

Transformative Innovation for better Climate Change Adaptation - Case Study: Mazovia - Stare Babice, Poland

Author: Murzyn, D.
Editor: Haegeman, K.

2024



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JRC137323

PDF ISBN 978-92-68-14298-1 doi:10.2760/86121 KJ-05-24-242-EN-N

Luxembourg: Publications Office of the European Union, 2024

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How to cite this report: European Commission, Joint Research Centre, Murzyn, D., *Transformative Innovation for better Climate Change Adaptation - Case Study: Mazovia - Stare Babice, Poland*, Haegeman, K.H. editor(s), Publications Office of the European Union, Luxembourg, 2024, <https://data.europa.eu/doi/10.2760/86121>, JRC137323.

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Abstract

The aim of this report is to investigate the potential for harnessing key features of Transformative Innovation to improve the design and the implementation of Climate Change Adaptation (CCA) strategies for Mazovia region and the municipality of Stare Babice, in Poland, as at October 2023, based on empirical analyses. The study draws on the conceptual framework on this question previously defined for the JRC (European Commission, 2024), and the methodology for case studies articulated in the same report. The case study research comprises overall 14 case study reports covering 16 different territories from across the EU and beyond, casing various institutional contexts, a variety of biogeographical regions within different climate risks, different ranges of population sizes, and representing a diversity of approaches to CCA and transformative innovation¹.

The framework takes the form of an analytical grid, structured into seven sections, each of them representing a key feature of the 'transformative innovation' approach where the features are understood as essential conditions for the design and implementation of CCA strategies with this high level of ambition. Each section sets out the main question(s) to be addressed in relation to its respective transformative innovation feature. This report is the result of a collaboration between the Joint Research Centre (JRC), DG CLIMA and DG RTD.

¹ A full list of the case studies is provided in Annex 2

Acknowledgements

The authors would like to thank those persons who participated in the interviews for the Case Study (interviewees list in annex 1), as well as staff of the European Commission's Joint Research Centre in charge of this project, both from JRC (Gérard Carat and Ales Gnamus) and from DG CLIMA (Irene Bonvissuto) and DG RTD (Prisca Haemers).

Executive summary

Policy context

Adapting to climate change has become an increasingly urgent priority for the EU and its territories. Given this urgency, and the systemic nature of climate resilience, new ways to accelerate adaptation are considered. Transformative innovation (TI) is at the focus of this report, particularly how it can help support and accelerate adaptation to climate change. The analysis in this report draws lessons for Mazovia region and the municipality of Babice (Poland) on how a TI approach is already helping the territory in increasing climate resilience, and what can be done in addition, to further accelerate adaptation. The analysis is based on a theoretical framework along 7 dimensions designed to compare TI and Climate Change Adaptation. It is one out of a series of 14 different case studies in European territories.

Main findings

Mazovian Voivodeship, Warsaw City and Stare Babice municipality are signatories of the Mission Charter on Adaptation to Climate Change. Features from the transformative innovation approach can further support Mazovia region and the municipality of Babice in their efforts towards systemic change, building on the following state-of-play.

- **Directionality:** The region's authorities are aware of climate change and the challenges it poses, including climate risks affecting key community systems. CCA is not explicitly targeted in innovation strategies, nor does innovation play an important role in CCA-related strategies at national level or in Mazovia region. Elements of a transformative approach are visible in efforts towards a circular economy and in the energy sector, areas that are more closely linked to climate change (although not explicitly adaptation) in the context of innovation.
- **Instrument portfolios and funding synergies:** Sources of funding for CCA include EU funds, the Mazovian Climate Change Adaptation Support Instrument, and the National Fund for Environmental Protection and Water Management. The municipality of Stare Babice has insufficient own funds and seeks additional resources. Climate policy networks and transnational cooperation projects support an exchange of good practices and increase the capacity to act on climate change issues, but activities are fragmented and uncoordinated.
- **Ensuring cross-domain synergies:** CCA is increasingly taken into account in sectoral policies, programmes and regulatory frameworks, however not every document contains proposals for concrete actions. Synergies between CCA and innovation policy in Mazovia region seem to be lacking. Incidental attempts exist for more interdepartmental cooperation.
- **Stakeholder involvement:** Polish law regulates the participation of socio-economic partners in the development policy (including drafting strategies). However, quality is neglected because there are no government guidelines or local customs regarding active involvement of stakeholders in this process. In Mazovia and Stare Babice, some examples of stakeholder engagement relate to CCA activities. Business involvement in CCA is still low, especially developing CCA strategies.
- **Multi-level governance:** Coordination between national, regional and local authorities in the field of CCA is underdeveloped. The implementation of CCA solutions rests largely on the shoulders of local authorities, who look for sources of funding, as the range of municipal

tasks is very broad. Consequently, cooperation between the different levels of government is most often limited to the issue of funding (as is the case of Mazovia and Stare Babice).

- Experimentation: Experimentation on innovative CCA solutions is rarely being conducted, nationally and regionally. Nevertheless, room for experimentation exists within the framework of programmes financed from the regional budget, though not CCA focused. A good example is the “Mazovian Start-up”, combining a social mission with innovative technology.
- Policy intelligence, learning and strategic capacity: CCA is new for government staff at various levels. However, a number of educational activities have been taking place. Locally, there is still insufficient data available. As for learning and strategic capacity, valuable experience and lessons are gained through participation in international initiatives and projects, but these activities are highly fragmented and expertise is overly dispersed.

Key conclusions

For each of the seven key transformative innovation features, possible ways towards a transformative climate adaptation approach for Mazovia region and Babice municipality include:

- Directionality: mainstreaming CCA measures in intervention areas such as water management, energy security, agriculture, and consider “system change” as the ultimate impact; ensuring a more synergistic approach to the CCA issue, including a more transformative approach, similar to that of circular or low-carbon economy; providing adequate financial support to local authorities, e.g. in drafting and implementing local adaptation plans.
- Instrument portfolios and funding synergies: Seeking better synergies between funding sources; integrating CCA elements into the regional innovation strategy, or promoting innovative solutions in the area of CCA in the selection process for projects financed under the regional operational programme.
- Ensuring cross-domain synergies: Making better use of existing interdisciplinary teams; considering CCA in innovation policy, encouraging businesses to seek innovative solutions; involving high management level in CCA as a transversal topic; seek an institutional leader.
- Stakeholder involvement: Applying a more inclusive participatory process; increasing business involvement; seeking lower entry barriers for participation; considering additional organisational and financial support for local level participation.
- Multi-level governance: Strengthening coordination between national, regional and local authorities in the field of CCA, balancing bottom-up and top-down elements.
- Experimentation: Making local authorities aware of the need to create a risk-tolerant environment for creativity; encourage public sector innovation and innovative procurement to support private sector experimentation in CCA; developing failure-accepting policy instruments and new types of risk-tolerant financing.
- Policy intelligence, learning and strategic capacity: Ensuring continuation in educational activities on CCA (e.g. through a national debate with a clear role for lower governance levels) and its broad and deep social and territorial dimensions; making better use of knowledge gained through participation in international initiatives; ensuring availability and access to data at the local level; widening the existing knowledge base.

1 Introduction

1.1 Profile of the territory

Mazovia (the Mazowieckie Voivodeship) is one of the sixteen voivodeships in Poland, established as a result of the local government reform on 1 January 1999. It is located in the central-eastern part of Poland. The voivodeship has an area of 35,559 square kilometres and, as of 2022, a population of over 5,5 million (GUS, 2023), making it the largest (11.4% of the total area of the country) and most populated (14,6% of the population) voivodeship of Poland. This is associated with increased pressure exerted on the environment.

Figure 1. Location of Mazovia region against the administrative division of Poland



Source: GUS, 2023

The capital city of the voivodeship is Warsaw, being at the same time the capital of the country. The city has about 1.8 million inhabitants, and together with the adjacent areas, 3 million. This means that more than 50% of the voivodeship's population live in the conurbation of Warsaw, and in total, 64% of the region's population in urban areas.

Mazowieckie Voivodeship is the most developed region of Poland. The region accounts for over 20% of the country's GDP. The main sectors are trade, telecommunications, financial services, insurance, IT, the motor and petrochemical industries. Outside Warsaw, Mazovia is a predominantly agricultural region with as much as 67% of the area under cultivation. The Kampinos National Park, which is a UNESCO-listed biosphere reserve, is located in the Mazovia region, most of it in the commune of Stare Babice (98% of the municipality lies in the buffer zone of the park).

Mazowieckie Voivodeship is the centre of science, research, education, industry and infrastructure in the country. Mazovia is the leader of innovation among 16 Polish voivodships and the capital region (*warszawski stołeczny*) is placed in 119th place in Europe in terms of innovativeness (Hollanders and Es-Sadki, 2023). It belongs to the group of "moderate" regions.

Regarding the statistical division of Poland into NUTS units, since 2016 at the NUTS level 2, Mazowieckie Voivodeship (previously constituted as one statistical unit of this level) has been divided into two statistical units: region "Warsaw capital" (*warszawski stołeczny*), including Warsaw with nine counties (powiats): legionowski, miński, nowodworski, otwocki, wołomiński, grodziski, piaseczyński, pruszkowski and warszawski zachodni; "Mazowiecki regionalny" (*mazowiecki regionalny*) covering the rest of Mazowieckie Voivodeship (fig. 2).

Figure 2. The division of Poland into NUTS 2 units



Source: GUS (30.09.2023)²

Mazowieckie Voivodeship is divided into 42 counties (*powiats*), these are subdivided into 314 communities / municipalities (*gminas*), which include 85 urban communities. The municipality of Stare Babice is part of the county "Warsaw West" (*warszawski zachodni*), so it is located in the "Warsaw capital" region. The Stare Babice commune also lies within the territorial area of the Warsaw metropolitan area.

² <https://stat.gov.pl/en/regional-statistics/classification-of-territorial-units/classification-of-territorial-units-for-statistics-nuts/the-nuts-classification-in-poland/>

The natural environment of Mazovia is subject to change and transformation, mainly due to anthropogenic impacts. Due to increasing urbanisation and significant expansion of infrastructure, there is a gradual reduction in the biologically active area. This is the reason for the increasingly frequent and devastating weather phenomena, especially in cities.

Progressive climate change associated with warming, including increased evaporation warming and desertification processes, are reflected in an increased area of occurrence of periodic drought phenomena in the voivodeship. More than 57% of the area of the region is characterised by extreme and severe agricultural drought, while approximately 30% of the areas of rivers, lakes and reservoirs have an identified acute danger of hydrological drought (SRWM 2030+).

The increase in the frequency of extreme weather events (torrential rains) in areas with impeded infiltration generates an increase in flood risk and in the level of vulnerability of the areas at risk, which is due to the increasingly intensive building and development of these areas. As a result of the changes, urban flooding is a frequent phenomenon.

Table 1. Main climate risks and their impacts in Mazovia

Climate risks	Impact
Increase in temperature	<ul style="list-style-type: none"> • Impact on the health of communities • Creation of heat islands in cities • Contribution to increased migratory movements • Changes in energy supply and demand patterns • Risks to energy supply
Droughts	<ul style="list-style-type: none"> • Hampering agricultural production - reducing crop and the profitability of agricultural activities and animal production, • in the case of forestry, the risk of droughts, storms and fires disrupts the health of forests and increases the risk of pests and diseases • An increase in food prices • Decreased public safety - fires • Increasing shortages of drinking water resources and the need to transfer water on a large scale
Increase in the frequency of catastrophic weather events (flash floods, flooding, hurricane force winds)	<ul style="list-style-type: none"> • Road blocking by fallen trees and power poles, road closure, damage to vehicles or damage to noise barriers • Threat to urban infrastructure through flooding and inundations, landslides and the destruction of communication routes, buildings and property • Loss of safe and attractive investment and residential areas • The risk of damage to energy transmission and distribution networks • Contribution to increased migratory movements

Source: Interview with the representatives of the Marshal's Office of the Mazovian Voivodeship, Department of Environmental Policy, Geology and Hunting, Climate Policy Department.

The same risks associated with climate change are also noted at the local level, including in the municipality of Stare Babice.

2 State-of-play of CCA and innovation strategies

In this section we look at the state-of-play at three different levels: national, regional and local. An overview of relevant policy documents at different governance levels in relation to innovation and CCA is presented in table 2.

Table 2. Policy documents related to CCA and Innovation

Document title	Short description	Year of adoption
National context - Poland		
<i>Strategic Adaptation Plan for Sectors and Areas Vulnerable to Climate Change to 2020 with the perspective by 2030 (SAP2020)</i>	This is a multi-sectoral national strategic policy document for the period 2013–2030. It indicates the objectives and directions of adaptation actions to be taken in the most vulnerable sectors and areas.	2013
<i>2030 National Environmental Policy – the Development Strategy in the Area of the Environment and Water Management (NEP2030)</i>	The most important strategic document in the area of the environment and water management in Poland, with an outlook to 2030.	2019
<i>The National Energy and Climate Plan 2021–2030 (NECP)</i>	It presents the objectives, targets, policies and measures in five dimensions of the Energy Union: decarbonisation, energy efficiency, energy security, internal energy market, research, innovation and competitiveness.	2019
<i>Energy Policy of Poland until 2040 (EPP2040)</i>	The document, which presents a way of carrying out the energy transformation of Poland and achieving climate neutrality according to national possibilities.	2021
<i>Productivity Strategy 2030</i>	The strategy defines a vision for the development of the Polish economy until 2030, as well as intervention directions and support instruments to stimulate investment growth and business productivity. An annex to this strategy includes the National Smart Specialisation – update 2022.	2022
Regional context - Mazovia		
<i>Mazovian Voivodeship Development Strategy 2030+. Innovative Mazovia (DSM2030+)</i>	The most important strategic document at the regional level. Counteracting natural hazards and adapting to climate change is one of the directions of action under the "green, low-carbon Mazovia" objective.	2022
<i>Environmental Protection Programme for the Mazovian Voivodeship until 2030 (EPPM 2030)</i>	This is the document for the implementation of the environmental policy of the Mazowieckie Voivodeship, taking also into account issues related to adaptation to climate change.	2023
<i>Regional Innovation Strategy for Mazovia until 2030 (RIS 2030)</i>	This is the strategy document for the development of the regional innovation support system in Mazovia. There are no explicit references to CCA in it, only the issue of broadly understood environmental protection has been included.	2021
Local context – Stare Babice		
<i>Development Strategy of Stare Babice Municipality until 2025</i>	The most important strategic document of the municipality. It makes no mention of climate change or CCA.	2016
<i>Environmental Protection Programme for the Municipality of Stare Babice until 2021 with an outlook for 2022–2025</i>	The programme sets out the environmental policy, establishes environmental objectives and targets. It also identifies possible climate change adaptation measures.	2018

Source: author's elaboration.

2.1.1 National context - Poland

Currently, the basis for the implementation of climate change adaptation measures in Poland is the **Strategic Adaptation Plan for Sectors and Areas Vulnerable to Climate Change to 2020 with the perspective by 2030 (SAP2020)**; Polish National Adaptation Strategy). The document was adopted in October **2013** and has not been revised/updated since then. The Ministry of Climate and Environment has prepared and is in the process of updating long-term strategic documents, the effective implementation of which will allow adaptation to the advancing climate change and countering extreme weather events.

In July **2019**, another document with the status of a development strategy was adopted: **2030 National Environmental Policy – the Development Strategy in the Area of the Environment and Water Management (NEP2030)**. This is one of the sectoral strategies prepared on the basis of the Strategy for Responsible Development until 2020 (with an outlook until 2030) (SRD) which is the main national development strategy. In the system of the strategic documents, the NEP2030 specifies further and operationalises the provisions of the SRD.

Among the strategic documents currently in force, it is also important to note those that directly address climate policy issues. **The National Energy and Climate Plan 2021-2030 (NECP)** was created to implement the obligation arising from Regulation (EU) 2018/1999 of the European Parliament and of the Council. It was submitted to the European Commission in December **2019**. In February **2021** the Council of Ministers have adopted the **Energy Policy of Poland until 2040 (EPP2040)**, which presents a way of carrying out the energy transformation of Poland and achieving climate neutrality according to national possibilities.

In **2021** the **Drought Effects Counteracting Plan (DECP)** was adopted (Dz. U. z 2021 r. poz. 1615). It is developed for a period of 6 years (2021-2027). As part of measures to minimise the negative effects associated with flood risk, flood hazard and flood risk maps and **Flood Risk Management Plans** were drawn up for the entire area of Poland (for river basin districts and water regions). Flood Risk Management Plans were last updated and adopted in **2022**.

It should be noted that, in addition to strategies at the government level, there are now a growing number of adaptation planning documents being prepared by public entities responsible for areas particularly vulnerable to the to the negative impacts of climate change. Examples of such documents include, for example, "**Programme for Adaptation of Forests and Forestry to Climate Change to 2020. Integrated Programme of the State Forests**. Financial Perspective 2014-2020." adopted by the State Forest Holding (Państwowe Gospodarstwo Leśne Lasy Państwowe), and the "**Plan for Adaptation of Railway Infrastructure to Climate Change**" prepared by Polskie Linie Kolejowe S.A. (Polish Railways). Their development proves that the topic of adaptation to climate change is increasingly recognized and taken into account in the activities of entities responsible for individual sectors of the economy.

As regards innovation strategy the most important strategic document is the **Productivity Strategy 2030**, adopted in July **2022**. The strategy is in line with the country's medium-term development strategy, and is an update, complement and development of the Strategy for Innovation and Efficiency of the Economy in force until 2020. In this document, climate change issues appear as a challenge, but there is no reference to adaptation measures. An annex to this strategy includes the National Smart Specialisation – update 2022. Sustainability in its broader sense is present in this strategy, but not climate change adaptation specifically.

2.1.2 Regional context - Mazovia

The Mazovian region does not have a climate change adaptation strategy, in the sense of a document with the status of a strategy dedicated to this issue. In Poland, there is no legal obligation to create such strategies. SAP2020 indicates the need to set adaptation directions at the regional level in regional development strategies. Moreover, issues related to climate change adaptation are present in other planning documents: strategic and programme ones.

The most important strategic document at the regional level is the **Mazovian Voivodeship Development Strategy 2030+. Innovative Mazovia (DSM2030+)**. The document was adopted in May **2022**, and is an update of the 2013 strategy. Counteracting natural hazards and adapting to climate change is one of the directions of action under the "green, low-carbon Mazovia" objective alongside others, i.e.: ensuring sustainable and balanced development and preserving high environmental values; pro-environmental energy transformation; improving environmental quality; increasing energy efficiency.

In addition, in January **2023**, the **Environmental Protection Programme for the Mazovian Voivodeship until 2030 (EPPM 2030)** was adopted. This is already the fifth document for the implementation of the environmental policy of the Mazowieckie Voivodeship, taking into account issues related to adaptation to climate change, and is a continuation of previous environmental protection programmes implemented since 2004. The obligation to prepare such a document results from Polish law, specifically Environmental Protection Law. Such a legal obligation only applies to environmental programmes (and not to adaptation programmes), as they form the basis of overall environmental policy, including in the area of climate change adaptation. The goals and directions of intervention set in the programme are in line with the NEP2030.

As regards innovation strategy, there are no explicit references to climate change adaptation in the **Regional Innovation Strategy for Mazovia until 2030 (RIS 2030)**, adopted in March **2021**, which is already the third generation of the strategy document for the development of the regional innovation support system (since 2007). Only the issue of broadly understood environmental protection has been included in the strategy, both through the selection of measures aimed at reducing pressure on the natural environment and through the promotion of innovative solutions in this regard.

2.1.3 Local context – (including) Stare Babice

A large part of the adaptation measures identified in SAP2020 are being implemented at the local level. There is a special role for cities where the adverse effects of climate change accumulate, indicating the need to include adaptation in the programming of development activities, such as through the development of municipal adaptation plans (especially for the largest cities). Most cities with more than 100,000 inhabitants already have **Urban climate change adaptation plans**, as outlined in SAP2020. According to the Ministry proposal, cities with more than 20,000 inhabitants will also be required to develop municipal climate change adaptation plans. In Mazovia, largest cities, with more than 100,000 residents (Warsaw, Płock, Radom) have already developed climate change adaptation plans. In subsequent years, some other cities and municipalities also created their climate change adaptation plans (ex. Łomianki, Ostrołęka, Wołomin). Most often, they planned activities in the time horizon up to 2030, but there are already some municipalities in the Mazovian voivodeship that have prepared their adaptation plans in a longer time horizon, such as Wołomin (up to 2050 with an outlook to 2100).

Stare Babice municipality does not have its own climate change adaptation plan, nor does the municipality intend to create such a document in the near future. The analysis of municipal documents showed that the strategic documents of the municipality do not include issues directly addressing climate change adaptation. The most important strategic document of the municipality: "Development Strategy of Stare Babice Municipality until 2025" (adopted in 2016) makes no mention of climate change or the need to take measures related to it. Climate change adaptation issues also do not appear in another strategic document: Low Carbon Management Plan for Stare Babice 2016-2030. Climate protection issues appear in the Environmental Protection Programme for the Municipality of Stare Babice until 2021 with an outlook for 2022-2025, the plan also identifies possible climate change adaptation measures. However, the plan needs to be reviewed and updated.

3 Analysis against conceptual framework: Transformative Innovation for better Climate Change Adaptation

3.1 Directionality

3.1.1 Current Status

Box 1. Main findings on directionality

The region's authorities are aware of climate change and the challenges it poses, including climate risks affecting the key community systems. The sense of urgency is becoming more apparent, and there is also a growing public support and societal endorsement in the face of great uncertainty about the risks of climate change. However, it seems that 'system change' or 'territorial resilience' is not yet considered the ultimate impact, it is rather disaster resilience and disaster risk management that is considered. CCA measures are increasingly mainstreamed in a number of intervention areas such as water management, energy security, transport, agriculture where the direct impacts of climate change are more readily visible, while the incorporation of CCA imperatives is lagging behind in many other policy domains.

CCA is not explicitly targeted in innovation strategies, nor does innovation play an important role in CCA-related strategies at national level or in the Mazovia region. Elements of a transformative approach are visible in efforts towards a circular economy and in the energy sector, and it is these areas that are most closely linked to climate change (although not explicitly adaptation) in the context of innovation strategies.

In the Polish primary strategic document, **Strategy for Responsible Development until 2020 (with an outlook until 2030)** (SRD), the risks associated with the effects of climate change are noted as one of the challenges facing Poland in the long term. Adaptation measures are recognised in the SOR in the context of the need to ensure macroeconomic stability as a foundation for sustainable and balanced economic growth.

Polish National Adaptation Strategy (SAP2020) plans adaptation measures, the implementation of which should increase the resilience to climate change of the water, agriculture, forestry, public health, energy, construction and transport sectors. Adaptation measures are also aimed at protecting biodiversity and Poland's particularly vulnerable regions - the Baltic coast and the Carpathian and Sudeten regions. One course of action is devoted to urban policy. The main goal of the SAP2020 is *"to ensure sustainable development and the effective functioning of the economy and society under climate change conditions"*. Specific objectives for vulnerable areas and sectors in terms of adaptation to climate change include (they have been defined to correspond to the key integrated development strategies from the point of view of adaptation - in brackets):

1. Ensuring energy security and a healthy environment (Energy Security and Environment Strategy),
2. Effective adaptation to climate change in rural areas (Strategy for Sustainable Rural, Agricultural and Fisheries Development),
3. Developing transport under climate change conditions (Transport Development Strategy),
4. Ensuring sustainable regional and local development taking into account climate change (National Strategy for Regional Development),
5. Stimulating innovation conducive to climate change adaptation (Strategy for Innovation and Efficiency of the Economy),

6. Shaping social attitudes conducive to adaptation to climate change (Strategy for the Social Capital Development).

Objective 5 indicates that *"new innovative organisational and technical solutions to support adaptation should be sought. A primary objective should be to stimulate technological innovation and to introduce mechanisms for institutions to cooperate in situations of multidimensional climate change risks"*. However, the indicated courses of action, to date, have not taken real shape.

SAP2020 is a document dating from 2013, the **National Environmental Policy** (NEP2030) adopted in 2019, although has a broader thematic scope, in those contents that relate to climate change adaptation itself seems to capture it more systemically, the vision includes a broader societal transformation. The specific objectives of the NEP2030 were laid down in response to the most important trends identified in the diagnosis in the area of the environment in a manner enabling the harmonisation of the issues related to environmental protection with the economic and social needs. The specific objectives of NEP2030 concern health, economy and climate. One of the directions of intervention, and one of the components of climate policy is adaptation to climate change, understood as: *"the launch of initiatives and the use of measures to reduce the susceptibility of natural and human systems to the arising or expected effects of climate change"*. NEP2030 forms the basis for investing European funds from the 2021-2027 financial perspective.

SAP2020 sets strategic goals for implementing regional and local measures. It also indicates the need to set adaptation directions at the regional level in regional development strategies. Four activities were planned in the **Mazovian Voivodeship Development Strategy 2030+. Innovative Mazovia** as part of climate change adaptation:

- Increasing the level of flood protection, flood risk management, prevention of landslides and flooding,
- Increasing the area of green spaces, especially publicly accessible, in urbanized areas,
- Preventing drought and mitigating its effects,
- Increasing water retention, including rainwater, shaping blue and green infrastructure in cities.

The overarching goal of the **Environmental Protection Programme for the Mazovian Voivodeship until 2030** is to improve the environment through rational management of natural resources. In addition to environmental issues, the Programme also addresses the issue of increasing climate change and sets out directions for adaptation. The obligation to determine them at the regional level is imposed by SAP2020. The Programme designates areas of intervention that are particularly vulnerable to climate change, where adaptation measures are most important, these are: water management, natural resources, water and wastewater management, soils, climate and air quality protection. These areas are defined rather narrowly in relation to national documents, which is partly due to the fact that the programme is concerned with environmental protection, so adaptation measures also relate only to this area.

As regards innovation strategy, the main objective of **RIS2030** is very general (achieving the position of innovation leader in the CEE region), it is accomplished through the implementation of four strategic objectives: 1) Increase of innovation activity in Mazovia; 2) Strong and effectively operating value chains connecting enterprises; 3) Effective ecosystem for creating and supporting innovations; 4) Increase in the internationalisation of the Mazovian innovation ecosystem. Objective 3 anticipates (inter alia) the creation of support instruments for enterprises and scientific units introducing innovations within the smart specialisation of Mazovia, including, inter alia, Industry 4.0, low-emission economy and circular economy.

As for the local level, the competence of local territorial self-government units includes the rational planning of spatial development, which contributes to protecting the population against air pollution and noise, droughts and floods, and the damage they cause, as well as to protecting nature against excessive pressures. Such measures are also being taken by the municipality of **Stare Babice**. The municipality of Stare Babice does not have a climate change adaptation strategy, but sees the need for coordinated action in this area. Currently, the municipality is focusing on activities related primarily to water management.

3.1.2 Good Practices

The definition of the objectives of the various regional strategies does not emphasise **social justice** in response to the uneven distribution of climate risks, although the region's authorities recognise these problems. The Mazovian Energy Agency is taking part in a project CEESEU-DIGIT (financed under Life programme) aimed at preparing a new type of regional energy and climate plans (ECAP) in six Central and Eastern European target areas, including Mazovia. The project also pays special attention to vulnerable social groups and those affected by energy poverty and promotes a just energy transition. The project runs from December 2022 to November 2024, during which time an **Energy and Climate Action Plan for the Mazowieckie Voivodeship** is to be developed.

Elements of a transformative approach are visible in Poland (and Mazovia region) in efforts towards a circular economy and in the energy sector, and it is these areas that are most closely linked to climate change (although not explicitly adaptation) in the context of innovation strategies. For example, in 2019, the Council of Ministers approved the **Roadmap for the Transition towards Circular Economy**, prepared by the Ministry of Entrepreneurship and Technology. It is a signpost for the development of this economy system in Poland indicating specific actions to be taken. The transformative approach is evident in this document. Among Poland's priorities for the circular economy, innovation, strengthening cooperation between industry and science and, as a result, the implementation of innovative solutions in the economy have been identified in the first place. At the regional level, the **transformational approach** is also evident in the strategic documents of the Mazowieckie Voivodeship: in the Mazovian Voivodeship Development Strategy 2030+, one of the priority actions is "strengthening the green transformation of enterprises towards a circular economy"; in the Regional Operational Programme for Mazovia 2021-2027 one of the priority objectives is "supporting the transformation towards a circular and resource-efficient economy". In turn, at the local level, some elements of a transformative approach are visible in the area of low-carbon economy, for example, they are present in the Low-Carbon Management Plan for the Municipality of Stare Babice for 2016- 2030.

3.1.3 Recommendations

The region's authorities are aware of climate change and the challenges it poses, including climate risks affecting the key community systems. The sense of urgency is becoming more apparent, and there is also a growing public support and societal endorsement in the face of great uncertainty about the risks of climate change. However, it seems that 'system change' or 'territorial resilience' is not yet considered the ultimate impact, it is rather disaster resilience and disaster risk management that is thought of.

Possible solutions:

- CCA measures should be mainstreamed not only in intervention areas such as water management, energy security, agriculture where the direct impacts of climate change are more readily visible, but should be approached more systemically and the “system change” should be considered as the ultimate impact.
- In developing the Climate Action Plan, the Mazovian authorities should ensure a more synergistic approach to the CCA issue, not only ensuring consistency with other strategic documents at the regional level, but trying to include a more transformative approach, similar to that of circular or low-carbon economy.
- The drafting of adaptation plans requires a high level of professionalism and specific skills not always present in local administrations, which are often burdened by many other emergencies. There is also a lack of financial resources to develop such a plan. Interviewees from the municipality of Stare Babice emphasised that developing a good strategy requires financial resources, which the municipality lacks and needs in order to implement such measures. It is therefore necessary to provide adequate financial support to local authorities.

3.2 Articulating portfolios

3.2.1 Current Status

Box 2. Main findings on articulating portfolios

The main source of funding for CCA in the Mazowieckie Voivodeship are EU funds. The region has also developed its own instrument: Mazovian Climate Change Adaptation Support Instrument - Mazovia for Climate, financed from the voivodeship budget. In addition, the region benefits from funding from the national budget, mainly from the National Fund for Environmental Protection and Water Management. The municipality of Stare Babice plans to obtain external funds (including those from the voivodeship budget and EU funds) for the implementation of CCA, as its own funds are insufficient and do not allow it to implement the ambitious goals. The Mazowieckie voivodeship and also various entities from the region are engaged in climate change adaptation activities internationally. Climate policy networks and transnational cooperation projects support an exchange of good practices and increase the capacity of regional/local governments on climate change issues. However, these activities are fragmented and regionally uncoordinated.

Domestic instruments

Recently, an increase in climate change adaptation activities can be seen in the Mazovian region. In February 2022, the **Mazovian Climate Change Adaptation Support Instrument - Mazovia for Climate 2022** was created. This was a programme of the Mazovian regional government, financed from the regional government's budget; it was prepared on the basis of Environmental Protection Programme for the Mazovian Voivodeship until 2030 (EPPM 2030). The objective of the Instrument was *“to raise the level of protection against the effects of climate change and natural hazards by financing activities related to climate change adaptation, including in particular green and blue infrastructure, biodiversity, micro retention and energy efficiency”*. Within the framework of the programme, local governments (gminas) could apply for funding for tasks related to: implementation of blue-green infrastructure to promote biodiversity, retention of rainwater from roof surfaces of

public buildings and implementation of energy-efficient outdoor lighting. Each municipality could submit a maximum of one application, for a maximum amount of EUR 22,400 (PLN 100,000⁴). A total of 157 tasks were submitted, amounting to more than EUR 2.5 million (PLN 11.2 million). In the end, the Mazovian Voivodeship Board selected 72 initiatives for implementation, which received support of more than EUR 1.3 million (PLN 5.7 million). 33 projects were related to the blue-green infrastructure task (mainly municipalities created green areas, 2 projects were related to the construction of brine graduation towers), and 39 projects were related to the modernization of street lighting to more energy-efficient ones; no project has addressed water retention. The municipality of Stare Babice also received a grant (over EUR 20,400) for the project "Creation of a new green area in the village of Blizne Jasińskiego". In February 2023, the Regional Government adopted the **Mazovia Climate Change Adaptation Support Instrument - Mazovia for Climate 2023** for implementation. In 2023, the scope of tasks to be financed was narrowed down to two: implementation of blue-green infrastructure to promote biodiversity; implementation of energy-efficient outdoor lighting. Funding opportunities have been increased to a maximum of EUR 44,700 (PLN 200,000). A total of 226 applications were submitted, amounting to EUR 7.1 million (PLN 31.6 million). Taking into account the funds planned for the implementation of the facility, 120 projects were selected for a total amount of nearly EUR 3.7 million (PLN 16.5 million); more than half of them were for upgrading outdoor lighting. In Polish strategic documents, climate is often combined with the area of energy, hence energy efficiency as a priority for action at the local level as well. In addition, the municipalities' interest in raising funds for energy saving projects is a consequence of rising energy prices due to Russia's invasion in Ukraine. Despite its significant potential, green and blue infrastructure is little used as a means of addressing the effects of climate change and adapting urban space. The programme is to be continued.

The Mazowieckie Voivodeship also has a special instrument aimed at supporting poviats and municipalities that do not have sufficient technical infrastructure potential and have limited chances of obtaining funds for the implementation of urgent needs from other aid programmes dedicated to infrastructure development. Its name is: "**Instrument for supporting tasks important for the even development of the Mazowieckie voivodeship**". It is not focused on the CCA, but it is a possible instrument to be used in this area should the municipality consider such action urgent and necessary.

The **National Fund for Environmental Protection and Water Management** (NFEPWM), in cooperation with the Voivodeship Funds for Environmental Protection and Water Management (including the fund in Warsaw serving the Mazowieckie voivodeship), is an important source of funding for climate change adaptation projects, particularly water management. The NFEPWM has implemented the priority programme "**Climate change adaptation and reduction of the effects of environmental risks**" since 2015 (till 2025). The objectives of the programme are: 1) to raise the level of protection against the effects of climate change and natural hazards (among others, in accordance with the courses of action enshrined in SAP2020) and major accidents, improve the removal of their effects, and strengthen selected elements of environmental management; 2) to disseminate modern, effective and efficient solutions in cities to improve the quality of life of residents and improve the resilience of cities to the effects of climate change by selecting through a competition the best investment solutions for green-blue infrastructure. The budget of the

⁴ Original figures are in PLN but converted in Euros with 15 October 2023 exchange rate: 1 EUR = 4,47 PLN).

programme is EUR 247.9 million (PLN 1.1 billion). Among the beneficiaries of this programme from the Mazovian province are (inter alia): Municipality and City of Żuromin, Municipality of Łomianki. Also, in cooperation with the NFEPWM, the municipality of Stare Babice is implementing activities. In the period 2022-2027, the programme continues under a slightly changed name ("Adaptation to climate change") and with the allocation of EUR 268.5 million (PLN 1.2 billion).

In addition, entities in the Mazovia region can benefit from other national sources of funding appropriate to their areas of activity. For example, Celestynów Forest District is participating in the Forest Carbon Farms research and development project, which is one of the flagship development programmes of the State Forests. The project aims to increase the amount of carbon dioxide absorbed by the forest ecosystem, mainly forest stands and soil, reduce emissions from wetlands, and store carbon in wood stockpiles.

The municipality of **Stare Babice** started thinking about the challenges of climate change a few years ago, and has begun concrete action in this area since 2020. At that time, a project concept was developed for comprehensive management of rainwater and snowmelt and the creation of water retention in rural areas of the Stare Babice municipality in the perspective to 2050. Gminne Przedsiębiorstwo Komunalne EKO-BABICE Sp. z o.o. (municipal utility company, responsible for water and sewage management) is responsible for its implementation. The project aims to increase the retention of urbanised areas through the restoration, construction of new or adaptation of existing water reservoirs, introduction of blue-green infrastructure facilities, and renaturalisation of areas located in floodplains. The aim of the project also remains to prepare the hydrological system of the Stare Babice Municipality to the projected climate changes (adaptation to climate change), including ensuring adequate protection against flooding and floods, particularly in urbanized areas. The municipality plans to obtain external funds (including those from the voivodship budget and EU funds) for the implementation of the above measures, as its own funds are insufficient and do not allow it to implement the ambitious goals. Stare Babice is currently focusing on adaptation measures in the water sector, as floods and periods of drought have been identified as the most important threats. Through activities in this area, the municipality is trying to get residents interested in the topic of climate change adaptation.

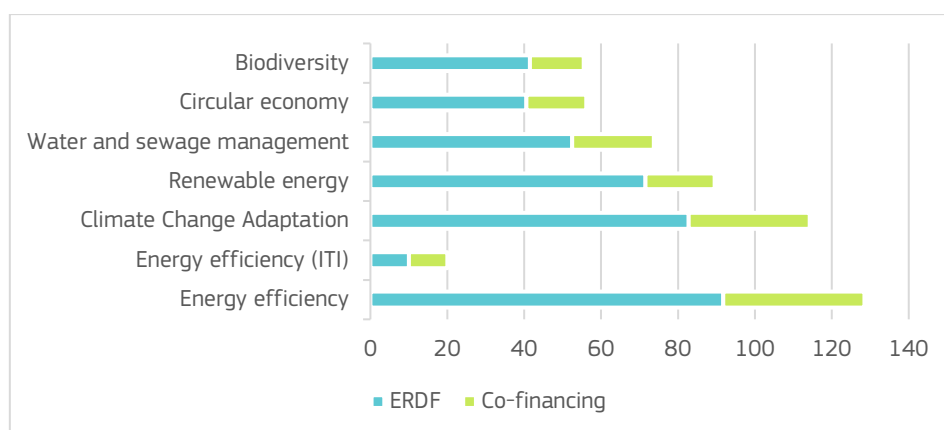
EU instruments

The most important source of financing for activities carried out within the framework of the Development Strategy for the Mazowieckie Voivodeship 2030+ is the budget of the Mazowieckie Voivodeship. Also of key importance for supporting the development of the voivodeship are funds from the European Union budget. Among the funds under the cohesion policy, the regional programme managed by the voivodeship government plays an important role: **European Funds for Mazovia 2021-2027 programme (FEM 2021-2027)**. The objective of supporting climate change adaptation and disaster risk prevention and resilience, taking into account the ecosystem approach, is being implemented through priority 2 "European funds for the green development of Mazovia." Four types of activities have been planned:

- Equipment and infrastructure for disaster management,
- Increasing flood protection and reducing the effects of drought through rainwater retention,
- Countering the effects of drought and heavy rains in urbanized areas through the use of green and blue infrastructure,
- Development of climate change adaptation plans.

The allocation for CCA activities is EUR 114.2 million, of which EUR 82.8 million comes from the ERDF. This is the second largest expenditure under this priority, after energy efficiency (fig. 4).

Figure 4. CCA against other activities under the priority 2 "European funds for the green development of Mazovia." FEM 2021–2027 (in EUR)



Source: FEM 2021-2027

The programme got off to a late start, with the first competitions announced in 2023. To date, one competition has been organised within the framework of CCA-related activities, for public administration and public services to purchase equipment and infrastructure for disaster management. The allocation for the competition was EUR 17.7 million (PLN 79.3 million). Another call is planned in 2023 for increasing flood protection and reducing the effects of drought through rainwater retention, with an allocation of EUR 21.0 million (PLN 93.9 million).

In the EU budget perspective 2021-2027, the Mazovian regional part of the voivodeship was covered for the first time ever by an operational programme dedicated to Eastern Poland, aimed at accelerating the development of the less developed eastern part of the country: **European Funds for Eastern Poland 2021-2027 (FEPW 2021-2027)**. This was possible due to the adoption of a new statistical division of the Mazowieckie Voivodeship into NUTS 2 regions: Mazowieckie regional and Warsaw capital. Climate change adaptation is one of the activities under this programme. The allocation for these activities is EUR 259 million, of which EUR 255 million comes from the ERDF. Support is provided for investments related to green and blue infrastructure in cities (especially medium-sized cities losing socio-economic functions), such as the construction of parks, gardens and urban meadows, connections between green areas, urban ponds and watersheds, streamlining the flow of canals or urban rivers. The investments also include upgrading already existing spaces in the city so as to facilitate the soaking of water into the ground and prevent its rapid evaporation during periods of drought and accumulation on the surface during heavy rains. Also supported is the development of climate change adaptation planning documents for cities in Eastern Poland. The first call for proposals ran from 31.07.2023 to 31.10.2023, for infrastructure investments comprehensively adapting cities to extreme weather conditions and mitigating the effect of urban heat islands through the development of green and blue infrastructure.

Further funds for CCA-related activities are available in the national programme **European Funds for Infrastructure, Climate, Environment 2021-2027 (FEnIKS)**. Funds (EUR 560.1 mln from Cohesion Fund) were planned in it for 44 cities that participated in the project "Development of climate change adaptation plans in cities with more than 100,000 residents" and the city of Warsaw. This is funding to support sustainable rainwater management systems with green/green-blue infrastructure/nature-based solutions. The measure plans to implement investments identified in urban climate change adaptation plans, including sustainable and climate-adapted rainwater management systems and green-blue infrastructure development. Support (EUR 1406.4 million from

the ERDF) has also been planned for other cities with more than 20,000 residents, and cities that are capitals of powiats with populations between 15,000 and 20,000, excluding medium-sized cities losing socio-economic functions located in eastern provinces - financed under the 2021-2027 European Funds for Eastern Poland Programme. The projects will consist of the development of urban adaptation plans and, separately, their implementation, including through the implementation of investment activities. The call for applications for this action runs from 29.09.2023 to 30.11.2023.

CCA-related activities are also planned in the **National Reconstruction Plan** financed by the European Recovery and Resilience Facility. Funding is planned for investments in rural areas related to basic infrastructure, including in particular investments related to water supply and wastewater treatment. Adaptation measures in rural areas will aim, in particular, to increase the resilience of agriculture to climate change, including the effects of drought. This will lead to improved ecosystem services, mitigation and adaptation to climate change and a better quality of life. However, the NRP, although accepted by the EU, is blocked due to the Union's doubts about judicial independence.

Promoting resource efficiency and supporting the shift toward a low-carbon and climate resilient economy in the agriculture, food and forestry sectors is one of the priorities of the **European Agricultural Fund for Rural Development**. This fund therefore represents another source of funding for projects in the CCA area in Poland. For example, from 5 to 31 October 2023, applications for aid can be submitted for operations of the type 'Water resources management' under the sub-measure 'Support for investments related to the development, modernisation and adaptation of agriculture and forestry' of the Rural Development Programme 2014-2020. The Polish Strategic Plan for the Common Agricultural Policy 2023-2027 also provides for climate change adaptation measures, including: increasing water retention, investments to recirculate water and reducing energy consumption in production.

As for **investment in innovation**, in FEM 2021-2027, in the priority dedicated to innovation and competitiveness ("European Funds for a More Competitive and Smarter Mazovia") there is not a word about climate change or adaptation to it. The case is similar with the FEPW 2021-2027 programme. However, in FEPW in the priority dedicated to supporting businesses and innovation, there is a measure "Circular economy in SMEs" (the circular economy is one of the national smart specializations). The measure provides two-phase (development and implementation) support for comprehensive SME projects for the implementation of the circular economy-transformation business model. Only in the national programme dedicated to innovation (the European Funds for Smart Economy 2021-2027, FENG 2021-2027) appears as a scope of intervention: „Research and innovation processes, technology transfer and cooperation between enterprises, research centres and universities, focusing on the low carbon economy, resilience and adaptation to climate change”. However, activities where CCA is mentioned are linked almost exclusively to energy efficiency and smart energy systems.

3.2.2 Good Practices

EU funds (cohesion policy, LIFE programme) are helping Polish authorities and regions to finance a variety of CCA projects, including those that increase their capacity in CCA. It is worth mentioning a few that have had the greatest impact on the development of activities in this area:

- The Ministry of the Environment created a project on **developing climate change adaptation plans for cities with a population of more than 100,000**, the main objective of which was to assess the vulnerability to climate change of 44 of Poland's largest cities and plan adaptation measures adequate to the identified risks. The project was implemented in

2017-2019, and co-financed by the European Cohesion Fund. The project involved 2 cities from the Mazovian province: Plock and Radom. In order to help local government representatives make optimal decisions that take into account the impact of advancing climate change, the Ministry of the Environment has developed the "Adaptation Manual for Cities" (under the same project). This document provides guidelines for the preparation of municipal adaptation plans to climate change adapted to local conditions and needs.

- An important step towards strategic thinking on climate change adaptation in the Mazowieckie Voivodeship (and Poland) was the **ADAPTCITY project** ("Preparation of a metropolitan city's climate change adaptation strategy using a climate map and public participation"), implemented in 2014-2019, funded by the LIFE programme. The aim of the project was to reduce the negative effects of climate change on Warsaw's ecosystem and initiate adaptation measures in other metropolises in Poland. The project contributed to: 1) supporting the City of Warsaw in developing a climate change adaptation strategy for Warsaw using an ecosystem approach; 2) stimulating the activity of authorities, administrations and municipal services in urbanized areas for climate change adaptation activities based on Warsaw's experience, which was achieved through a series of Metropolitan Climate Forums; 3) demonstrating the desirability and possibility of using predictive climate maps to build the city's climate change adaptation strategy; 4) deepening the awareness of the global problem of climate change among city authorities and encourage them to engage in actions at the European level.
- Another interesting project financed from the LIFE programme, implemented in the Mazovian region, was the project **LIFERADOMKLIMA**⁵ ("Adaptation to climate change through sustainable water management in the urban space of Radom"), implemented by the Municipality of Radom (second largest city in terms of population in Mazovia) in 2015-2022, in collaboration with: Radom Municipal Waterworks Ltd., University of Lodz, FPP Enviro Ltd. The main objective of the project was to create an urban space in Radom with increased resilience to climate change through the building demonstrative "green-blue infrastructure" for managing extreme storm water flows and control local flood risks. This project was based on cooperation between local government, science and practitioners.
- An interesting project has been created by a consortium of institutions from the Mazowieckie Voivodeship: Kampinos National Park, and the Warsaw University of Life Sciences, the Marshal's Office of the Mazowieckie Voivodeship, REC Poland. The **Kampinos WetLIFE** project is being implemented over the years 2020-2026, and is co-financed by the LIFE programme. It aims (inter alia) to improve the condition of wetlands in selected parts of the Kampinos Forest, those already owned by the State Treasury. Thanks to the construction of a number of small retention facilities, the swamps of this area will retain more water during periods of drought, and in wet periods, the water will flow not only through naturalised canals but also through numerous natural depressions in this area. This project is a continuation of an earlier project, also funded by the LIFE programme, from 2013 to 2019.

Finally, it is also worth mentioning another source of funding for CCA projects besides EU funds. At the beginning of 2022, four Mazovian entities (the city of Piastow, the municipality of Wyszaków and the municipality of Grodzisk Mazowiecki, the Sendzimir Foundation) received funding from the **Financial Mechanism of the European Economic Area** for climate change adaptation projects.

⁵ <https://life.radom.pl/en/>

As part of the initiatives, they are undertaking adaptation and mitigation measures in the field of green and blue infrastructure.

International dimension of CCA

Climate policy networks and transnational cooperation projects can support an exchange of good practices in multilevel governance and increase the capacity of local governments on climate change issues. The Mazowieckie voivodeship and also various entities from the region are also engaged in climate change adaptation activities internationally.

Several cities in the Mazowieckie Voivodeship are signatories to the **Covenant of Mayors for Climate & Energy**, and in 2022 the Mazowieckie Voivodeship joined the initiative in its role as coordinator of local mayors' climate and energy actions for a fairer, climate-neutral Europe for all. As part of this initiative, some local authorities have developed Energy and Climate Action Plans (examples include the municipalities of Jabłonna Lacka, Stara Kornica, Kotuń or the city of Minsk Mazowiecki).

Mazovian Voivodeship, Warsaw City and Stare Babice are signatories of the **Mission on Adaptation to Climate Change Charter** (3 out of 19 all signatories from Poland).

The Mazowieckie Voivodeship has been accepted (in October 2022) into the thematic partnership of the EU Urban Agenda: **Greening Cities**. This partnership focuses on green and blue infrastructure in an urban context and creates extensive links to other priority sectors, namely the built environment, sustainable transport, water management and urban agriculture. Additionally, it reflects on biodiversity preservation and adaptation to climate change.

Bearing in mind that the Mazowieckie voivodeship is covered by **Interreg** territorial cooperation programmes, interregional, cross-border and transnational activities in CCA are implemented in the Interreg Central Europe Programme in terms of supporting the exchange of knowledge and good practices in climate change mitigation and adaptation at the local and regional level, especially between regions with similar territorial characteristics with regard to the practical implementation of climate action plans. The measures taken are consistent with the objectives of the European Union Strategy for the Baltic Sea Region in this thematic area. Mazovia, as many regions in EU have made use of Interreg to fund climate change adaptation (CCA) planning and implementation. According to data collected in the KEEP database⁶, entities from the "Warsaw capital" region participated in 274 projects, and from the "Mazowiecki regional" region in 29 projects.

Entities from the Mazowieckie voivodeship participate also in other international projects, financed from the EU budget. It is worth mentioning the CapaCITIES project, which involves the Institute of Environmental Protection - National Research Institute in partnership with the Warsaw University of Technology. The project is funded under the EU Missions programme of **Horizon Europe**, running from 2022 to 2024. This is a support action for national and regional authorities to advance their governance structures and strengthen dedicated support for cities to achieve the climate-neutral Cities Mission.

⁶ <https://keep.eu/projects/> (accessed: 30.09.2023).

3.2.3 Recommendations

There are some domestic and EU instruments to support the implementation of regional (Mazovia) and local (Stare Babice) development strategies, including in the area of climate change adaptation. However, these activities are fragmented and regionally uncoordinated. Moreover, although there is a great deal of interest on the part of municipalities in CCA activities, the local authorities are looking for sources of funding, as the range of municipal tasks is very broad. As interviewees stressed, municipalities must implement their statutory actions first, hence often climate change adaptation issues, although considered important, are placed lower among priorities. The problem is also the lack of sources and/or incentives for funding innovative initiatives leading to CCA transformation. Action in the area of climate change adaptation is more often associated with environmental policy than with innovation policy.

Possible solutions:

- There is a need for defining better synergies between funding sources.
- For a transformative innovative approach it would be helpful to integrate CCA into the regional innovation strategy (when it is updated), or to promote innovative solutions in the area of CCA in the selection process for projects financed under the regional operational programme.
- Financial support is needed, and a special role here is for EU funds. According to the interviewees, EU funds are a catalyst for change in the Polish regions, forcing beneficiaries to make a different kind of investment and at the same time changing their thinking. If it were not for the EU's clearly defined priorities and directions, including in the CCA area, it is likely that a lot of funds would still be spent on the need to expand road infrastructure in municipalities.

3.3 Cross-domain synergies

3.3.1 Current Status

Box 3. Main findings on cross-domain synergies

The need for CCA is increasingly taken into account in sectoral policies, programmes and regulatory frameworks, however not every document contains clear proposals on how to implement concrete actions. In Polish strategic documents, climate is often combined with the area of energy, hence energy efficiency as a priority for action, which became even more apparent after Russia's invasion in Ukraine in 2022. Synergies between CCA and innovation policy in Mazovia region seem to be lacking. In the context of organizational structures in public offices, as a rule, CCA issues are the responsibility of environmental departments. Attempts are being made to approach these issues more interdepartmentally, for example by setting up interdisciplinary teams and working groups, interdepartmental meetings, however, such activities are incidental and not systemic. As for the research system, scientists from different fields are increasingly beginning to collaborate under a common umbrella, e.g. climate change, but for the time being these are mostly educational rather than research activities.

The need for CCA is increasingly taken into account in **sectoral policies**, programmes and regulatory frameworks in water management, disaster risk management, forestry, agriculture, biodiversity, where the direct impacts of climate change are more readily visible. CCA is also increasingly mainstreamed in transport, construction and energy sector. This is less frequently the case in other domains such as tourism, education and skills, R&I. The policy documents differ in the level of detail to the extent that climate change adaptation has been recognised as an important element in the further development of a particular sector. These topics are closely linked to the concept of sustainable development, the implementation of which is served by, among other things, adaptation measures, which was undoubtedly noted in the documents analysed. Based on the analysis, it should be noted that although in the vast majority of documents the necessity and inevitability of taking adaptation measures has been noted, not every document contains clear proposals on how to implement them. The analysed documents were equipped with procedures for verification of their implementation, which is important for the possibility of their practical application. An example of a document that notes a number of adaptation measures and tasks is the National Environmental Policy 2030, while few concrete proposals in this regard are included, for example, in the Strategy for Sustainable Development of Transport until 2030.

A crucial domain for achieving climate adaptation in Polish policy documents is **urban development**, where cities experience most of the direct impacts of climate change. Hence the focus on urban areas, encouraging cities to create climate change adaptation plans (e.g. as a condition for accessing funding for activities in this area), etc.

In Polish strategic documents, climate is often combined with the area of energy, hence **energy efficiency** as a priority for action. This became even more apparent after Russia's invasion in Ukraine in February 2022, when energy security issues became a priority. In addition, rising energy prices entail the search for additional sources of funding for energy efficiency and renewable energy projects.

It is worth looking at the **synergies between CCA and innovation policy** in the region. Such synergies seem to be lacking in the Mazovia region. There are no explicit references to climate change adaptation in the Regional Innovation Strategy for Mazovia until 2030, adopted in March 2021, which is already the third generation of the strategy document for the development of the regional innovation support system (since 2007). Only the issue of broadly understood environmental protection has been included in the Mazovia 2030 RIS, both through the selection of measures aimed at reducing pressure on the natural environment and through the promotion of innovative solutions in this regard. Pro-environmental solutions are included in the description of the four areas of smart specialization by promoting initiatives in raw material and energy efficiency, waste management, and the implementation of technologies and substances that are neutral or minimize negative impacts on the environment. Attention has been paid to circular economy solutions that contribute to sustainable production and sustainable consumption, and increase the share of renewable raw materials in the economy. The circular economy has already moved to the operational level, hence it is easier for entrepreneurs to think and act about such issues, with climate change adaptation not yet happening.

The Mazowieckie Voivodeship plans to develop a Climate Action Plan, coherent with such documents of the region as: Mazovian Voivodeship Development Strategy 2030+. Innovative Mazovia, Regional Innovation Strategy for Mazovia 2030, Spatial Development Plan, Environmental Protection Programme, Waste Management Plan, Air Protection Programme. Such a document would have the potential to ensure better synergy of activities in CCA.

3.3.2 Good Practices

Structures set up to facilitate synergies

In the context of organizational structures in public offices, as a rule, climate change adaptation issues are the responsibility of environmental departments. Attempts are being made to approach these issues more interdepartmentally, for example, in the Municipality of Stare Babice, the local office holds **weekly interdepartmental meetings** to discuss the most important problems of the municipality from different perspectives. However, climate change issues tend to appear in discussions alongside other topics, rather than as a separate important topic for discussion.

The need for cross-domain synergies is acknowledged, although there is no discussion of supporting CCAs in this context yet. However, there are examples of the creation of **interdisciplinary teams and working groups** in related areas. There is an interdepartmental European Green Deal Team in the Marshal's Office of the Mazowieckie Voivodeship, which aims to develop solutions to achieve the objectives contained in the European Green Deal and related policy documents and legislation, including: clean energy and energy efficiency, sustainable industry, construction and renovation of buildings, sustainable mobility, biodiversity, elimination of pollution and a fair, healthy and environmentally friendly food system. There is also an energy poverty team in place. Such teams are established on a demand-driven basis, and a climate change adaptation team could potentially also be established. In addition, all documents are reviewed internally by the various departments, which is also an element of joint action in an area.

In addition, there are some structures at the national level, in which the regional government participates, that could be adapted to such a cross-sectoral climate change group. An example is the **working groups on national smart specialisations**, whose members include representatives of enterprises, business environment institutions and scientific units from different areas.

Research system and interdisciplinarity

Scientists from different fields are increasingly beginning to collaborate under a common umbrella, e.g. climate change, but for the time being these are mostly educational rather than research activities. It is worth mentioning here some initiatives that are nationwide, but have their initiators in Mazovia:

- Experts from the University of Warsaw have prepared an **interdisciplinary textbook on climate change** that can be a teaching aid for teachers in high schools and universities. Sixteen experts representing various fields of knowledge (such as physics, chemistry, biology, ecology, economics, psychology and engineering) and affiliated with different academic centres worked on it. The "Climate ABC" handbook also accompanies an online course by the same name offered by the University of Warsaw.
- **The Inter-University Climate Academy Postgraduate Programme** created through the cooperation of three universities (technical, economic and humanities): Stanislaw Staszic University of Science and Technology in Krakow, the Warsaw School of Economics and the University of Wroclaw. The programme was created with significant support from the banking and business sectors: Bank for Environmental Protection Foundation (BOŚ Foundation), Business for Climate Foundation (on the foundation's website, it is possible to sign the Business Declaration for Climate Change Adaptation) and Climate Education Foundation. The very idea of the study itself came from the business sector (the need for knowledge).

3.3.3 Recommendations

Synergies between CCA and innovation policy in Mazovia region seem to be lacking. In the context of organizational structures in public offices, as a rule, CCA issues are the responsibility of environmental departments. In Polish strategic documents, climate is often combined with the area of energy, hence energy efficiency as a priority for action, which became even more apparent after Russia's invasion in Ukraine in 2022. The lack of synergy with innovation policy is also the result of silo thinking, as departments dealing with the economy (and its innovation) are oriented towards efficiency in general.

Possible solutions:

- There is a need to approach CCA issues more interdepartmentally, for example by using the already existed interdisciplinary teams and working groups, interdepartmental meetings, however, such activities should be more systemic.
- Climate change adaptation should also be given greater consideration in innovation policy, with measures to encourage businesses to seek innovative solutions in this field.
- Following the local analysis, all relevant departments should be approached, a balanced co-operation of environmental and economic departments is of particular relevance. The management of CCA should not take place in a specific sectoral department (e.g. environment), but at the highest level of management, as it is a transversal topic and not a sectoral one.
- This implies the need for an institutional leader in the CCA and more cooperation between departments - which was also highlighted by the interviewees.

3.4 Increased breadth and depth of stakeholder involvement

3.4.1 Current Status

Box 4. Main findings on stakeholder involvement

Polish law regulates the participation of socio-economic partners in the development policy (including drafting strategies). However, quality is neglected because there are no government guidelines or local customs regarding active involvement of stakeholders in this process. In Mazovia and Stare Babice, there are some examples in terms of stakeholder engagement, including (to some extent) in CCA activities. Citizen budgets are an interesting way to involve citizens, although few projects are related to the CCA. As far as business is concerned, its involvement in CCA is still low, especially when it comes to participating in the development of CCA strategies. Companies tend to identify adaptation measures within the framework of the circular economy, because here certain processes have already emerged, are being implemented, there are requirements and it is more tangible.

The Polish Law on the Principles of Development Policy, in Article 6, contains obligations and provisions for conducting **consultations on the documents on the basis of which development policy is carried out** (including strategies). The participation of social and economic partners in the implementation of development policy applies to all its stages - from the planning and programming process, through management and implementation, to monitoring and evaluation. This approach helps ensure that development activities are aligned with national, regional and local needs and priorities. According to the National Strategy for Regional Development, the tasks of “development partners” include (NSRD 2030):

- co-participation in setting the goals and directions of regional development through participation in consultations of strategic documents and programmes created at the national, regional and local levels,
- participating in the process of assessing the degree of implementation of development policy objectives, through, for example, participation in monitoring committees at the national and regional levels,
- taking over some of the implementation tasks at the regional level on the basis of an agreement or contract with the provincial government, and implementing projects in the formula of cooperation with public entities.

The cooperation network at the national, regional and local levels involves entities with different statuses. Social and economic partners can include: employers' organizations, regional, sub-regional or industry organizations, trade union organizations, professional bodies, chambers of commerce, NGOs, research institutes. However, quality is neglected because there are no government guidelines or local customs regarding active involvement of stakeholders in the drafting of strategic documents. Municipalities aim to reduce the workload and costs of their preparation as much as possible, and the public consultation provided is at a minimal level. Most often, documents are also posted on websites for public consultation. For example, consultations of the Environmental Protection Programme for the Mazovian Voivodeship until 2030 lasted less than a month in July 2022. More than 180 comments were submitted, mostly by public institutions. Particularly noticeable is the lack of presence of the business sector and citizens in these consultations. In addition, a **Monitoring Committee** was set up during the programme procedure, consisting of representatives of the Mazovian Marshal's Office from various fields covering environmental aspects, representatives of government administration and the science. The Committee's tasks included the analysis of the goals, assumptions and directions of activities included in the draft programme, as well as ongoing supervision of the programme's implementation.

As for **business**, its commitment to climate change adaptation is still low. In the EU-funded programmes in the CCA measures, the beneficiaries include municipalities and cities (which have their statutory tasks and have to manage flood risks, for example), but not enterprises. Hence, their participation in these activities is lower. In competitions for entrepreneurs there are additional (bonus) criteria concerning environmental issues, but not necessarily related to CCA, it can be e.g. eco-projection. There is also a low level of awareness among SMEs as to what CCA changes can be made, rather entrepreneurs identify adaptation measures with the circular economy, because here some processes have already emerged, are being implemented, there are requirements and it is more tangible. At the local level this cooperation with business is also small, most often limited to sponsoring some events, including those dedicated to the environment. The Stare Babice municipality has also cooperated several times with various companies in testing the companies' products, such as new water treatment technologies.

3.4.2 Good Practices

An interesting example of citizen involvement was the **public consultation with an educational component** organised by the Stare Babice Municipality to consult on the location of green spaces in the municipality. The municipality asked the Sendzimir Foundation (a regionally, and nationally, recognised organisation promoting sustainable development, including climate adaptation activities) to lead the consultation. Two meetings were held with residents. The first meeting consisted of an exchange of information about what the residents expect and what the authority expects and requires.

Then, on this basis, a project was made, presented at the second meeting. The solution proved to be very beneficial, however, a small number of residents took part in the consultation.

To increase public participation, various **open events** are also organised. The following are examples of events organised by the local government of the Mazowieckie Voivodeship: Clean Air Congress (8-9.03.2023), conference “Small-scale retention - great opportunities for local authorities” (18.10.2023). In turn, the municipality of Stare Babice organised a conference in April 2022 on the 'Impact of climate change on water management'. One of the main objectives of this conference was to draw attention to the issue of climate change and its consequences, and to engage the community in addressing it.

An example of involving stakeholders in innovation activities are the **working groups for smart specialisation**, operating in Mazovia since 2014. They are composed of: enterprises, business environment institutions, NGOs, scientific units. They not only participate in giving their opinion on the strategy at the beginning, but also take an active part in its implementation. One of the implementation documents for innovation activities and EU funding are the 'Priority Research Directions' (Research Agenda). This document is redrafted from time to time (already the fourth version) and widely consulted each time. These groups are also invited to consult on project selection criteria. The groups are not rigid in nature; interested parties can join at any time. In addition, there is the **Mazovian Innovation Council**, which is an opinion-giving and advisory body for the Mazowieckie Voivodeship Board in the area of innovation, entrepreneurship and new technologies policy. Council members include representatives from business, academia and local government. The Council's tasks include, among others: evaluation and assessment of the region's innovation policy, including RIS, evaluation of the status of RIS implementation based on innovation data from the strategy monitoring and evaluation system, participation in the development of RIS implementation programmes.

A special form of citizen consultation and participation is the **civic budget**, the rules for the establishment of which are regulated in the law on municipal self-government. As part of the civic budget, residents decide annually by direct vote on a portion of the municipal budget expenditures. Tasks selected as part of the civic budget are included in the municipal budget resolution. For cities with county rights, the establishment of a civic budget is mandatory. The Polish government has proposed that it should be mandatory for the civic budget to set aside a pool of funds for tasks related to increasing greening and retention. According to the authors of the amendment, the implementation of tasks financed from a separate part of the civic budget is expected to lead to an increase in biologically active area in cities and retention of rainwater and snowmelt. This idea is still in consultation, but there have already been voices from the Union of Polish Metropolises that such a provision not only expands the responsibilities of cities with county rights, but - most importantly - limits the freedom of citizens to decide which projects from the civic budget are to be implemented. Masovian Voivodeship also has its own civic budget. Its aim is to actively involve the region's inhabitants in the management of the voivodeship, to enable the inhabitants to co-determine the distribution of funds from the voivodeship budget; to increase the inhabitants' awareness of the voivodeship's own tasks. Among the projects that have received funding to date are those related to the CCA, e.g. “The second life of Mazovian rainwater”. It is a project involving the construction of a series of rainwater harvesting systems from public buildings owned by the Mazowieckie Voivodeship. The collected rainwater can be used for watering greenery during non-rainy periods or can be distributed free of charge to local residents.

Good practice in managing sustainable development, developing innovative and interdisciplinary solutions, and creating a knowledge-based economy in a rapidly changing environment requires the cooperation of policy makers, practitioners and researchers. There are some good practices in

involving business sector in environmental activities (less adaptation) in the region. An example is the successive editions of the start-up competition 'Start-up from Mazovia' (funded from regional budget), where for the past three years there has been a separate category 'Social impact', where prizes are awarded to start-ups creating innovations in favour of positive environmental or social impact - in this category, prizes and awards are increasingly given to entities introducing technologies directly or closely related to climate change adaptation. Similar competitions are organised at national level, also with EU funding. It is difficult for regions to involve large companies, not least because they do not benefit from regional programmes, nor do they get involved in strategy development, consultation, etc. Large companies are more likely to think at a marketing level, to associate environmental action with CSR.

At the local level, the municipality of Stare Babice came up with the initiative to create an energy cluster and invited companies to cooperate. The goal of the municipality is to strive for energy self-reliance in the future, to take care of improving air quality, energy education, protection of endangered species using green energy infrastructure, and to encourage investors and business partners to promote and invest in clean air. In March 2022, an agreement of intent on the Stare Babice Municipality Energy Cluster "Energy for Babice" was concluded. The agreement was concluded between Stare Babice Municipality, Eko-Babice Municipal Enterprise, Plant Breeding and Acclimatization Institute - National Research Institute in Radzików, Megavision Technology, Petra Invest Green Energy and Ekomatic. The energy cluster is also a promotion of innovation and environmentally friendly technology.

In general, the interviewees stressed that business needs to see tangible results, primarily financial, in some action; in the area of climate change adaptation, the potential has yet to be discovered. Another way to engage business is through social responsibility. There is already an example in Poland (although not from the Mazowieckie Voivodeship, but from Pomorskie Voivodeship) of integrating the business community around climate change adaptation goals. In 2019, a foundation called Biznes dla Klimatu (Business for Climate) was established, whose overarching goal is to integrate the business world, science and all enthusiasts to act to halt climate change and environmental degradation. A "Business Declaration for Climate Change Adaptation" has been published for companies across Poland to sign. By September 2023, more than 20 companies have signed the declaration, including companies from Mazowieckie Voivodeship.

3.4.3 Recommendations

An important outcome of the strategies and projects implemented in the region should be the activation of local stakeholders to work together towards integrated climate action. The interviewees recognised that the inclusion of stakeholders in the process of creating and implementing CCA strategies generates input on priorities and technical possibilities, and can also lead to a more widespread acceptance of the plan's goals. The process can take place on several levels but always needs to include input of and support from crucial local stakeholders.

Possible solutions:

- It is particularly important to involve business more strongly in CCA activities.
- Overall, an inclusive participatory process is suggested.
- The citizen's budget could provide incentives (not an obligation) for submitting projects for tasks related to increasing greening and retention.

- However, limited resources might impede a local municipality's capacity to include all relevant stakeholders (which was particularly emphasised by representatives of the Stare Babice municipality). Additional organizational and financial support from the regional level could mitigate this issue.
- Interviewees also pointed out that participatory methods to include civil society stakeholders should generally aim for a low entrance barrier.

3.5 Multi-level governance

3.5.1 Current Status

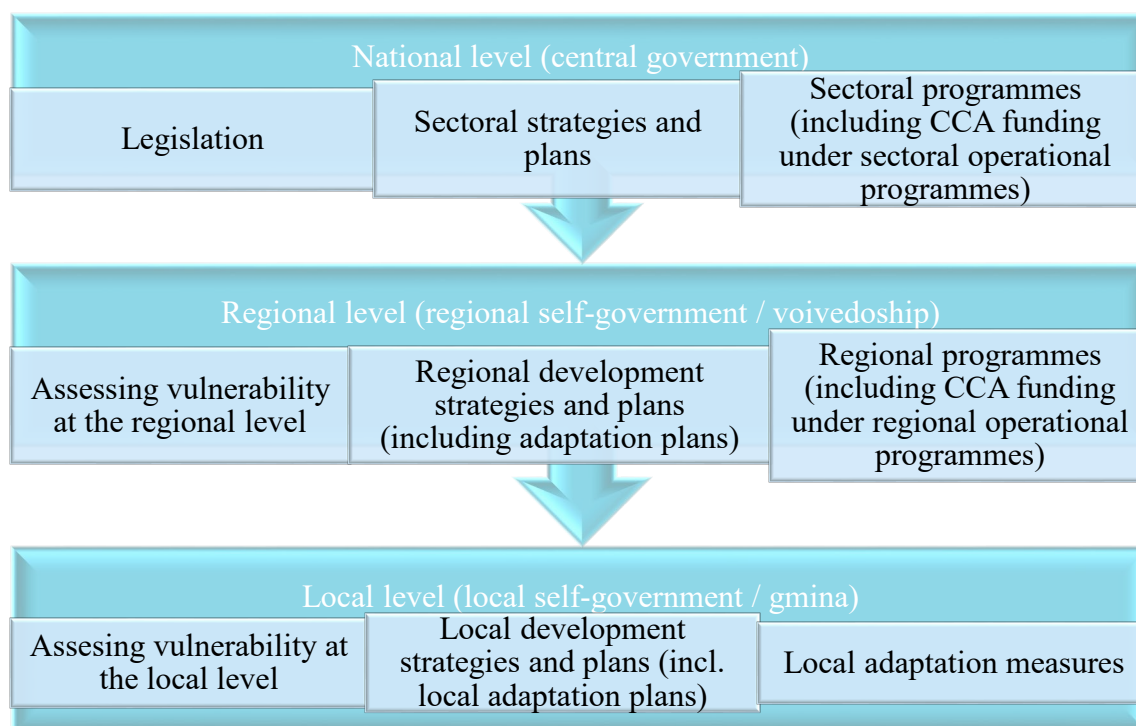
Box 5. Main findings on multi-level governance

The implementation process of SAP 2020 is to be carried out with particular emphasis on communication and cooperation within the development management system. However, coordination between national, regional and local authorities in the field of CCA is underdeveloped. While there are mechanisms and instruments for collaborative action, these are not being used in the area of climate change adaptation. For other efforts, both bottom-up and top-down approaches work - either an active administration with political backing or a region providing additional financial and administrative support. A strong push for climate action is needed from the municipality itself. The implementation of CCA solutions rests largely on the shoulders of local authorities. There is a great deal of interest on the part of municipalities in CCA activities, but local authorities are looking for sources of funding, as the range of municipal tasks is very broad. They take care of the first needs first, especially when it comes to residents' access to public services. Consequently, cooperation between the different levels of government is most often limited to the issue of funding (it is also the case of Mazovia and Stare Babice).

The SAP 2020 implementation process should be carried out with a particular focus on communication and cooperation within the development management system, using the cooperation platforms in place. CCA activities are carried out on the basis of relevant regulations and with the help of relevant legal, financial and organizational instruments within the framework of development policy.

In Polish development policy, there are some **mechanisms available for reconciling development activities between different levels of government**. As a result of the amendment to the Law on the Principles of Development Policy, in 2020 three new instruments were introduced: programme contract, sectoral contract and territorial agreement. The programme contract is linked to the co-financing and conditions for the use of EU funds, while the sectoral contract is a mechanism for agreeing the scope of territorially-oriented sectoral activities to be undertaken by the respective ministers in their development programmes. Both types of contract are concluded between the national government and the regional/voivodeship governments. The territorial agreement is primarily intended to agree on interventions that are relevant to local communities (a municipality, several municipalities or a district). These could be potentially used for planning joint CCA activities, but no examples of such activities were found during the analysis. The programme contract for the Mazovian province identifies 30 priority projects, but none of which address climate change adaptation. There are no sectoral contracts in CCA. The territorial agreement is a completely new instrument in development policy, examples are not yet known, and it was already criticised at the drafting stage because of its unclear character.

Figure 5. Implementation scheme of CCA strategy



Source: author's elaboration, based on SAP 2020.

There are also joint action mechanisms embedded in cohesion policy such as **Integrated Territorial Investments** (ITI). In Mazovia, in accordance with the provisions of the regional development strategy, the ITI instrument will be used to support the urban functional area of Warsaw, which includes 79 local self-government units (including Stare Babice) making up the "Warsaw capital" region. The projects of the ITI can implement all the objectives of the cohesion policy, they should have an integrated and supra-local nature and serve to strengthen functional relations. Therefore, it seems that they could be used for the implementation of joint activities in the area of CCA as well. However, in the "Strategy of Integrated Territorial Investments for the Warsaw Metropolis 2021-2027+", which is an implementation document, there is no reference to adaptation to climate change, there is mention of climate change as a challenge, but among the fields of cooperation is only "to protect air quality and build a low-carbon economy by increasing the energy efficiency of buildings." (see fig. 4). Another territorial instrument included in the regional operational programme is **Mazovian Structural Territorial Investments** (MSTI) for 6 cities which are capitals of sub-regions together with their functional areas. The MSTI is to be realised through cooperation of the municipalities, initiated by these cities and taking the form of: an association, inter-municipal agreement or inter-municipal association. Within the framework of ITI and MSTI, only integrated projects may be realised, solving common problems and realising common objectives. They could therefore also be CCA projects.

The **division of responsibilities between the self-government and the government in the region** is a challenge. After the public administration reform of 1998 in voivodeships we have both government and regional self-government administration. The government administration is represented by the voivode - as a representative of the government in the area, while the regional self-government administration is represented by the voivodeship marshal - as the host of the area. These entities are sometimes competing with each other for power in the voivodeship. Sometimes

they also don't know what the other party is doing, e.g. interviewees from the regional self-government claimed to have no information on whether the region has a mechanism for collecting, assessing or reporting on economic losses caused by extreme weather and climate events, as it's voivode who is in charge of public safety issues.

The implementation of CCA solutions rests largely on the shoulders of **local authorities** (who are responsible, for example, for spatial planning). Cooperation with the provincial/regional office, from a local (Stare Babice) perspective, is mainly based on raising funds for activities. Representatives of the municipality also participate in trainings and events organized by the regional office. The regional government, on the other hand, tries to assist local authorities by providing expert support in the field of adaptation or spatial planning, possibly enabling the municipality to get in touch with organisations/institutions providing support, including financial support. These activities are even more visible since the Mazowieckie Voivodeship has joined the Covenant of Mayors on Climate and Energy as a coordinator of local mayors' climate and energy actions. In terms of joint activities undertaken by the regional government and the municipality of Stare Babice, one such example is the Kampinos WetLIFE project, in which both entities participate and cooperate since 2013.

3.5.2 Good Practices

In order to assist in the implementation of SAP2020, **Climate Change Adaptation Working Group** has been established at the General Director of Environmental Protection (an expert institution responsible for environmental protection and control of the investment process). The group consist of people representing, among others, the General Directorate for Environmental Protection and regional environmental protection directorates, the Ministry of the Environment, the Ministry of Development and regional marshal offices (including Mazovian regional self-government). The group has been functioning since 2015, but meetings are held sporadically (one meeting per year, the minimum for the team to actually exist). The same applies to other working groups set up by other institutions, generally of a more occasional nature.

Attempts are also being made to coordinate activities and develop solutions in this area through externally (including EU) funded projects. Such an example is the CapaCITIES project, which is to develop support action for national and regional authorities to advance their governance structures and strengthen dedicated support for cities to achieve the climate-neutral Cities Mission (i.e. not strictly related to climate change adaptation). However, the project is at a very early stage of implementation and the results of these activities are not yet available.

Different territorial authorities are also trying to share their experiences with CCA, an example was the **Climate Metropolitan Forum** - a series of 11 conferences, in 2017-2018, that were part of the ADAPTCITY project. The meetings were addressed to representatives of the cities of the Union of Polish Metropolises, the authorities and city administrations and the local governments surrounding the metropolitan cities. At the forum, the problems and experiences of cities and municipalities in metropolitan areas related to adapting to climate change were presented.

3.5.3 Recommendations

The implementation process of SAP 2020 is to be carried out with particular emphasis on communication and cooperation within the development management system. However, coordination between national, regional and local authorities in the field of CCA is underdeveloped. While there are mechanisms and instruments for collaborative action, these are not being used in the area of climate change adaptation.

Possible solutions:

- The interviewees stressed that coordination is important in CCA activities, there has to be an initiative that actually comes from the very top, is implemented through the local governments, on the same, transparent basis, equal for all.
- It is important that there is one coordinator who will give directions and it will be uniform, consistent and that everyone is working in the same direction. Also, centralisation can be a good thing if it is well managed and goes down to lower levels. However, there are examples of such attempts at coordination which interviewees view unfavourably. In 2018, the State Water Management Company Wody Polskie took over the competence to manage water basins in Poland, previously it was dispersed and more was happening, municipalities felt the responsibility to take care of it, and now it is centralised and practically nothing is happening. NGOs themselves try to raise funds to clean up their area.
- In general, the coordination between national, regional and local authorities in the field of CCA should be strengthened. There are some cooperation mechanisms and instruments in Polish development policy and EU cohesion policy that can be used in the area of climate change adaptation. The territorial agreement is primarily intended to agree on interventions that are relevant to local communities (a municipality, several municipalities or a district). These could be potentially used for planning joint CCA activities. The instrument of Integrated Territorial Investments may be used in the urban functional area of Warsaw also for CCA measures.

3.6 Room for experimentation

3.6.1 Current Status

Box 6. Main findings on experimentation

Currently in Poland, both at national and regional level (Mazovia), experimentation on potential innovative CCA solutions is rarely conducted. There also appears to be no capacity to introduce experimental approaches in this direction, nor is there a perceived need or necessity to do so. Nevertheless, some room for experimentation exists within the framework of programmes financed from the regional budget, although not specifically targeting CCA. A good example is the “Mazovian Start-up”, which combine a social mission with innovative technology and in its new edition focuses on solutions that help prevent climate change and support the responsible development of the agri-food sector.

The research and analysis carried out did not reveal examples of experimentation in the area of CCA in Mazovia, there also seems to be no recognised need to do so. SAP2020 does not provide a clear place for experimentation in its sectoral activities. According to respondents, the EU and national budgeting processes for CCA-relevant programmes (mainly under cohesion policy) also do not provide

opportunities for experimentation. In CCA-related activities, public institutions and local authorities with statutory tasks (e.g. to ensure flood safety), are most often identified as beneficiaries - this is also not conducive to experimentation. From the point of view of region and municipality administration, more room for experimentation and introducing new ideas is seen in programmes such as Life and Interreg.

As a testing ground, interviewees from the regional government indicated their own programmes, financed from the regional budget, among others: competitions aimed at clusters, open competitions for NGOs, a competition for so-called economic development animators. In the latter case, the local government is looking for such NGOs that could direct certain activities thematically; for the last 3 years this support has been in the field of Industry 4.0, but it could potentially also be directed towards CCA, the limitation is the low budget.

However, companies in general (apart from start-ups) think more in terms of the fact that they have to adapt to something, rather than that they have an impact on reality and can take part in the transformation of the entire Polish economy towards an adaptive model. In other words, they see their participation in CCA more by making changes at home (in production processes, e.g. increasing energy efficiency) than by making changes in the economy by develop more innovative solutions for CCA.

3.6.2 Good Practices

The voivodeship budget finances the "Start up from Mazovia" programme, which is an instrument for promoting and supporting the Mazovian startup ecosystem. The competition selects start-ups with an attractive innovation formula and high growth potential that are successful in introducing innovative economic solutions (new services, products). Among the solutions supported so far are a zero-emission gas turbine, an urban air filtration system that can be installed on top of an existing street lighting system, high-efficiency airborne solar panels for the generation of multipurpose heating energy, a year-round prefabricated house that generates more energy than it consumes.

Another programme implemented in Mazovia is "**Mazovian Startup**", an accelerator programme aimed at innovative and socially responsible start-ups from the region. It is organised by the Mazowieckie Voivodeship and implemented by Youth Business Poland. The programme offers support to positive impact start-ups, i.e. those that combine a social mission with innovative technology. In the fourth edition of the programme (2023-2024), it is to focus on solutions that help prevent climate change and support the responsible development of the agri-food sector. It is pointed out that "*examples could include: green technologies, sustainable production and cultivation, organic food, responsible production, reduction of carbon footprint.*"

3.6.3 Recommendations

Currently in Poland, both at national and regional level (Mazovia), experimentation on potential innovative CCA solutions are rarely conducted. There also appears to be no capacity to introduce experimental approaches in this direction, nor is there a perceived need or necessity to do so.

Possible solutions:

- It is worth making local authorities aware of the need to create a risk-tolerant environment for creativity.

- Failure-accepting solutions are needed in policy instruments and new types of risk-tolerant financing are necessary.
- There is a need to encourage public sector innovation and innovative procurement to create space for private sector experimentation in CCA.

3.7 Policy intelligence, learning and strategic capacity

3.7.1 Current Status

Box 7. Main findings on policy intelligence, learning and strategic capacity

Climate change and adaptation to its impacts are still new areas for government staff at various levels and residents. However, a number of educational activities have been taking place in this area for several years, which should result in an increase in the awareness and competence of public authorities. The knowledge base on climate change in Poland is mainly available at national level. Climate data is provided by public institutions, i.e.: CSO, IMGW-PIB, IOS-PIB, National Water Management Authority. A good knowledge base on CCA has been developed through two editions of the EU-funded KLIMADA project. From a local perspective and the needs for planning activities in specific areas related to climate change adaptation, however, there is still insufficient data available, and existing publicly available databases often fail to serve their purpose. As for learning and strategic capacity, valuable experience and lessons are gained through participation in international initiatives and projects, but these activities are highly fragmented and expertise is overly dispersed. The public administration is also trying to establish direct cooperation with science centres and research institutes. A good example is the cooperation between the municipality of Stare Babice and the UNESCO Chair of Ecohydrology and Applied Ecology of University of Lodz on managing water resources.

Awareness and understanding of CCA

Climate change and adaptation to the impacts of climate change are still new areas for government staff at various levels and residents. The lack of understanding of the concept of climate change adaptation is still a barrier to the management of natural resources and space. Moreover, Polish municipalities declare most frequently mitigation activities, which can be explained by national and EU support. The obligation to develop local low-carbon management plans, together with financial incentives to achieve this, has led to a local focus on energy efficiency and air quality. According to the results of the project POLCITCLIM⁷ “Organizing for Resilience. A Comparative Study on Institutional Capacity, Governance, and Climate Change Adaptation in Poland and Norway”, among the factors explaining differentiation in locally undertaken actions, the most important one is size (population) of a municipality and the competences of local administration. In the case of adaptation, the perceived vulnerability of a commune (experience of past and expectation of future extreme weather events related to water) is also important (Lackowska, Swianiewicz, 2017). However, a number of educational activities have been taking place in this area for several years, which should result in an increase in the awareness and competence of public authorities. On the one hand, regional (Mazovian) and local (Stare Babice) authorities are themselves learning and improving their competences; on the other

⁷ <http://polcitclim.uw.edu.pl/>

hand, they are also carrying out educational activities related to climate change (not necessarily focused on CCA) in schools and kindergartens.

Knowledge base for CCA

As for monitoring activities, environmental activities are monitored and reported on an ongoing basis, as this is a legal obligation. However, activities in the area of climate change adaptation are not treated separately here, but appear alongside activities in the area of environmental protection. In terms of **monitoring, modelling, forecasting and scenarios related to climate** metrological phenomena, the most important institutions are Institute of Meteorology and Water Management – National Research Institute (IMGW-PIB) and Institute of Environmental Protection – National Research Institute (IOS-PIB). In case of monitoring and prediction of flood risk in Poland, the main institutions responsible are the Institute of Meteorology and Water Management – National Research Institute and the National Water Management Authority which is National Water Holding “Polish Waters”. IMGW-PIB conducts continuous air temperature monitoring, including gathering information on the classification of thermal conditions, variability of thermal conditions and recording of extreme temperatures. IMGW-PIB has been monitoring Poland’s climate for over 100 years on an ongoing basis, conducting observations and measurements of all relevant climate variables. It present the study “Climate of Poland”, since 2020, providing a synthetic description of Poland’s climate in the past year, presented in the context of the long-term climate characteristics and from the perspective of contemporary global warming. In addition, research teams of IMGW-PIB, on the basis of current observational measurements and historical data, prepare analyses of Poland's climate change and projections according to available emission scenarios. The results of these analyses are used in urban planning, economic and business forecasting, administrative management, environmental protection and many other fields. As part of monitoring and obtaining data on hydrological and meteorological hazards, IMGW-PIB and National Water Management Authority provide data within the framework of Hydroportal and IMGW's map service. In terms of drought monitoring in Poland, there is an Agricultural Drought Monitoring System (ADMS). It is operated by the Institute of Soil Science and Plant Cultivation – State Research Institute. The developed system includes computer applications that integrate meteorological data needed to calculate the climatic water balance (CWB) and data from a digital soil-agricultural map showing the spatial differentiation of water retention of various agronomic soil categories. The threat of drought is also being investigated on the NUTS-5 (LAU2) level (gminas).

In terms of innovation, the system is based on CSO data, which has a lot of limitations. There are attempts to create other databases as well, but the challenge is to ensure continuity of data provision. The CSO has such a legal obligation and has the resources to do so, and all the other platforms that are emerging and are not legally mandated have a difficulty in obtaining data. For example, there is a system at the national level for monitoring smart specialisations, which is based mainly on data from the CSO, and on what the regions report, but according to interviewees, this system benefits the national level and national smart specialisations more than regional ones, hence some regions stopped providing data to the ministry at the end of the previous programming period because they simply did not see the benefit for themselves. At the regional level, therefore, they are moving away from setting up their regional platforms if there is no funding to purchase the data and ensure continuity of delivery.

From a local perspective and the needs for planning activities in specific areas related to climate change adaptation, however, there is still insufficient data available, and existing publicly available databases often fail to serve their purpose. This is also confirmed by interviewees from the Stare Babice municipality.

3.7.2 Good Practices

Climate change adaptation is the subject of projects that are undertaken by state institutions and bodies to spread knowledge about climate change and assess its impact in order to improve the efficiency and effectiveness of adaptation measures in climate-sensitive sectors. In 2011-2013, such a project called "**KLIMADA**. Development and Implementation of a Strategic Adaptation Plan for Sectors and Areas Vulnerable to Climate Change" was carried out by the then Ministry of Environment and IOS-PIB together with a team of external experts. Its effect is the development of the first strategic document that directly addresses the issue of adaptation to ongoing climate change, entitled: "Strategic Adaptation Plan for Sectors and Areas Sensitive to Climate Change to 2020 with an Outlook to 2030 (SAP 2020)" adopted by the Council of Ministers on October 29, 2013. In the following years, another project was implemented: "KLIMADA 2.0. Knowledge base on climate change and adaptation to its effects and channels of its dissemination in the context of increasing the resilience of the economy, environment and society to climate change and counteracting and minimizing the effects of extraordinary risks". The project involves a series of activities whose main objective is to provide the necessary knowledge on climate change and assessment of its impacts for improving the efficiency and effectiveness of adaptation measures in climate-sensitive sectors. Both projects were co-financed by EU funds. The project was carried out by the Institute of Environmental Protection - National Research Institute using EURO-CORDEX data, and one of the main goals was to provide comprehensive information and reliable data on the causes and effects of climate change.

A projection of climate change trends for the Environmental Protection Programme for the Mazovian Voivodeship until 2030 was based on data posted on the Klimada 2.0 portal. In addition, the regional authorities declare the use of other databases such as: Central Statistical Office (CSO) data, Climate-ADAPT database, Community of Practice (EU Mission on Adaptation to Climate Change Portal).

Businesses in cooperation with research institutes are also trying to create solutions to help manage climate change. An example of such a solution is the Polish Atlas of Rainfall Intensities (PANDa), a digital platform containing information on rainfall intensities authoritative for all cities in Poland. The platform was developed by RetencjaPL Sp. z o.o. in cooperation with the Institute of Meteorology and Water Management - National Research Institute (IMGW-PIB), and co-financed by EU funds.

Learning and strategic capacity

Due to the complexity of climate change adaptation and its interdisciplinary nature, the learning process in the region is ongoing. Valuable experience and lessons are gained through **participation in international initiatives** (Mission on Adaptation to Climate Change Charter, Covenant of Mayors for Climate & Energy, Greening Cities, Partnership for Regional Innovation) **and projects** (mainly under INTERREG and LIFE), but these activities are highly fragmented and expertise is overly dispersed.

Mazowieckie Voivodeship in its role as coordinator of local mayors' climate and energy actions tries to support local authorities in their activities, e.g. by providing information on ongoing initiatives, support in the development of documents (e.g. ECAP, which is an obligatory document to be developed by the municipality within 2 years of joining the Covenant of Mayors), education (e.g. through the organisation of webinars), and the implementation of support programmes financed from the voivodeship's own budget.

The officials participate in various educational programmes and improve their competences (although not necessarily those dedicated to CCA). For example, officials from the Mazovia region participated

in the Gov_LAB programme which aimed to introduce a method of designing services aimed at entrepreneurs; it was based on service design methodology and design thinking tailored to the needs of public institutions. There was also programme for local governments: GovTech Inno_Lab, increasing the competence of local government units in implementing innovation and cooperation with innovators. Both programmes were run by the Polish Agency for Enterprise Development and financed from EU funds.

Improving access to knowledge can be achieved through **cooperation between researchers and decision makers**. The public administration is also establishing direct cooperation with scientific centres and research institutes. An example of such activities is the cooperation between the municipality of Stare Babice and the Faculty of Biology and Environmental Protection at the University of Lodz (UNESCO Chair of Ecohydrology and Applied Ecology). Scientists are helping the Stare Babice municipality and the "Eco-Babice" Municipal Plant located there to effectively manage water resources. The chair has extensive experience in the field of catchment management of water resources. It is one of only 11 UNESCO Chairs in Poland. Its innovative water conservation solutions are recommended by EU institutions and implemented on various continents. The cooperation involves the preparation and implementation of joint implementation projects that adapt the municipality to climate change through sustainable water management and management, and biodiversity support. Earlier, the same chair from the University of Lodz collaborated with the municipality of Radom (also a region of Mazovia) in the project "Adaptation to climate change through sustainable water management in the urban space of Radom". Thanks to the cooperation between the local government and science, it was possible to build innovative solutions of demonstration blue-green infrastructure. Sustainable water management at the site of precipitation (an integrated, "source control" approach) is widely used and widely recognized as good practice and an effective climate change adaptation strategy worldwide. This is an example of supporting the exchange of knowledge and know-how.

An interesting example of cooperation with NGOs working in the field of climate education was the involvement of such a foundation (Fundacja Sendzimira) to conduct public consultations in the municipality of Stare Babice. These consultations concerned plans for the implementation of a specific public space utilization project, where residents initially expected some traditional solutions, and the municipality saw the potential to use the land for purposes favourable to adaptation activities. The commune of Stare Babice also cooperates with the Sendzimir Foundation in other activities, such as taking part in the "Green Leader" project. This is a programme that supports local leaders in environmental protection, sustainable development and climate change mitigation and adaptation. Participants in the programme expand the knowledge and skills needed to plan and carry out environmental and climate actions in their neighbourhoods. Teams of three people from municipalities with a population of less than 50,000 are invited to participate in the programme. The project is funded by the Polish-American Freedom Foundation.

Public authorities from Mazovian municipalities cooperate with the National Fund for Environmental Protection and Water Management and the Regional (Mazovian) Fund for Environmental Protection and Water Management, e.g. in terms of obtaining financing, participating in events like conferences, etc. Stare Babice Municipality organized a conference in April 2022 entitled: "Impact of climate change on water management", which was an important event bringing together local authorities (including neighbouring municipalities), provincial authorities, representatives of science and other partners, with the goal to involve the local community. It was a starting point for cooperation and launched a series of activities in the municipality dedicated to climate change adaptation in the area of water management.

3.7.3 Recommendations

Climate change and adaptation to its impacts are still new areas for government staff at various levels and residents. However, a number of educational activities have been taking place in this area for several years, which should result in an increase in the awareness and competence of public authorities. From a local perspective and the needs for planning activities in specific areas related to climate change adaptation, however, there is still insufficient data available, and existing publicly available databases often fail to serve their purpose. As for learning and strategic capacity, valuable experience and lessons are gained through participation in international initiatives and projects, but these activities are highly fragmented and expertise is overly dispersed.

Possible solutions:

- Raising awareness of climate change and possible adaptation measures is an important prerequisite. Such educational activities have already been carried out, but most often they were project-based and ended at the end of the funding period. There should be continuity in educational activities targeting all levels of government and the country's population. It would be helpful to launch a national debate (with a clear role for the regions) on climate change and its broad and deep social and territorial dimensions.
- It is important to make further use of international networks for the exchange of knowledge and experience in CCA, and the knowledge gained by the regions' authorities through participation in international initiatives and projects should be more widely discounted.
- It would be necessary to ensure access to data at the local level, and adapt existing publicly available databases to the needs of planning activities in specific areas related to CCA at local level.
- Due to the interdisciplinary nature of the climate adaptation issue, the existing knowledge base should and must continue to grow. It will be very important to follow the latest scientific research and good practices, and to implement them systematically, taking into account environmental considerations.

4 Conclusions

Both Mazovia and Stare Babice are undertaking a number of activities to address the threats of climate change on their territories. However, the research found that these activities lack a truly transformative approach in CCA, based on an innovation system. A number of areas have been identified where the region's innovation capacity is not being harnessed for climate change adaptation activities, although there appears to be potential for this.

In general, the biggest **barriers to transformative innovation action in CCA** in Mazovia (including Stare Babice) are:

- low public awareness,
- lack of clear synergies between CCA and innovation policy,
- lack of political leadership and weak multi-level governance for CCA,
- low level of involvement of various stakeholders, especially business,
- fragmented actions and dispersed expertise,
- insufficient financial resources for adaptation,
- Insufficiently fast processes for adapting the region's and the country's policies to the new challenges.

Raising awareness of climate change and possible adaptation measures is an important prerequisite. Such educational activities have already been carried out, but most often they were project-based and ended at the end of the funding period. There should be continuity in educational activities targeting all levels of government and the country's population. It would be helpful to launch a national debate (with a clear role for the regions) on climate change and its broad and deep social and territorial dimensions.

CCA measures should be mainstreamed not only in intervention areas such as water management, energy security, agriculture where the direct impacts of climate change are more readily visible, but should be approached more systemically and the "system change" should be considered as the ultimate impact. In developing the Climate Action Plan, the Mazovian authorities should ensure a more synergistic approach to the CCA issue, not only ensuring consistency with other strategic documents at the regional level, but trying to include a more transformative approach. On the other hand, climate change adaptation can also be given greater consideration in innovation policy, with measures to encourage businesses to seek innovative solutions in this field. This implies the need for an institutional leader in the CCA and more cooperation between departments. Following the local analysis, all relevant departments should be approached, a balanced cooperation of environmental and economic departments is of particular relevance.

Coordination between national, regional and local authorities in the field of CCA should be strengthened. There are some cooperation mechanisms and instruments in Polish development policy and EU cohesion policy that can be used in the area of climate change adaptation. The territorial agreement is primarily intended to agree on interventions that are relevant to local communities (a municipality, several municipalities or a district). These could be potentially used for planning joint CCA activities. The instrument of Integrated Territorial Investments may be used in the urban functional area of Warsaw also for CCA measures.

An important outcome of the strategies and projects implemented in the region should be the activation of local stakeholders to work together towards integrated climate action. The inclusion of

stakeholders in the process of creating and implementing CCA strategies generates input on priorities and technical possibilities, and can also lead to a more widespread acceptance of the plan's goals. The process can take place on several levels but always needs to include input of and support from crucial local stakeholders. It is particularly important to involve business more strongly in CCA activities. Overall, an inclusive participatory process is suggested. However, limited resources might impede a local municipality's capacity to include all relevant stakeholders. Additional organizational and financial support from the regional level could mitigate this issue. Participatory methods to include civil society stakeholders should generally aim for a low entrance barrier.

It is important to make further use of international networks for the exchange of knowledge and experience in CCA, and the knowledge gained by the regions' authorities through participation in international initiatives and projects should be more widely discounted. It would be necessary to ensure access to data at the local level, and adapt existing publicly available databases to the needs of planning activities in specific areas related to CCA at local level. Due to the interdisciplinary nature of the climate adaptation issue, the existing knowledge base should and must continue to grow. It will be very important to follow the latest scientific research and good practices, and to implement them systematically, taking into account environmental considerations.

There is a great deal of interest on the part of municipalities in CCA activities, but local authorities are looking for sources of funding, as the range of municipal tasks is very broad. Municipalities must implement their statutory actions first, hence often climate change adaptation issues, although considered important, are placed lower among priorities. Financial support is needed, and a special role here is for EU funds. EU funds are a catalyst for change in the Polish regions, forcing beneficiaries to make a different kind of investment and at the same time changing their thinking. If it were not for the EU's clearly defined priorities and directions, including in the CCA area, it is likely that a lot of funds would still be spent on the need to expand road infrastructure in municipalities. Without EU support, the transformation to a more adaptive, more resilient economy would be much slower.

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CapaCITIES (Advancing national support for climate-neutral cities) <https://dutpartnership.eu/capacities/>

CEESEU-DIGIT (Central and Eastern Europe Sustainable Energy Union's Design and Implementation of regional Government Initiatives for a just energy Transition) <https://ceesen.org/ceeseu-digit/>

LIFERADOMKLIMA (Adaptation to climate change through sustainable water management in the urban space of Radom) <https://life.radom.pl>

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Stare Babice Municipality Office: <https://stare-babice.pl/>

List of abbreviations and definitions

Abbreviations	Definitions
ADMS	Agricultural Drought Monitoring System
BOŚ	Bank for Environmental Protection
CCA	Climate Change Adaptation
CEE	Eastern European Countries
CSO	Central Statistical Office (Poland)
CWB	Climatic Water Balance
DECP	Drought Effects Counteracting Plan
DG CLIMA	Directorate-General for Climate Action
DG RTD	Directorate-General for Research and Innovation
DSM	Mazovian Voivodeship Development Strategy
ECAP	Regional Energy and Climate Plans
EPP	Energy Policy of Poland
EPPM	Environmental Protection Programme for the Mazovian Voivodeship
ERDF	European Regional Development Fund
EU	European Union
EUR	Euro
EURO-CORDEX	European branch of the CORDEX initiative
FEM	European Funds for Mazovia
FENG	European Funds for Smart Economy
FEnIKS	European Funds for Infrastructure, Climate, Environment
FEPW	European Funds for Eastern Poland
GDP	Gross Domestic Product
GUS	Central Statistical Office (Poland)
IMGW-PIB	Institute of Meteorology and Water Management – National Research Institute
IOŚ-PIB	Institute of Environmental Protection – National Research Institute
ITI	Integrated Territorial Investments
JRC	Joint Research Centre

KLIMADA	Development and implementation of the Polish National Strategy for Adaptation to Climate Change
LAU	Local Administrative Units
LIFE	EU funding instrument for the environment and climate action
MSTI	Mazovian Structural Territorial Investments
NECP	National Energy and Climate Plan
NEP	National Environmental Policy
NFEPWM	National Fund for Environmental Protection and Water Management
NGO	Non-Governmental Organisation
NUTS	Nomenclature of Territorial Units for Statistics
PANDa	Polish Atlas of Rainfall Intensities
PLN	Polish Zloty
REC	Regional Environmental Centre
RIS	Regional Innovation Strategy
R&I	Research and innovation
SAP	Strategic Adaptation Plan
SME	Small and Medium-sized Enterprises
SRD	Strategy for Responsible Development
SRWM	Development Strategy of Mazovian Voivodeship
TI	Transformative Innovation
UNESCO	United Nations Educational, Scientific and Cultural Organization

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Annexes

Annex 1. List of interviews

Table 3. List of interviews

Date	Interviewee
	Stare Babice Municipal Office
9.08.2023	Joanna Pałyska, Head of Environmental Protection Referee „EKO-BABICE” Sp. z o.o.
9.08.2023	Marcin Łasiński, CEO
	Marshal's Office of the Mazovian Voivodeship Department of Environmental Policy, Geology and Hunting
27.09.2023	Tomasz Krasowski, Director of the Department of Environmental Policy, Geology and Hunting
27.09.2023	Magdalena Wiśniewska, Head of Climate Policy Unit
	Marshal's Office of the Mazovian Voivodeship Department for Regional Development and European Funds
4.10.2023	Małgorzata Białczak, Head of the Unit for the Development and Management of Regional Innovation Strategy
4.10.2023	Anna Nitka, chief expert in the Unit for the Development and Management of Regional Innovation Strategy

Annex 2. List of case studies

Case studies have been carried out to analyse to what extent and how enabling factors towards ‘Transformative Climate Change Adaptation’ strategies, as identified in the conceptual report (European Commission, 2024), are at play in reality, and what can be done to overcome barriers in various territorial contexts. The methodological framework described in the conceptual report essentially acts as a practical guide for undertaking cases studies on CCA strategies in different territories, in a uniform way. These case studies are listed below.

Table 4. Transformative innovation for better climate change adaptation – Case studies

Country	Territory	URL (*)	DOI	JRC number
Belgium	Leuven	https://publications.jrc.ec.europa.eu/repository/handle/JRC137313	10.2760/58125	JRC137313
Finland	Espoo	https://publications.jrc.ec.europa.eu/repository/handle/JRC137316	10.2760/177322	JRC137316
Finland	Turku - Southwest Finland	https://publications.jrc.ec.europa.eu/repository/handle/JRC137315	10.2760/211155	JRC137315
France	Provence-Alpes-Côte d'Azur	https://publications.jrc.ec.europa.eu/repository/handle/JRC137314	10.2760/46893	JRC137314
Greece	Attica and North Aegean regions	https://publications.jrc.ec.europa.eu/repository/handle/JRC137322	10.2760/493562	JRC137322
Iceland		https://publications.jrc.ec.europa.eu/repository/handle/JRC137291	10.2760/305796	JRC137291
Italia	Emilia-Romagna	https://publications.jrc.ec.europa.eu/repository/handle/JRC137319	10.2760/790200	JRC137319
Netherlands	Northern Netherlands	https://publications.jrc.ec.europa.eu/repository/handle/JRC137312	10.2760/10862	JRC137312
Poland	Mazovia - Stare Babice	https://publications.jrc.ec.europa.eu/repository/handle/JRC137323	10.2760/58125	JRC137323
Portugal	Norte	https://publications.jrc.ec.europa.eu/repository/handle/JRC137321	10.2760/399394	JRC137321
Romania	Nord Vest - Cluj	https://publications.jrc.ec.europa.eu/repository/handle/JRC137317	10.2760/923916	JRC137317
Slovenia	Gorenjska	https://publications.jrc.ec.europa.eu/repository/handle/JRC137320	10.2760/502482	JRC137320
Spain	Andalucia - Granada	https://publications.jrc.ec.europa.eu/repository/handle/JRC137324	10.2760/104672	JRC137324.
Sweden	Blekinge and Värmland	https://publications.jrc.ec.europa.eu/repository/handle/JRC137318	10.2760/249067	JRC137318

(*) Links may give error message for those studies still under publication

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