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ROUGH ASSESSMENT OF THE CONSIDERATION OF SPATIAL PLANNING TOOLS IN THE MUNICIPAL PLANS FOR ADAPTATION TO CLIMATE CHANGE. AN EXAMPLE OF SELECTED POLISH CITIES

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ABSTRACT: The subject of the study whose results are presented in this paper is an attempt at assessing the consideration of spatial planning tools in the municipal plans for adaptation to climate change, performed on the sample of fifteen Polish cities with populations of over 100,000. The assessment was performed using a three-step descriptive analysis. The first stage consisted of identifying the thematic areas of such adaptation for which spatial planning tools had been used. The second stage, done against the background of a general review of spatial planning tools, involved identifying the tools that could be assigned to the already identified thematic areas of urban adaptation to climate change. The number of tools used was totalled at the third and final stage, and synthetic analysis of the tools used was performed using a set of selected criteria.
The study is the first, basic attempt to empirically verify the hypothesis that spatial planning and spatial policy play a critical role in adapting cities to climate change, as stated in the subject literature.

KEYWORDS: climate, adaptation, spatial planning

Introduction

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2007) concluded that climate change would constitute the most significant challenge during the coming decades due to the growing population and the massive use of fossil fuels to provide energy for socio-economic development. In the face of these facts, the common ways of responding to climate change have been identified as follows: 1) mitigating current and future climate change by reducing GHGs emissions and/or increasing their absorption, and 2) adaptation to the effects of climate change. Initially, this reduction of GHG emissions and/or favouring their absorbers received much more attention in the political and scientific communities. During political debates and scientific discussions, less attention was paid to adaptation to climate change. This changed in the aftermath of the Paris Agreement (2015), which called not only on states and regions but also on cities to take action in the face of climate change impact and cooperate with other public and private actors (Lesnikowski et al., 2017). This tendency can be explained by the dynamically increasing number of climate-related disasters compared to the long-term results of climate change mitigation policies (Simonet & Fatorić, 2016). Moreover, during this century, the climate system will undergo significant changes, regardless of any and all efforts to reduce GHGs emissions, mainly due to the thermal inertia of oceans and the long cycle of carbon dioxide and other greenhouse gases (Matthews & Caldeira, 2008). The Sixth IPPC Report (2021) claims that many of these changes will be irreversible.

It is clear that climate change is a global phenomenon, but the effects are felt locally (Bowen & Friel, 2012). This has shifted attention to finding strategies to reduce the susceptibility of territories and populations to the impact of climate change, especially in cities with their growing number of inhabitants and population density, their accumulation of technical infrastructure, as well as their significant social, economic and demographic differentiation (Legutko-Kobus, 2017; Gendźwill, 2017). The Charter of European Planning (2013) clarifies that the local political and substantive leaders must proactively alleviate the impact of climate change instead of passively waiting for the initiatives of their national governments. It is the local action plans that should be the main tool for initiating the adaptation processes.

In the sphere of political activities, a direct result of the interest in adaptation to climate change at the municipal level were numerous initiatives undertaken at various latitudes, including Poland, which involved the development of municipal plans/policies of adaptation, while in the sphere of academic activity it was research on the efficacy and credibility of such plans/

DOI: 10.34659/eis.2022.80.1.427

policies. These studies frequently hypothesise on the key role of spatial planning in adaptation processes. This is rooted in the well–established conviction significant the major advantage of spatial planning is its ability to coordinate matters of common interest or common good in the situation of sustainable development and to function at various levels of space, time and governance at the same time (Aylett, 2015; Czarnecki 2015; Pangsy-Kania 2015; Radziejewski, 2015). This would mean that the success of adaptation to climate change depends primarily on whether the planning activities (the planning tools utilised) as specified in the municipal adaptation plans will result in relevant corrections to the local plans for spatial development or will get accounted for in the newly created plans of this type. The study aimed to empirically verify this hypothesis through a rough assessment of the use of spatial planning tools in the plans for adaptation to climate change as developed by selected Polish cities.

An overview of the literature

Two main research trends have developed within the literature focused on municipal plans for adaptation to climate change. Within the first one, the subject of scientific considerations is the consistency of such plans for adaptation to climate change and their compliance with other municipal plans and programs (for economic development, environmental protection, spatial planning, revitalisation etc.) as well as the compliance of these plans with sectoral plans/programs of higher-level public administration, since the adaptation is horizontal in nature – it goes beyond the traditionally sectoral and vertical divisions in administration. This trend is represented, among others, by Johnson & Breil (2012), who conducted comparative studies of seven municipal plans for adaptation to climate change – those of New York City, Metropolitan District of Quito, Greater London, Tunis, eThekwini Municipality (Durban), Ho Chi Minh City and Bangkok. The study identified the various administrative levels of adaptation planning, the tools and information used in developing adaptation policies, and the role of governance and financing in adapting cities to climate change. Chrobak and Kryczka (2020), on the other hand, carried out a comparative analysis of five key instruments of municipal policies of the city of Wrocław (The Strategy of Wrocław 2030; Adaptation Plan to Climate Change 2030, The Environment Conservation Program for the City of Wrocław for 2016-2020, The Low-carbon Economy). Plan for Integrated Territorial Investments of Wrocław Functional Zone, The Downfall Management Program of Wrocław), verifying the degree of their correlation with the main climate threats identified within the city. Meanwhile, Hurlimanna et al. (2020) examined the occurrence of issues related to the adaptation of cities to climate change in the Australian instruments (pol-

DOI: 10.34659/eis.2022.80.1.427

icies, strategies, legislation) of urban planning at the levels of both the nation and the state of Victoria and in terms of their consistency and compliance. In his research, Wilson (2007) analysed the regulations relating to flood hazards, urban environment, wildlife habitats and water resources as included in 14 local development plans adopted in 2000-2005 in Great Britain. The analysis focused on their consistency with actions covered by local adaptation plans.

Within the other trend, the subject of consideration is the credibility of municipal adaptation policies. Researchers assess the efficiency of actions covered by the plans for adaptation to climate change in the context of the need to raise financial resources for their implementation from private and/or public sources. This trend was initiated by Averchenkov and Bassi (2016) and further developed by Olazabal et al. (2019). Olazabal and her team have developed a conceptual framework for assessing the credibility of municipal plans for adaptation to climate change, including an assessment of political and economic credibility, technical and scientific credibility, and the credibility (legitimacy) of local authorities. Available resources, reliability, and public and private institutional support were identified as key political and economic credibility components. The components of technical and scientific credibility include helpful knowledge, monitoring, evaluation and reporting of achievements, as well as adaptation management. The assessment of the credibility of local authorities took into account its transparency and dialogue with the stakeholders of adaptation. The conceptual framework for assessing the credibility of municipal plans for adaptation to climate change was tested on a sample of four cities from four continents: Copenhagen, Durban, Quito and Vancouver.

Research methods

General information on case studies – selected Polish cities

At the Ministry of the Environment initiative, between January 2017 and January 2019, forty-four Polish cities of, as a rule, over 100,000 inhabitants carried out a project to develop municipal plans for adaptation to climate change. The main goal of the project was to "prepare city authorities and inhabitants to consciously and responsibly respond to possible climate change and its effects". For the purposes of this study, 15 cities were selected for detailed analysis, namely: Białystok, Bydgoszcz, Gdańsk, Katowice, Kielce, Kraków, Lublin, Łódź, Olsztyn, Opole, Poznań, Rzeszów, Szczecin, Wrocław, and Zielona Góra. Three central institutes for research coordinated the project. The project was based on a uniform methodology, as described in „Podręcznik adaptacji dla miast" (Ministry of Environment, 2017), which

DOI: 10.34659/eis.2022.80.1.427

contains detailed guidelines for subsequent stages of adaptation plans development, i.e., the stage initiating the process, assessing the city's climatic susceptibility, climate risk analysis, studies on adaptation options, assessment and selection of adaptation options, and finally the preparation of a planning document.

Purpose, subject and stages of research

As already mentioned, the aim of the research presented in the article is rough verification of the hypothesis about the special role of spatial planning in adapting cities to climate change. The verification attempt was based on a descriptive analysis, which made it possible to evaluate the scope of the use of spatial planning tools in the adaptation plans of selected cities. The study was a three-stage one. At the initial stage, I identified the areas of planned local public intervention to reduce the susceptibility of cities to the predicted negative effects of climate change. Like any other form of public planning in a market economy, spatial planning is a form of public sector intervention in the market mechanism allocating factors of production, goods and, indirectly, also socio-economic activity of man in space (Markowski, 2013; Drzazga, 2018). In the case of spatial planning, the nature of this intervention is inherently non-physical (non-material). Still, it has effects primarily in the material dimension – it leads to a specific spatial development. At the second stage of the analysis, spatial planning tools were reviewed without considering any specific techniques. At the third stage, I conducted a comparative analysis of the use of spatial planning tools for individual areas of local public intervention as specified in planning documents and identified their relevant features to assess their role in the adaptation planning activities.

Results of the research

An analysis of the content of plans for adaptation to climate change demonstrated that the cities selected had planned their public intervention in the six most important areas:

- ensuring the thermal and humidity comfort of the population in public spaces,
- securing ventilation and airing of the city,
- ensuring natural water retention of the ground,
- limiting the urbanisation pressure on floodplains and lands with high landslide risk,
- protection against strong winds, local hurricanes and whirlwinds,
- protection of biodiversity and environmental components,

DOI: 10.34659/eis.2022.80.1.427

- up-to-date visualisation of the distribution of exposure to climate risk throughout different areas of the city.

Public intervention in the sphere of ensuring the thermal and humidity comfort of the population in public spaces is dictated by an increased frequency of extreme thermal phenomena, i.e. heat or cold waves, and the occurrence of urban heat islands (UHIs). An "urban heat island" means an increase in air temperature in the ground layer of the atmosphere within an urban area in relation to the air temperature outside the city. Urban heat islands result from a local increase in air temperature due to the rise in the share of heat–absorbing surfaces of roads and buildings, a reduction in green areas and the number of trees, and hydrological changes.

The aim of public intervention in the sphere of ventilation and airing of the city is to counteract air stagnation within the urban area due to limited horizontal and vertical exchange of air masses and to the lack of appropriate climate supply zones – large areas of open space located by the prevailing wind direction (Rawski, 2017).

Public intervention in the sphere of natural water retention in cities, especially in large cities, has become a necessity in the situation where the natural mechanisms maintaining the water balance have been eliminated from the built environment by the disappearance of natural (permeable) surfaces and in particular the disappearance of natural water circulation systems. The urban planning of the 20th century had water significance reduced to its utility functions, and consequently, water management became a purely engineering domain. The classical engineering approach to urban water management deals solely with a water supply and wastewater disposal.

Public intervention in the urbanisation process of floodplains (i.e. areas that are not usually covered by water, but there is a risk of such coverage whenever water rises in natural watercourses, reservoirs, canals or at a seashore) is a key element of a flood risk management system. Flooding is one of the most dangerous hydrological phenomena that humans can face. Intervention in areas at risk of landslides relates primarily to mountain and foothill areas.

A public intervention consisting of protection against strong winds, local hurricanes, and whirlwinds translates to the protection of residents' life, health, and property in the event of a threat from falling trees, branches, or damaged elements of building structures.

In the context of adaptation to climate change, the public intervention of cities includes up-to-date visualisation of the distribution of exposure to climate risk throughout different city areas.

It should be noted that among the above-mentioned thematic areas earmarked by the cities in question for public intervention, no consideration was given to the positive effects of climate change, which means a visible

DOI: 10.34659/eis.2022.80.1.427

narrowing of the concept of adaptation to climate change. The IPCC (2013) defines adaptation as adapting natural or human systems in response to the actual or likely climatic stimuli or mitigating damage or taking advantage of beneficial opportunities. However, the cities have not demonstrated any awareness of the opportunities related to climate change, and consequently of the possibilities of using them, which seems to suggest that adaptation to climate change is perceived solely as a forced response that requires a lot of investment, sacrifices and resulting restrictions (Simonet & Fatoric, 2016). This may reduce the social commitment to such adaptation.

Local public authorities can and should use the entire range of spatial planning activities/tools in the process of adapting cities to climate change. These include inventories, analyses, developing urban and architectural concepts, studies of pre-conditions, environmental impact assessments, eco physiography studies, zoning (urban planning) standards, visualisations, reviews, monitoring and evaluation of plans[1]. Among these tools, a significant role is played by urban planning standards, i.e., patterns of spatial development, which include principles, guidelines, recommendations and urbanisation indicators. The standards may be "soft", i.e., they may function as land development and development methods recommended for use in a given area or mandatory when the necessity to apply them results from local, regional or national law provisions. The latter may be national or regional guidelines for the development of local plans for spatial development or may be applicable outside the plan as a spatial management regulation of a national, regional or local reach, specifying the management methods for specific types of areas (e.g. floodplains, protected natural areas, single-family housing estates, landscaped or natural green areas).

In the sphere of ensuring thermal and humidity comfort in public spaces, four tools were used: a spatial analysis of the scope and distribution of UHIs, the concept of building green and blue infrastructure, the architectural and landscaping concept of urban green areas, urban planning standard (technical and architectural recommendations for shaping public spaces, taking into account the green and blue infrastructure), review of planning documents (pre-conditions studies and local plans for spatial development) in terms of up-to-date temperature forecasts for the city. The scope of using these tools in plans for adaptation to climate change is shown in Table 1.

[1] The list of these tools is obviously much shorter than the general list of spatial policies' tools, which also includes, inter alia, stimulating and incentivising measures (e.g. tax preferences, targeted subsidies), compulsory measures (e.g. expropriations, pre-emptive rights), urban marketing, regulations (e.g. laws and administrative decisions), as well as participatory spatial planning processes (social consultations and mediation).

DOI: 10.34659/eis.2022.80.1.427

Table 1. Spatial planning tools identified in the sphere of ensuring thermal and humidity comfort in public spaces

City	Analysis of the scope and distribution of UHIs	Architectural and landscaping concept of urban green areas	The idea of building green and blue infrastructure	Urban planning standard	Review of planning documents
Białystok	–	–	–	+	+
Bydgoszcz	–	–	–	–	+
Gdańsk	+	–	–	+	+
Katowice	+	–	–	–	+
Kielce	–	–	+	+	+
Kraków	–	–	+	–	+
Lublin	–	–	+	+	+
Łódź	–	–	–	–	+
Olsztyn	–	–	–	+	+
Opole	–	+	–	–	–
Poznań	–	–	+	–	–
Rzeszów	–	–	–	–	–
Szczecin	–	–	–	+	+
Wrocław	+	–	–	–	–
Zielona Góra	–	+	–	–	–
Total	3	2	4	6	10

Source: author's work based on the adaptation plans studied.

As can be seen from the information in Table 1, in the sphere of ensuring thermal and humidity comfort in public space, the spatial planning tools most often used were a review of planning documents and urban planning standards in the cities' adaptation plans.

However, it should be noted that the activity consisting of conducting a review of planning documents was formulated in a very general manner – as a review in terms of up-to-date temperature forecasts – and did not explicitly require these documents to be modified.

In the sphere of securing ventilation and airing of the city, three spatial planning tools were used in municipal plans for adaptation to climate change: analysis of the pre-conditions / potentials for ventilation and airing of the city (i.e. classification of areas by their air exchange function and identification of barriers to city ventilation), the urban planning standard related to passive and active protection of ecological corridors and city ventilation,

DOI: 10.34659/eis.2022.80.1.427

as well as verification of the existing planning documents in such terms. The scope of using these tools in plans for adaptation to climate change is shown in Table 2.

Table 2. Spatial planning tools identified in the sphere of ensuring ventilation and airing of the city

City	Analysis of pre-conditions/potentials	Urban planning standard	Verification of planning documents
Białystok	–	+	+
Bydgoszcz	–	+	+
Gdańsk	–	+	–
Katowice	–	+	+
Kielce	+	+	+
Kraków	–	–	+
Lublin	+	+	+
Łódź	–	+	+
Olsztyn	–	+	+
Opole	+	+	+
Poznań	–	–	–
Rzeszów	–	–	–
Szczecin	+	+	+
Wrocław	+	+	+
Zielona Góra	–	+	+
Suma	5	12	12

Source: author's work based on the adaptation plans studied.

The information shown in Table 2 indicates that in the sphere of ventilation and airing of the city, the studied entities envisage using such spatial planning tools as the urban planning standard and verification of the existing planning documents. The urban planning standard aims to passive protection of city airing (building development restrictions) and active protection of ecological corridors (protection and enlargement of green areas with an appropriate species composition and multi-storey structure).

In the sphere of ensuring natural water retention, four tools were used: land surveys of the components of rainwater management system/retention potential of water reservoirs and green areas, urban planning standards, studies of hydrological, lithological and natural preconditions for the crea-

DOI: 10.34659/eis.2022.80.1.427

tion of retention, and verification of planning documents. The scope of using these tools in municipal plans for adaptation to climate change is shown in Table 3.

Table 3. Spatial planning tools identified in the sphere of ensuring natural water retention

City	Land survey	Pre-conditions study	Concept of building green and blue infrastructure	Urban planning standard	Verification of planning documents
Białystok	–	–	–	+	+
Bydgoszcz	–	–	–	–	–
Gdańsk	–	–	+	+	+
Katowice	–	–	+	+	+
Kielce	+	–	–	+	+
Kraków	+	–	–	–	–
Lublin	–	–	–	+	+
Łódź	–	–	–	–	+
Olsztyn	–	–	–	+	+
Opole	+	–	–	+	–
Poznań	–	–	–	–	–
Rzeszów	–	–	–	–	–
Szczecin	–	–	–	+	+
Wrocław	–	–	–	+	+
Zielona Góra	–	+	–	+	+
Total	3	1	2	10	10

Source: author's work based on the adaptation plans studied.

In the municipal plans for adaptation to climate change covered by the study, the most significant importance is attached to the following spatial planning tools in the area of natural water retention: verification of planning documents and the urban planning standard of protecting unsealed (permeable) areas against the pressure from investors.

In the sphere of limiting the urban pressure on floodplains and areas threatened with landslides, five spatial planning tools were used: the concept of blue and green infrastructure in natural floodplains, assessment of landslide threat, urban planning standard to limit investment/building in river floodplains and areas actually flooded in the past, the adaptation of provisions of the planning documents to the currently forecasted threats, and removal/function change of infrastructure facilities located in flood risk

DOI: 10.34659/eis.2022.80.1.427

zones. The scope of using these tools in municipal plans for adaptation to climate change is shown in Table 4.

Table 4. Spatial planning tools identified in the sphere of limiting urban pressure on both floodplains and areas at risk of landslides

City	Concept of blue-green infrastructure	Assessment of landslide risk	Urban planning standard	Verification of planning documents	Removal/function change of objects in high-risk zones
Białystok	–	+	+	–	–
Bydgoszcz	–	–	–	–	–
Gdańsk	–	–	–	–	+
Katowice	+	–	–	–	–
Kielce	–	–	+	–	–
Kraków	–	–	–	+	–
Lublin	–	–	+	–	–
Łódź	–	–	–	+	–
Olsztyn	–	–	–	–	–
Opole	–	–	–	–	–
Poznań	–	–	–	–	–
Rzeszów	–	–	–	–	–
Szczecin	+	–	+	–	+
Wrocław	–	–	–	–	–
Zielona Góra	–	–	–	–	–
Total	2	1	3	2	2

Source: author's work based on the adaptation plans studied.

The spatial planning tool most widely used in the municipal plans for adaptation to climate change in the sphere of reducing pressure on floodplains was the urban planning standard, followed by the concept of blue-green infrastructure and adaptation of planning documents to the forecasted flood risk.

One tool was used in the sphere of protection against strong winds, local hurricanes, and whirlwinds – a land survey of urban green areas and facilities in urban areas in terms of their vulnerability in extreme weather conditions. Its use has been declared by four cities: Bydgoszcz, Lublin, Szczecin and Wrocław.

The following eight cities reported the protection of biodiversity and components of the natural environment through accounting for the results of

DOI: 10.34659/eis.2022.80.1.427

the dendrological survey and assessing the value of trees in municipal adaptation plans: Białystok, Bydgoszcz, Kielce, Lublin, Olsztyn, Opole, Poznań and Wrocław.

Six cities declared ongoing updating of visualisations of the distribution of exposure to climate risk in various areas of the city in their plans for adaptation to climate change: Białystok, Gdańsk, Katowice, Olsztyn, Rzeszów and Wrocław.

The scope of using spatial planning tools in all the spheres discussed is presented in Table 5.

Table 5. Spatial planning tools identified in various spheres of adaptation to climate change

City	Sphere / maximum number of tools used							
	Thermal comfort / Max. 5	Ventilation and airing of the city/ Max. 3	Water retention / Max.5	Pressure on floodplains and areas with a high risk of landslides/ Max.5	Protection against solid winds / Max.1	Environment protection Max.1	Visualization of risk exposure/ Max.1	Total
Białystok	2	2	2	0	0	1	1	8
Bydgoszcz	1	2	0	0	1	1	0	5
Gdańsk	3	1	3	0	0	0	2	9
Katowice	2	2	3	1	0	0	3	11
Kielce	3	3	3	2	0	1	0	12
Kraków	2	1	1	0	0	0	0	4
Lublin	3	3	2	2	1	1	0	12
Łódź	1	2	1	0	0	0	0	4
Olsztyn	2	2	2	0	0	1	1	8
Opole	1	3	2	0	0	1	0	7
Poznań	1	0	0	0	0	1	0	2
Rzeszów	0	0	0	0	0	0	1	1
Szczecin	2	3	2	3	1	0	0	11
Wrocław	1	3	2	0	1	1	1	9
Zielona Góra	1	2	3	0	0	0	0	6

Source: author's work.

The information presented demonstrates that in the municipal plans for adaptation to climate change of the cities studied, the richest range of spatial planning tools/planning activities was identified in the sphere of ensuring

DOI: 10.34659/eis.2022.80.1.427

thermal and humidity comfort of the population in public spaces as well as ensuring natural water retention (5), in the sphere of reducing pressure on floodplains and on areas with a high risk of landslides (4) and then in the sphere of ventilation and airing of the city (3). One tool was identified in the remaining spheres of public intervention where spatial planning tools are used. Lublin and Kielce are the leaders of the declared use of spatial planning tools in planning for adaptation to climate change, followed by Katowice and Szczecin. Those most significantly lagging behind include Rzeszów, followed by Poznań, Kraków and Łódź.

A vast majority of identified spatial planning tools are used at the pre-planning stage and are informative and diagnostic in nature (e.g. surveys of the retention potential of water reservoirs and green areas; surveys of greenery and objects located in urbanised areas in terms of their vulnerability to extreme weather conditions; analysis of the scope and distribution of UHIs; assessment of landslide risk) or conceptual (e.g. the concept of building blue-green infrastructure). In the planning phase, an important role is played by urban planning standards, the creation of which is declared in the plans for adaptation to climate change. However, the plans don't make it clear whether adherence to these standards will be mandatory or optional (recommendations only). The most directive is the planning activity intended to be used by Gdańsk and Szczecin and consists of the removal/function change of objects located in high-risk flood zones. Nearly half of the cities surveyed have declared that they would use one of the tools – ongoing spatial visualisations of the distribution of exposure to climate risk – apart from the planning activities.

The above analysis of the use of spatial planning tools in municipal plans for adaptation to climate change in the cities studied should be supplemented by observation of using these tools against the background of other types of tools. Tools/activities have been divided into educational and informational or organisational and technical (investment) activities to develop municipal plans for adaptation to climate change. Spatial planning activities/tools have been placed in the organisational tools/activities group. In general, technical tasks dominate in the analysed plans for adaptation to climate change and are followed by information and education tasks. It should be noted that estimated expenditure amounts were assigned to the individual investment, information and education tasks. On the one hand, it is understandable as, as DuPuis & McFarland (2016) emphasise, the use of tools generating cities' own revenues are limited not only by the local economic and political realities, but – significantly – are inevitably affected by the policies incorporated in the multi-level governance framework that covers not only various levels of the national government, but also non-governmental entities such as international organisations and supranational networks. As cities become

DOI: 10.34659/eis.2022.80.1.427

key players in the process of adaptation to climate change, the question must be about not only what climate tools and strategies to adopt but also how to finance them (Gore & Robinson, 2009; Peterson, 2018). On the other hand, the dominance of investment tasks in municipal plans for adaptation to climate change may mean that their authors consider adaptation to be limited to the technical adaptation of cities to biophysical changes, i.e., incremental adaptation to reduce the cities' susceptibility to climate change. Meanwhile, the latest literature on adaptation to climate change contradicts the efficacy and legitimacy of such perception of adaptation, as it limits the potential of adaptation space (Morchain, 2018; Eriksen et al., 2015; Corry & Jorgensen, 2015). It is suggested to move from incremental adaptation, consisting of further infrastructure investments, to transformational adaptation, i.e., one which aims to eliminate ways of creating susceptibility to climate change. This would mean the need to expand the thematic scope of adaptation processes, and this would require a broader discussion, far beyond the scope of this article.

Conclusions

The conducted assessment of the use of spatial planning tools is the first preliminary attempt to empirically verify the hypothesis about the key role of spatial planning in adaptation processes. Another attempt should be made when the plans are already at their monitoring and review phase and a subsequent one – after their full implementation.

It should be noted that the current assessment faced major problems related, firstly, to the fact that the lists of strategic goals as included in the plans in question had been formulated based on various criteria, and secondly to the fact that in some cases, the responsibility for using a specific tool / performing a particular action was not clearly assigned to organisational units of the local authorities. More often than not, the lists of strategic goals had been devised using the criterion of climate stressor type (e.g. temperature, extreme precipitation) and/or the criterion of the type of action/tool to achieve the goals set (e.g. technical, information and/or educational activities). In this context, the city which stands out is Białystok, as it had identified a detailed strategic goal of adaptation – accounting for climate change in spatial planning – and had just one action assigned to this goal, namely the development and adoption of planning and urbanisation guidelines in view of climate change, those to be accounted for both in a study on pre–conditions and directions of the city's spatial development and the resulting local plans for spatial development. Only five municipal climate change adaptation plans specify which organisational units will be in charge of implementing individual adaptation measures.

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