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CLIMATE AS AN AREA OF STRATEGIC INTERVENTION IN URBAN DEVELOPMENT

KLIMAT JAKO OBSZAR INTERWENCJI STRATEGICZNEJ W ROZWOJU MIAST

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Abstract: EU policies currently place significant emphasis on the commitment to ensure climate neutrality. A substantial role in these efforts is to be played by cities and local communities. This paper seeks to fill the gap in the research on the strategic commitment in Polish cities regarding the climate issue. This study has two purposes. It aims to highlight the key fields of local authorities' climate commitment and also ascertain the extent to which climate is approached as an area of strategic intervention in major Polish cities. The research shows that the matter of climate is viewed in a very narrow sense, with the local authorities' commitment usually being dedicated to a few areas of intervention. The analysis points to three generations of strategic documents and shows that cities are more likely to address climate issues if they are significantly exposed to climate and climate-induced risks and extreme weather events. It is evident that urban development strategies in Polish cities follow EU policies and their commitment rarely surpass the scope of intervention detailed in these policies or mainstream concepts of urban governance and urban planning.

Keywords: development policy, city development strategy, urban climate and bioclimate, EU Climate and Energy Policy, climate action.

Streszczenie: W politykach Unii Europejskiej szczególny akcent jest kładziony obecnie na osiągnięcie neutralności klimatycznej. Istotną rolę w tym dążeniu odegrać mają miasta i lokalne społeczności. Artykuł wypełnia lukę badawczą dotyczącą aktywności strategicznej samorządów polskich miast w zakresie klimatu. Cel badania jest dwojakiego rodzaju. Z jednej strony dotyczy on wyodrębnienia kluczowych obszarów aktywności samorządów lokalnych w zakresie klimatu, z drugiej – określenia, w jakim zakresie klimat jest polem interwencji strategicznej w polskich miastach wojewódzkich. Wyniki rozważań wskazują, że kwestia klimatu postrzegana jest wąsko – aktywność samorządów koncentruje się zazwyczaj jedynie na kilku z wymienionych obszarów. Analiza pozwala wyróżninić trzy generacje dokumentów, a także stwierdzić większą skłonność do formułowania zapisów dotyczących kwestii klimatu w miastach szczególnie narażonych na ryzyka klimatyczne i klimatozależne oraz zjawiska ekstremalne. Wyraźna jest adaptatywność strategii rozwoju miast Polski do polityk Unii Europejskiej, a ich aktywność rzadko wykracza poza obszary nakreślone w tych politykach czy poza główne nurty w zakresie zarządzania miastem czy urbanistyki.

Słowa kluczowe: polityka rozwoju, strategia rozwoju miasta, klimat i bioklimat miasta, polityka klimatyczno-energetyczna UE, działania na rzecz klimatu.

1. Introduction

In 2019, the climate issue became widely popular, as evidenced by the status of The Oxford Word of the Year 2019 awarded to 'climate emergency' along with closely related terms such as: climate action, climate crisis, climate denial, eco-anxiety, ecocide, extinction, flight shame, global heating, net-zero, and plant-based (Oxford Dictionary…, n.d.). It is worth mentioning that the global political debate around climate was set in motion with the United Nations Framework Convention on Climate Change of 1992, and the European Commission's commitment to climate issues dates back to the ratification of the Kyoto Protocol (Council Decision of 25 April 2002...). Starting from 2013, a 20% reduction target and a goal to reduce an extended number of greenhouse gases have been in place as part of the second commitment period of the Kyoto Protocol (Ratification of the second commitment period of the Kyoto Protocol...).

In 2013 the European Commission passed an EU strategy on adaptation to climate change in order to make the Community more climate-resilient (The EU Strategy on adaptation to climate change, n.d.). In 2016 the EU ratified the Paris Agreement, aimed at limiting global warming to well below 2°C and making efforts to reduce it to 1.5°C (Paris Agreement 2015, n.d.). The Katowice package of 2018 defined mitigation and adaptation as the key goals (Summary and recommendations by the Standing Committee...). An even more comprehensive approach was offered under the European Green Deal, namely to provide full climate neutrality for the continent by 2050, with the European Climate Pact aiming to engage citizens and communities in action for the sake of our climate and environment (European Climate Pact, n.d.).

Climate is also addressed by Polish city policies as part of the commitment to implement EU regulations and programmes, especially the climate and energy package. As part of the 7th Environment Action Programme (EAP), it has been

assumed that most of the EU cities will have implemented the principles of sustainable urban development and planning within the programming perspective 2020. Three priority areas were defined: natural capital, resource-efficient economy, and human health and wellbeing. Each of these priorities has been associated with actions for the climate (General Union Environment Action Programme…, 2014).

The assumptions behind the national development policy emphasize the interdependence of measures in order to ensure nationwide sustainability and sustainable development while maintaining "social, economic, regional and spatial cohesion, improving economic competitiveness and generating new jobs on national, regional and local scales" (Ustawa z dnia 6 grudnia 2006). Low emissions, efficient use of energy, environmental protection and adaptation to climate changes have become major concerns of the National Urban Policy until 2023 (National Urban Policy…, 2015). The development policy pursued under the Polish system of development planning relies on development strategies, programmes and programme documents adopted at national, regional, metropolitan and local levels (Ustawa z dnia 6 grudnia 2006, Articles 2 to 4).

The main research problem of this paper is to find out to what extent and in what scope the climate issue is reflected in the strategic measures adopted by Polish cities. This research problem was split into the following subproblems: (1) "What are the key (target) fields of climate commitment among local authorities?", (2) "Is climate a significant component of the areas of strategic intervention in major Polish cities?", (3) "To what extent is climate addressed as an area of strategic intervention in Polish cities?". The meteorological aspect of this research is based on the investigation of literature in the fields such as climatology, economics, urban governance, urban planning, EU policies and regulations and national climate policies as well as the desk research approach, i.e. the investigation of selected strategy documents adopted in major Polish cities.

2. Climate within scientific perspectives

Meteorology and climatology are two major fields of study addressing climate issues. Climatology investigates specific characteristics of climate within urban areas as well as bioclimatology (Kozłowska-Szczęsna, Krawczyk, and Kuchcik, 2004), conceived in the narrow sense as the features of cities' bioclimate (Forysiak, 2016; Mayer, Kuppe, Holst, Imbery, and Matzarakis, 2009). Due to the substantial contribution of climate and weather events to social and economic realms, climate has been explored by various disciplines of science, such as economics, management studies, architecture and urban planning.

Bankier.pl estimates that 70% of the economy is dependent on weather events (Bankier.pl, n.d.). What might be of interest to the field of economics in this respect is the changes in the value system that come with the models of: ecological resilience

(Domański, 2012); environmental and ecological economics; sustainable growth (Borys, 2013; Sunkel, 2016; Zaręba, Krzemińska, and Dzikowska 2019); the green economy (Barbier and Markandya 2013; Plac 2019); and green cities (Simpson and Zimmermann, 2013). The factors that are investigated by economists (Broto, 2020; Ghofrani, Sposito, and Faggian, 2020) in line with the smart city concept are energy self-sufficiency, smart construction technologies, infrastructural systems as well as air quality, especially as part of the smart environment concept (Orłowski and Rosińska, 2018). All of these are also elements of urban and climate resilience (Aguiar, Bents, Silva, Fonseca, Swart, Santos, and Penha-Lopes, 2018; Kumar, Deka, and Kumari, 2020; Lorenz, Dessai, Forster, and Paavola, 2017), hybrid development (Drobniak, Jania, and Plac, 2017; Drobniak, 2018) and climate adaptation in urban and regional studies (Kythreotis, Jonas, and Howarth, 2020). In the practice of urban governance, weather derivatives are used to reduce the risk associated with meteorological events (Czekaj, 2016) – they are used widely by local authorities in highly developed countries.

From the perspective of architectural design and town planning, climate is thought of as a factor contributing towards high quality housing and living conditions, light, air and colour being key factors in modernist architecture (Rembarz, 2017). Local climate impacts on the behaviour of public space users (Gehl, 2009) and might force them to seek protection from urban heat islands within urban ecosystems (Oke, 1973; Yang, Feng, De-Xuan, and Ke-Jia, 2016). Urban studies often look into the following properties for the urban climate: radiation balance; air circulation; pollution; temperature; vapour and humidity; bioclimatic aspects of urban life, namely: photochemical, thermal, chemical, acoustic and biological stimuli; and the role of green areas: climatogenic, filtering and noise suppressing properties (Lewińska 1991; Serghides, Dimitriou, Kyprianou, and Papanicolas, 2019; Stošić Mihajlović, Mihajlović, and Trajković, 2017). Other climate-significant aspects are the development of passive buildings and air ventilation (Alexander, 2008; Yang, 2014). As argued by Bajçinovci (2017), "[...] passive design principles are associated with sustainable environmental design". This particularly means thermal, spatial, visual, acoustic and air quality aspects and the relationship between architecture, nature and the community (McNamara and Buggy 2017).

This study highlights suggested scope of activities that can be addressed by local authorities as part of their pro-climate activities in urban areas. These include the implementation of climate and energy policy and the European Green Deal, provisions addressing individual elements of this policy, e.g. adaptation to climate changes and mitigation of their consequences, the climate risk and extreme weather events, urban resilience to climate changes, reduction of emissions and the improvement of the air quality. Based on an interdisciplinary survey of literature, a broader area, namely the development of the built-up environment with the consideration of climate factors, was also conceptualized.

The pro-climate approach to the development of the built-up environment implies diverse activities undertaken by local authorities, of which the following

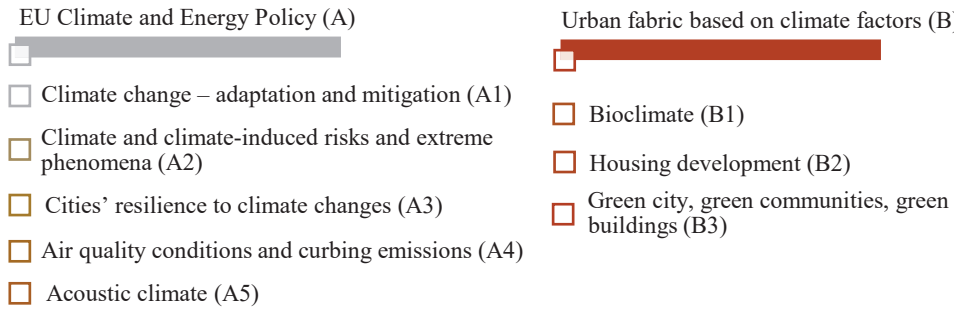

Fig. 1. Target fields of strategic climate intervention (themes)

Source: author's compilation.

were taken into account in this study: bioclimate (the way climate factors impact on human health and life); the development of pro-climate housing and the pursuit of the idea of green cities, communities and buildings within the pre-existing built-up environment in order to improve the local microclimate.

3. Fields of local authorities' commitment to climate

3.1. Research methodology

This paper aims to juxtapose the achievements of various disciplines of science with cities' strategic thinking and examine development strategy documents adopted by major Polish cities (desk research), with the emphasis on the objectives formulated at strategic and operational levels, outcomes, adopted monitoring systems, the alignment of those efforts with concrete instruments aimed at implementing the development policies, as well as the actors responsible for these efforts.

A detailed analysis was conducted to assess the alignment between the adopted strategic measures and the defined potential aspects of climate commitment. Next the author assessed whether the specific objectives are quantifiable and investigated the degree of specificity and concretization of those goals and their mutual alignment. The analysis aimed to find out whether the formulated goals and the adopted strategic recommendations, that is funding instruments and spatial policies, are aligned for climate issues.

3.2. Results and discussion

The themes directly or indirectly related to climate, climate-responsible development of built-up environment or climate policy objectives are part of all development strategies in major Polish cities. However, the level of specificity, the scope of the

provisions and the way they are defined with respect to urban climate do vary. When aligned with the general objectives and developmental challenges, they make up the scope of strategic intervention in most of the documents in question.

The provisions directly addressing some of the target themes of intervention indicated by the author can be found in the development strategies of Białystok, Katowice, Kielce, Kraków, Opole Poznań, Toruń, Warsaw, Wrocław and Zielona Góra. In most cases these provisions address the improvement of urban air quality conditions or the general provisions of climate and energy safety policies, including those in respect of renewable and sustainable energy sources. For Toruń, a significant ecological challenge to its development, besides the need to reduce pollution and greenhouse gas emissions, both related to climate change, is to reduce transport noise. In Opole, climate change and the city counteracting them make an essential part of the city's vision to make it a model green city. In Kraków, the issue of climate and the related concerns make an important part of the body of provisions devoted to development challenges. Not only does this section address the need to improve the air quality but also "to make adaptations towards the climate policy, especially to reduce the emission of pollutants and improve energy efficiency; and to build the city's resilience to the adverse impact of climate change" ("Tu chcę żyć"…, 2018, p. 4), with climate issues making three of the six strategic objectives representing six aspects of the smart city concept. They mostly aligned with such aspects as: smart environment, smart living and smart mobility.

Hardly any provisions addressing climate concerns can be found in the fields of strategic intervention in Bydgoszcz, Gdańsk, Gorzów Wielkopolski, Lublin, Olsztyn, Rzeszów and Szczecin. In Łódź, the provisions in question are of an indirect nature – the vision envisages sustainable development that involves, among others, a more sustainable system of urban transportation. The only city with a development strategy that does not address climate directly is Szczecin, which provides recommendations at the level of lines of action to develop the built-up environment in a way that addresses green areas, water access and safety considerations, and this relates to the climate issue only indirectly. These provisions do not translate into operational objectives and are not aligned with general or specific objectives.

A closer look at the extent to which diagnostic insights are linked with strategic provisions reveals some diverse insights. For Opole, the synthetic findings in the diagnostic section of the document are reflected in a very extensive and elaborate body of provisions addressing development objectives. In Białystok, some trends related to the growing climate warming, the rising occurrence of natural disasters and heightened noise levels have been defined in the city's scenarios, yet hardly any of these translate into objectives. In Gorzów Wielkopolski, the factors related to the city's climate and microclimate covered by the diagnostic part of the document are connected with three areas of strategic intervention: air pollution, noise emissions and urban green areas. In Bydgoszcz, the poorly developed diagnosis of climate factors and trends, concluding that the low-chimney-stack emissions are a burden

to the city, is reflected in operational objectives regarding air pollution and related reduction measures. SWOT insights are also in line with strategic provisions in Kielce and Kraków.

Table 1. Target fields of strategic climate intervention (themes) in Polish cities

City	Year of issue	Target fields of strategic climate intervention (themes)									
		A	A1	A2	A3	A4	A5	B	B1	B2	B3
Białystok	2010			□◇	□	●◇	◆▲		●		●■◇▲
Bydgoszcz	2013	◆▲	▲	▲		▲	▲				
Gdańsk	2014	◆⅄	■◆	■◆▲	■◆	■◆	□◇	■◆		▲	◆
Gorzów Wlkp.	2009			⅄	▲	■◇▲	▲	◇			■◆
Katowice	2015	◇⅄				●□▲		□		⅄	▲
Kielce	2015	⅄		▲	▲	○◇▲					●
Kraków	2018	●▲	●◆▲	●■◆▲	●◆▲	●□◆▲	◆▲	◇⅄		◇	◆▲
Lublin	2013					◆	◆	◇			
Łódź	2012	◇				○□◆	□◇	◇			■◆
Olsztyn	2013					◆	◆				
Opole	2019		●■▲	◆▲	●◆▲	●■◆▲	◆▲	○		○◇	●◆▲
Poznań	2017	▲	□◇⅄			■◆▲	◇▲			○⅄	●□
Rzeszów	2015	◆▲		□◆▲	◆▲	□◆▲					
Szczecin	2011			◇							◇
Toruń	2018	●◆	●			●◆	●◆	●◆		◇	◆
Warsaw	2018	●◆			◆	●□◆	◆	○◆		◇	
Wrocław	2017	◆	■		◆	■◆	◆	◇		◆	●■◆
Zielona Góra	2012	▲			□◆▲	□◇▲		⅄			●

Key: ●○ – main development challenges (direct/indirect measure), ■□ – specific objectives (goals), ◆◇ – lines of action, ▲⅄ – strategic activities, initiatives, projects.

Source: author's compilation based on desk research of Polish cities` development strategy documents.

In Rzeszów, the references to the climate policy and the reasons for the policy defined in the strategic diagnosis, covering, among others: the assessment of: climate scenarios and city management for the adaptation to climate change; weather anomalies; hygrometric conditions; thermal conditions (bioclimatology issues), the consequences for inhabitants' life and health; and the resilience of the built-up environment, are all aligned with the development objectives only at the level of general objectives and actions aimed at addressing climate change, including the reduction of related risks, delivering and regenerating anti-flood safeguards and reducing low-chimney-stack emissions. Strategic measures address only a few issues

and fail to cover other concerns such as the development of the built-up environment and the impact on inhabitants' health. In Szczecin, despite the diagnostic section addressing the rise in CO and the standard level of Benzo[a]pyrene exceeded in 2008, the diagnostic insights do not translate into strategic intervention, not even in terms of air quality.

Climate concerns are addressed both at the level of specific and general objectives and lines of action and tasks within the strategies in question. They are often linked to sustainable development. The most frequently mentioned actions or lines of actions (direct provisions) are: the reduction in emissions (including the elimination of its sources); the increase in efficient use of energy; improving thermal efficiency of buildings (including public buildings); expanding heating networks; reducing emissions from transportation systems, including by incorporating certain elements of sustainable urban mobility and e-mobility and moving transit road traffic out of the city; providing the city with green areas to mitigate noise; and nurturing green thinking among inhabitants.

As far as the issues in question are concerned, the temporal analysis reveals three generations of development strategy documents adopted between 2013 and 2017. In the cities with strategy documents adopted prior to 2013, the objectives mainly address two categories: reducing pollution emissions and improving air quality and developing green areas, with the subjects of other categories usually being addressed indirectly. The documents drafted in the later period, that is by 2017, usually also include development objectives on climate and energy policy at the level of general provisions. The objectives formulated following 2017, additionally address specific elements of the policies (Poznań, Wrocław, Warszawa, Toruń, Kraków and Opole). Three cities make an exception to this division: Gdańsk (2014), Bydgoszcz (2013) and Białystok (2010). In Bydgoszcz, a body of operational objectives linked with the current climate and energy policy of the EU were proposed. Gdańsk has the third generation strategy, which comprehensively covers most of the elements associated with the EU climate policy in place without surpassing its demands. Białystok's strategy is the oldest document of all those reviewed and thus climate plays an important role there. This document comprises objectives contributing to the city's resilience and identifying the risk related to climate conditions. Consequently, the need to deliver and maintain green areas in order to improve the urban microclimate plays an important role there.

The scope of issues addressed in each generation of documents and the specified milestones coincide with the ratification of agreements and policies at European level, especially with the EU's implementing measures related to the Kyoto Protocol, the EU Strategy on Adaptation to Climate Change and the Paris Agreement. Since the surveyed documents mostly address urban air quality, the important question is whether local governments target specific urban territories in this respect, for instance to ensure air circulation of the urban system. The diagnostic insights in Kraków pointed to the threat to the city's air regeneration zones due to the pressure

from investors; these provisions, however, are not directly aligned with the section addressing strategic intervention within that municipality and are not aimed at specific parts of the city. The document only addresses essential development challenges related to smart environment that fall under the EU climate policy and provides the following smart living provisions: "attending to the natural environment and green areas" ("Tu chcę żyć"…, 2018, p. 9), without further explaining or specifying these efforts.

In Opole (Urban Development Strategy for Opole…, 2019, p. 12), the vision recognizes the need for protecting green areas and reducing the expansion of built-up environment into air circulation zones – it is pointed out that "green areas and air quality protection are priorities" and the fact that "residential housing should encompass green areas". Furthermore, the city's strategy offers the following recommendation for the spatial policy: "[...] development plans shall include provisions envisaging urban ventilation and systems of green areas, including screening with green strips". This strategy also stresses the need to protect green areas and limit the expansion of the newly developed buildings onto territories that provide air circulation zones was emphasized and suggests the forward-looking use of air purifiers. Opole is the only city where such an objective was formulated (at the level of general objectives).

The alignment of urban governance with the spatial policy in place is a valuable aspect of this strategy and contributes to integrated development. In Katowice, air quality provisions for specific urban zones have been addressed indirectly at the level of specific objectives (zone-based air protection); Kraków has dealt with air quality through its commitment to reduce traffic in the city centre (including transit traffic) at the level of lines of action; and in Zielona Góra and Poznań the same concern has been addressed at the level of operational objectives. It is worth noting that a number of spatial provisions address the development of green cities, residential estates and buildings. Besides Opole, it is also worth noting the broader perspective in Łódź, which follows the municipal spatial policy via the specific objective to "preserve and manage the bioactive space" (Integrated Development Strategy for Łódź…, 2012, p. 16).

In most cases the measuring indices for climate-related objectives are of a general nature and usually refer to the concentration of harmful substances, urban green areas, facilities and systems as well as community facilities and ecological education. The prevalent targets are: the annual average rate of PM10 and PM 2.5 contamination, the annual average B(a)P pollution, low-chimney-stack emission rate [ton/annum], rate of meetings and consultations held. Such indices might also be defined in a more complex way regarding estimated ecological impact – CO_2 reduction (Rzeszów) or the natural environment quality index (Warsaw). Polish cities often define indices that are hard or impossible to quantify, e.g. the annual CO_2 emissions in Bydgoszcz, sometimes ambiguous as in the rate of disasters or critical situations (Białystok), or even unreliable: the share of public green areas in the total city area (Poznań); dust/gas pollutants captured or neutralized by reduction devices (Białystok). The most prevalent mistake is the use of emission indices

already adopted in the particularly harmful industrial plants operating in a given city (industry-related quantity measures) and using them in the context of the city's air quality, often in a way that does not fit the purpose. One can mention here: the share of 'pocket' parks (with up to 0.5 ha) or the percentage of people living in a 300-metre radius (ca. 15-minute walk) from green leisure areas (Kraków, Wrocław); the number of days with the PM 10 concentration exceeded (Katowice, Rzeszów, Wrocław); the length of delivered and upgraded urban heating systems (Gdańsk); and the number of furnaces using solid fuels (Gdańsk). From the territorial and spatial perspective, the indices usually address: the average level of noise near major roads; the ratio of inhabitants living in zones where allowable noise levels are exceeded and the total area of green space in the city centre.

Climate-related indices are usually formulated for strategic level objectives, less frequently at operational level. It is rare to see the indices defined at both of these levels. This is the case only in Białystok, Katowice, Rzeszów and Zielona Góra. Lastly, in cities Łódź, Toruń, Olsztyn, Kielce and Opole, climate-related issues are not being monitored. Warsaw uses a single general synthetic indicator covering the entire natural environment, three-quarters of which are based on climate-related indicators. In Wrocław, two out of the nine requirements adopted to monitor the execution of the development strategy regard climate; Kraków has provided the indices in the development strategy document, stressing the need to further develop the process of strategy monitoring based on the indices defined in strategic programmes and projects, benchmark analyses and the surveys of development trends.

The way climate objectives are linked with development objectives varies in specificity. The largest degree of alignment characterizes the objectives aimed at improving and ensuring high-quality air, in most cities formulated at the level of general and specific objectives and at the level of lines of action or specific operational objectives. This can be observed in Gdańsk, Kraków and Opole for the objectives covered by the present analysis that contribute towards the execution of the climate policy, i.e. those related to adapting to and alleviating the consequences of climate changes, climate and climate-induced risks and extreme weather events, urban resilience to climate changes and weather and climate phenomena, as well as pollution emissions and air quality conditions. The substantial alignment characterizes the objectives related to alleviating and adapting to climate change in Poznań (provisions of an indirect relevance), climate-specific risks and extreme weather events in Rzeszów, urban resilience of Rzeszów and Zielona Góra, and the commitment to the green city concept and delivering green areas in cities and urban communities. Spatial objectives that fall within issues related to developing the urban fabric with the consideration of climate factors, including housing development, are marked by lower consistency across all stages of the development planning process. Regardless of the issues concerned, in Bydgoszcz, Olsztyn and Lublin, the objectives are formulated at the lowest operational level, i.e. strategic activities or lines of action.

The nature of alignment with the development mission, its vision and challenges, largely depends on the extent to which they have been elaborated on within a given development strategy. This is a direct dependence, meaning that the more elaborate the section of provisions dedicated to the main themes of strategic intervention, the more references to the concerns in question one can find. However, when just considering the strategic vision and mission of a given city towards the end of its strategy's timeframe, full alignment with specific and operational objectives can be found only in Opole, while no alignment with any of the analysed areas was found in Zielona Góra, Szczecin, Rzeszów, Olsztyn, Lublin, Gorzów Wielkopolski, Gdańsk and Bydgoszcz.

In Warsaw and Gdańsk, the objectives at the same level of strategic thinking were aligned – the objectives that complement each other were highlighted. In Warsaw, for the objective regarding the quality of the natural environment, joint efforts towards a clean environment are intended to reinforce pro-community attitudes, improve local space and encourage inhabitants to walk or use bicycles and make Warsaw more attractive for those very talented and the high-fliers.

The documents in question lack a consistent approach as to how they define funding sources, implementing the instruments and actors working together to deliver climate-related objectives. While the description of funding sources in the context of entire strategies is part of virtually all documents, the other two categories are covered only in the documents adopted since 2017 in Katowice, Kraków, Poznań, Rzeszów, Warsaw and Wrocław, the exception being the strategy of Gorzów Wielkopolski. These provisions are at an early stage of development, and they are usually of a very general nature and cover the entire development strategy document. The most frequently mentioned implementation instruments are project-funding instruments, including low-carbon economy plans, sustainable public transport plans and noise prevention schemes.

Kraków has the largest number of various climate project-funding programmes (14), including schemes and plans for: low-stack-chimney emission reduction, noise prevention, small-scale water retention, flood mitigation and prevention, as well as the Climate Change Adaptation Plan, which has been referred to in Wrocław, too. Climate objectives are rarely aligned with spatial planning instruments. This is only the case in Białystok, Kraków, Rzeszów and Warsaw, the latter having formulated a range of concrete guidelines. The actors responsible for implementing the strategies at the level of objectives are defined only in four documents. Usually these are the city councils or municipal companies responsible for municipal management, environmental protection, transportation, investments and matters related to architecture and urban planning. In Poznań, working groups for the implementation of priorities have been established. All cities demonstrate a low degree of concretization of the scope of tasks and a limited diversity of entities involved.

4. Conclusion

This analysis shows that major Polish cities seek to implement climate policy recommendations mainly by ensuring proper air quality conditions, and their approach to this aspect is most comprehensive throughout the strategic process. These observations point to a process of collective learning about how to define the scope of development objectives in the area of climate and ensuring their continuous implementation as successive generations of documents show the transition from general provisions towards more specific objectives. The way the objectives were formulated has been evolving radically since 2017, when the EU Paris Agreement was ratified.

The temporal analysis has demonstrated that the content of the documents follows EU climate regulations and guidelines. The cities that have delivered new quality and improved on the demands of these regulations are: Gdańsk (2014), Bydgoszcz (2013) and Białystok (2010). In addition, the spatial aspect of the documents shows that they adapt to the threats resulting from climate and climate-induced weather events. The challenge of climate change and the need to ensure the resilience of the urban fabric are particularly evident in the cities that have borne significant expenditure or were forced to evacuate their inhabitants due to the River Odra flood in 1997 (Opole, Wrocław), or the flood in Central Europe in 2010 (among others Kraków, Wrocław, Bydgoszcz, Warsaw, Opole, Toruń and Gorzów Wielkopolski), or are subject to to partial flooding as the levels of seas and oceans are rising (Gdańsk). With the EU adopting the target of full energy neutrality, one should expect that the newly drafted documents will address the issues in question even more.

The cities need to improve on the Community's current approach to climate concerns and embrace the insights of bioclimatology, town planning and architectural design to ensure proper living conditions and inhabitants' health and lives. The process of defining and implementing climate objectives ideally should involve grassroots and pro-climate movements, as advised by the EU, as well as urban climatology and bioclimatology experts and researchers concerned with the extreme phenomena. It is also advisable to coordinate the process of urban development planning with the Urban Climate Change Adaptation Plans as an instrument to implement climate objectives. Furthermore, it is advisable to align development planning and urban governance with spatial policies in place, i.e. spatial planning studies (including territorial and thematic studies), including by means of instruments aimed at implementing climate-related objectives of urban development strategies. With the growing occurrence of extreme and dangerous events and the greater unpredictability of those events, cities are advised to employ financial instruments to manage weather risks, e.g. with weather derivatives, as this can help stabilize cities' budget expenses. Lasty, it is recommended to diversify the sources and forms of funding for climate-related tasks in order to increase the flexibility of actions undertaken and their effectiveness in the event of unpredictable events, which might force cities to divert their funds towards

other objectives. In light of the EU's postulate to engage local communities in pro-ecological and pro-climate efforts, it is recommended to provide such measures in Polish cities' development strategies.

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