22	22	2	22	42	– 9	2	42
7a) [%]	– 1	– 1	– 9	– 1	0	37	– 9	0
7b) [%]	– 3	– 3	– 11	– 3	– 12	39	– 11	– 12
7c) [%]	2	2	15	2	– 4	36	15	– 4
7d) [%]	– 8	– 8	19	– 8	– 27	52	19	– 27
8	0.21–0.37	0.3–0.37	below 0.21	0.19–0.3	0.37–0.52 and more	0.21–0.37	0.21–0.37	over 52
9	Average	high	Average	high	average	average	high	high
10	Lack of growth	Lack of growth	Lack of growth	Lack of growth	growth	lack of growth	growth	growth
11	decision phase	implemen-tation	Decision phase	implemen-tation	Decision phase	Formulat-ing phase	implemen-tation	formulat-ing phase
12	YES	YES	YES	YES	YES	YES	YES	YES

Source: own work based on: European Commission 2009, p. 24; PESETA 2009, pp. 32–35; Ciscar, Iglesias, and Soria 2011, p. 2681; Norwegian Meteorological Institute 2013, p. 83; Eurostat 2014, pp. 24–27.

The projected average temperature increase for EU countries, depending on the scenario, ranges from 2.4 to 3.9°C. In the "old" member states, the highest increases, in all scenarios, will occur in the northern European countries (i.e., Sweden, Finland, Denmark) and the lowest in the UK and Ireland. Changes in temperature for Poland (as well as for other Central European countries) are below the EU average.

The highest increase in temperatures in the summer months is expected in Greece, Spain, Portugal, and Italy. However, while in Spain, Italy, and Portugal, the highest increases (4.9°C) may occur only in some regions, in Greece, practically the whole country is expected to have the maximum possible increase. Poland is in the group of most countries, with an expected temperature increase of 3.3–3.7°C. A similar situation is forecast for the winter months: the biggest changes are expected in Spain, Portugal, Italy, and Greece.

The analysis of precipitation intensity for the EU countries indicates a change in precipitation, ranging from a decrease of 2% to an increase of up to 6% (depending on the scenario). In the EU–15, the highest increases will be in Denmark, Finland and Sweden, and the highest decreases will be in Spain, Portugal and Greece. Poland, Germany, the Netherlands and Belgium can expect increases of between 1 and 15%.

Among the EU–15, the highest total per capita loss due to weather events between 1980 and 2015 was recorded in Denmark, Austria, and Luxembourg (a loss of more than €1500 per capita), while the lowest was recorded in Finland, Belgium, and Poland (a loss of €350–380 per capita). The number of people forecast to be affected by floods is highest for Poland, Germany, Belgium, the Netherlands, Greece, Spain, Italy, and Portugal.

Among the EU–15, the highest annual agricultural production losses for all four scenarios are expected in Italy, Spain, Greece, and Portugal. The positive dimension of climate change is reflected in increases in agricultural production in Denmark, Sweden, and Finland. The agricultural sector in Poland, like in Belgium, Germany, and the Netherlands, is only likely to see increases in the 4.1°C scenario, with the other scenarios predicting decreases of between 1 and 8% per year. Depending on the scenario in the UK and Ireland, changes in agriculture could be either positive (increases of 15 to 19% per year) or negative (decreases of 9 to 11% per year).

Analyzing changes in atmospheric conditions for the EU–15, the following common features can be observed:

- Finland, Denmark, and Sweden: there will be an increase in temperature well above the global average, a decrease in ice cover (including lake and river ice cover), an increase in river flow, the movement of species in the north, an increase in crop yields, a decrease in energy demand for heating, an increase in hydropower potential, a risk of increased damage from winter storms, and an increase in summer tourism.
- Poland, Germany, Belgium, and the Netherlands: there will be an increase in extreme temperatures, a decrease in summer precipitation, an increase in water temperature, an increase in the risk of forest fires, a decrease in the economic value of forests, a decrease in agricultural yields, and an increase in summer tourism.
- The United Kingdom and Ireland: there will be an average increase in temperature and precipitation close to the European average; the profitability of agricultural production will be dependent on the advancement of climate change progress – there will be no unidirectional impact: depending on the implementation of the scenario, there will be decreases or increases; an increase in profitability of the tourism industry, lower frost mortality, and in the absence of adaptation, a high percentage of land loss due to sea level rise.

- Greece, Italy, Spain, and Portugal: there will be an increase in temperature well above the European average, a decrease in annual precipitation and the annual flow of rivers, an increase in the risk of biodiversity loss, an increased risk of desertification, a decrease in the supply of agricultural products, an increased risk of forest fire, an increase in mortality caused by heat waves, a decrease in summer tourism revenues but a potential increase at other times of the year.

In the accepted division of the survey, all of the EU–15 countries recognize the problem of climate change. However, the degree of implementation of adaptation policies, their implementation into national policies, as well as the commitment to financing global action varies. Greece is characterized by a low level of sophistication and commitment to implementing adaptation measures, with high values determining the negative impact of climate on the country. France and Finland's adaptation strategies are at the highest level of implementation. Germany is distinguished by its high contribution to international climate-related expenditures and Sweden by its more than 50% share of Renewable Energy Sources (RES). Germany and France have high levels of primary energy use, while only Poland has an upward trend in its use.

Analyzing the losses resulting from weather events between 1980 and 2015, it is clear that the burden is not evenly distributed. The average for the whole EU is 779 euros per person, although ten countries were above this value, including the Czech Republic. Estonia, which has the lowest cost of all European countries, incurred a cost more than 25 times lower than the country with the highest cost – Denmark.

Analysis of the values of the synthetic climate change index shows that the greatest negative economic and social impacts of climate change are expected in Italy, Spain, Portugal, and Greece. The index has been presented in ranges because it can vary within a country, especially for vast countries. The lowest index is shown for Ireland. In Poland, as in the UK, France, and Sweden, it reaches moderate values (but not low, with values in the south-western regions of these countries estimated to be similar to those for Italy or Spain). Most worrying is that despite the high values for this indicator for Greece, the country has the lowest level of adaptation activity, despite increased public awareness of the need to adapt. The analysis of this indicator also shows that all EU–15 Member States will be affected to a greater or lesser extent by the negative impacts of climate change, with the negative consequences becoming more serious and severe the further south-west in Europe one goes.

Adaptation policy of the EU–15

In most EU–15 countries (eight countries), the level of commitment to policy development and adaptation measures at the national level was described as high. Poland was among those countries that were rated medium. In addition, a greater number of coun-

tries reported increased public awareness of the need to adapt (10 countries). Poland was in the small group of countries where the level of awareness had remained low. Only two countries (Belgium and Greece) indicated that there was no need to adapt their national policies to climate change.

The earliest stage of the adaptation policy-making process (called timetabling) was found only in Greece. Of the EU–15, most are in the "implementation" phase (7 countries), three are one stage lower (including Poland) – in the "decision" phase – and two more (Italy and Sweden) are at an even earlier stage – the "formulation" phase. The highest level of monitoring and evaluation (evolution) was declared in France and Finland.

Conclusions

Regarding negative climate impacts, Europe is divided into North and South, where the negative consequences of climate change become more severe the further south one goes. Indicators such as the total per capita cost of weather events, funding, and the sophistication of adaptation policies divide Europe into East and West, with the higher the level of development, the higher these indicators reach.

Having achieved the goal of the study, it can be stated that Poland has the lowest projected impact of climate change but also the lowest degree of advancement of adaptation policy. However, comparing Poland with the other new member states shows the opposite tendency. Among those countries, Poland has the highest expected impact of climate change on the economy and society, but with a more advanced adaptation policy. For most of these countries, the first stage of implementation, the "formulation phase," is indicated, while Poland has reached the second stage, the "decision phase." Thus, this highest level is not commensurate with the advancement of climate change impacts.

A comparative analysis of all the member states indicates that France, despite the moderate impact of climate change (as measured by the variability of selected indicators in the study), is in the advanced (last) stage of adaptation measures. Meanwhile, Finland can be identified as a country that recognizes climate change and is actively trying to mitigate and adapt to it. Greece, on the other hand, has one of the highest expected impacts of climate change while also having the lowest level of adaptation policy sophistication. Poland, due to its geographic location, is in a slightly better position. However, it is also in the group of countries with the greatest vulnerability to climate change and climate impacts on macroeconomic variables – the highest projected levels of GDP loss and annual change in crops due to climate change. At the same time, it is at an early stage of adaptation policy development, with a medium level of reported willingness to develop policy and take adaptation action at the national level. However, there has been no increase in public awareness of the need for adaptation.

The results indicate that for Polish businesses to be increasingly unaffected by the negative consequences of climate change, following the example of Western countries, they should not only plan for adaptation, but practically implement it on a large scale. And not tomorrow but today. The added value of the presented research results is the preliminary diagnosis of the advancement of the adaptation policy of the Member States against the background of the forecasts of progressing climate change, which will be the basis for many further studies in this area.

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Analiza porównawcza działań adaptacyjnych do zmian klimatu podejmowanych przez kraje członkowskie Unii Europejskiej

Celem niniejszego opracowania jest wskazanie, jaki jest poziom zaawansowania polityki adaptacyjnej Polski w stosunku do polityki innych krajów unijnych. Dokonano analizy sytuacji Polski na tle krajów członkowskich Unii Europejskiej. Wykorzystaną metodą badawczą był benchmarking. Badania zostały poprzedzone porównaniem stopnia wpływu zmian klimatycznych na gospodarkę poszczególnych krajów Unii. W badaniu wykorzystano 12 jednostek porównawczych, prognoza do 2100 roku dla 27 krajów. Wartością dodaną przeprowadzonej analizy jest diagnoza wskazująca, czy zaawansowanie polityki adaptacyjnej poszczególnych krajów jest adekwatne do prognozowanej zmiany klimatu. Na podstawie przeprowadzonych badań ustalono, że na tle państw zachodnich Polska jest krajem o prognozowanym najniższym wpływie zmian klimatu reprezentowanych przez wybrane wskaźniki badania, ale także najniższym stopniu zaawansowania polityki adaptacyjnej. Porównanie Polski z pozostałymi krajami przyjętymi do struktur UE, począwszy od 2004 roku, wskazuje na odwrotną tendencję.

Przeprowadzone badania stanowią punkt wyjścia do dalszych analiz szeroko rozumianej adaptacji o zasięgu zarówno krajowym, unijnym, jak i światowym. Wskazują bowiem, że mimo wysokiego tempa wzrostu negatywnych konsekwencji zmiany klimatu stopień realizacji polityki adaptacyjnej jest wciąż niewystarczający, często na wczesnym etapie planowania.

Słowa kluczowe: adaptacja, polityka adaptacyjna, zmiany klimatu