

PLANNING CLIMATE CHANGE ADAPTATION IN SMALL AND MEDIUM-SIZED TOWNS – RESULTS OF PRELIMINARY RESEARCH IN SOUTHERN WIELKOPOLSKA REGION

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ABSTRACT

Urban adaptation to climate change is necessary. However, this process occurs mainly in big cities. In less populated areas, climate change adaptation actions are conducted and investigated less frequently. The goal of the study was to examine whether and what type of climate adaptation actions are planned in small and medium-size towns and whether town size is related to the advancement of adaptation planning. The research was carried out in 5 differently sized towns in southern Wielkopolska Region: Żerków, Koźmin Wielkopolski, Pleszew, Jarocin, and Ostrów Wielkopolski. The analysed materials were the minutes of town council sessions in 2017–2021 and the resolutions adopted by town councils. The resolutions were analysed in terms of reference to pro-climate actions. It was found that climate-related topics were addressed by 4-6% of the resolutions adopted by town councils. In most cases, the planned actions were related to the following sectors: transport, power engineering, and water management. The study found a link between town size and the number of documents addressing pro-climate actions.

Keywords: city, measure, midwestern Poland, pro-climate, town council resolution

INTRODUCTION

The necessity to prepare towns and cities for predicted and already observed climate change has been confirmed many times (Castán Broto & Westman, 2020; EEA, 2016; IPCC, 2021; Mohamed Jameel & Abed Hassan, 2022). Most advanced towns and cities in terms of adaptation to climate change are big cities. Thus, interest of researchers is focused on them (Olazabal & Ruiz de Gopegui, 2021; Otto et al., 2021ab; Patterson, 2021; Pietrapertosa et al., 2019; Reckien et al., 2018). For example, research studies conducted for Italian towns to evaluate the

planning of climate change mitigation and adaptation include 76 large and medium-size towns (Pietrapertosa et al., 2019). Similarly, an overview of climate change adaptation carried out for 104 German towns and cities focuses on large and medium-size cities; smaller towns are represented by 24 towns of a population of at least 50 thousand (Otto et al., 2021ab). To analyse institutional adaptation in a specific field (municipal water), based on a sample of 96 big cities on six continents, the study selected cities with a population of >400 000 (Patterson, 2021). In the extensive research by Reckien et al. (2018), devoted to the assessment of local climatic plans and encompassing as many

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as 885 towns in Europe, only 10 towns (1.1%) have a population of less than 50 thousand. Olazabal & Ruiz de Gopegui (2021) in their ex-ante evaluation of adaptation planning in 59 cities located in developed and developing regions of the world considered only coastal cities of a population of over 1 million.

So far, much less attention has been devoted to adaptation in small towns (Lehmann et al., 2021; Mitchell et al., 2022; Salvia et al., 2021ab). Lehmann et al. (2021) developed a typology of coastal towns and cities which may help to identify all barriers to or possibilities of planning, development and implementation of adaptation strategies. Salvia et al. (2021b) conducted a comparative analysis of climate change mitigation goals declared in local climatic plans of 327 European towns and cities. Their study took into consideration towns of a various size, including small ones of less than 50 thousand residents. The smallest town in the study had a population of 17,163. The work by Mitchell et al. (2022) is a case study of small German towns concerning implementation of adaptation platforms in Boizenburg, located in north-east (11,488 residents), and in the administrative unit of Verbandsgemeinde Liebenwerda in southern Brandenburg, which is composed of four towns of a total population of 24,250.

Nevertheless, even in big cities the degree of adaptation to climate change is most often evaluated as not very advanced (Araos et al., 2016; Olazabal & Ruiz de Gopegui, 2021; Otto et al., 2021ab; Planning for Climate, 2020; Reckien et al., 2014, 2018). Poor advancement of adaptation to climate change is well illustrated in the results of the research by Araos et al. (2016) conducted in 401 cities across the world of a population of >1 million, out of which only 15% took any adaptation initiatives until March 2014. Research carried out a few years later for German cities showed that adaptation initiatives were mostly or entirely absent in about one third of the examined communes (Otto et al., 2021a).

The process of preparation for dealing with climate change effects takes place even more slowly in less densely populated areas and small urban centres (Lehmann et al., 2021; Otto et al., 2021b;

Planning for Climate, 2020; Salvia et al., 2021ab). In the assessment of readiness for adaptation carried out on a sample of 104 German towns the lowest rates were among a group of the smallest towns, in this case from 50,000 to 100,000 residents (Otto et al., 2021b). The resources at the disposal of small communities allow them only to conduct adaptation actions to a limited extent (Fitton et al., 2021; Häußler & Haupt, 2021; Kalbarczyk & Kalbarczyk, 2022). Moreover, the adaptation actions taken in the first place are usually reactive (Dulal, 2018; Termini & Kalafatis, 2021). Comprehensive planning and implementation of diverse adaptation actions to climate change require not only big financial outlays but also appropriate competences, organisational skills and application of modern and innovative technologies (Castán Broto & Bulkeley, 2013; Kalbarczyk & Kalbarczyk, 2022; Olazabal & Ruiz de Gopegui, 2021; Szwerański et al., 2018).

The goal of the work is to examine if and what type of adaptation actions are planned in small and medium-sized towns. In addition, it has been investigated if and how the size of a town is related to the advancement of climate change adaptation planning.

MATERIALS AND METHODS

The selected 5 towns differed in population size: from about 2,000 in Żerków to about 70,000 in Ostrów Wielkopolski (BDL, 2022; GUGiK, 2022). The basic characteristics of the towns are presented in Table 1.

All the towns are situated in the south of Wielkopolska (a region in midwestern Poland), four of which in the Kalisz Upland, and one (Żerków) in its close vicinity. The basic climatic characteristics of the examined towns are similar. Average annual temperature is 8.2–8.4°C and average precipitation amounts to 520–560 mm yearly (Farat, 2004).

The research material consists of existing planning documents and minutes from town council sessions in 2017–2021. The study was based on examination of all the resolutions of town council sessions (in total 3,004 resolutions) with the focus on references to pro-climate actions (Fig. 1). Out of all the resolutions

Table 1. Basic characteristics of the examined towns

Town	Geographical location	Area of town (km ²)	Number of residents	Average annual air temperature (°C)	Aaverage annual precipitation total (mm)
Ostrów Wielkopolski	N 51°39'17" E 17°48'26"	41.90	68,657	8.4	550
Jarocin	N 51°58'25" E 17°30'04"	21.96	25,838	8.2	540
Pleszew	N 51°53'50" E 17°47'08"	13.38	16,080	8.3	520
Koźmin Wielkopolski	N 51°49'39" E 17°27'14"	5.89	6,366	8.3	550
Żerków	N 52°04'06" E 17°33'46"	2.16	2,120	8.2	560

Source: own preparation.

the study identified those which can contribute to climate change mitigation or urban adaptation to climate change effects. The catalogue of adaptation measures has been adopted from Biagini et al. (2014) and is in line with the guidelines of Adaptation

Handbook for Cities (Podręcznik adaptacji dla miast, 2013). Examples of mitigation actions are: reducing greenhouse gas emissions, improving energy efficiency or using renewable energy sources, while adaptation actions include e.g.: construction of flood banks

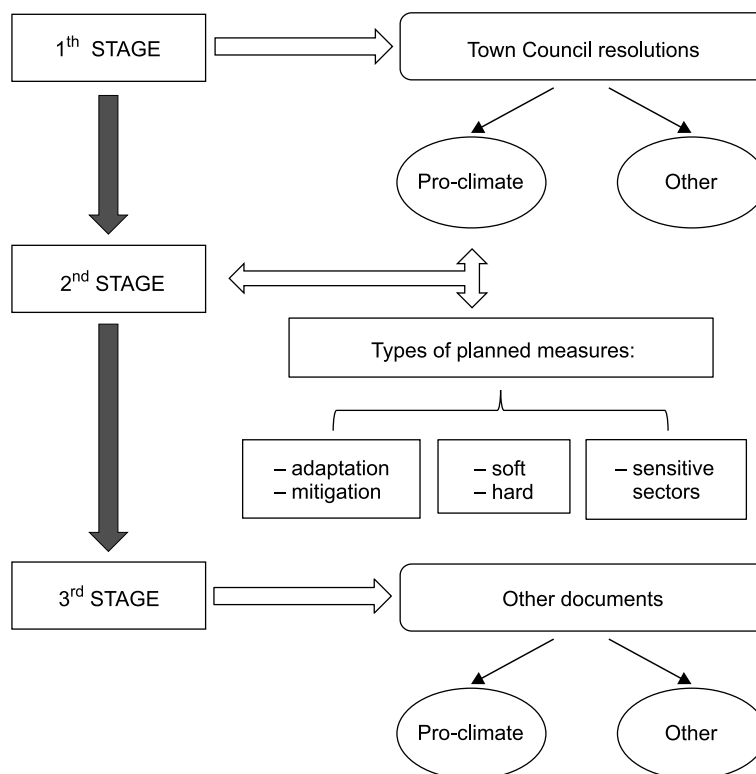


Fig. 1. Stages of the research procedure
Source: own preparation.

and storage reservoirs, development of green areas, education regarding good practices, development of information and early warning systems.

In the next stage, the selected resolutions were grouped according to: a type of planned measures, the division into soft and hard measures (<http://www.future-cities.eu/>, Ford et al., 2013), and according to being related to one (or more) of the sectors sensitive to climate change in Poland, as described in the Strategic adaptation plan... (SPA, 2013). Ford et al. (2013) defined hard measures as interventions of an easily observable influence. On the other hand, he described soft measures as being more effective in reducing vulnerability to threats. The division is clarified more specifically by Sovacool (2011). According to Sovacool (2011), hard adaptive measures include “capital-intensive, large, complex, inflexible technology and infrastructure, whereas soft adaptive measures prioritize natural capital, community control, simplicity and appropriateness”. The document Strategic adaptation plan... (SPA, 2013) indicates goals and directions of adaptation actions to be taken in the sectors and areas that are most vulnerable to climate change. The most sensitive sectors and areas comprise: water management, agriculture, forestry, biodiversity and protected areas, health, the power industry, construction, transport, highlands, coastal areas, spatial economy and urbanised areas. Vulnerability of these sectors is determined based on climate change scenarios adopted for the Strategic adaptation plan... (2013).

In the last stage, the other available documents, strategies, programmes, etc. which had been adopted by the investigated towns were analysed. Similarly to resolutions, these documents were studied with respect to a type of planned pro-climate actions.

The results of the study are presented graphically with the use of Microsoft Office, including Excel.

RESULTS AND DISCUSSION

In total, the study covered 3,004 resolutions adopted in 2017–2021. Their number increased along with the size of a town with an exception of the biggest town, Ostrów Wielkopolski, where it was 110 smaller

than in the second biggest town – Jarocin. In the smallest towns, Żerków and Koźmin Wielkopolski, the town councils adopted on average about 70–80 resolutions yearly; in Pleszew about 120 resolutions/year; and in the two biggest towns, Jarocin and Ostrów Wielkopolski, approx. 150–170 resolutions each year. It was found that at the end of 2021 none of the considered towns developed a municipal plan of adaptation to climate change. This confirms an observation that a program and financial support guaranteed on a supra-local level have a fundamental importance for the planning of urban adaptation to climate change (Kalbarczyk & Kalbarczyk, 2022; Otto et al., 2021a). Small and medium-sized towns were not qualified to the first governmental project from 2015–2019 which supported development of adaptation plans for towns with a population of more than 100,000. In a new draft law aimed at strengthening of the climatic dimension of the municipal policies from 2021 (<https://www.gov.pl/web/premier/projekt-ustawy-o-zmianie-niektorych-ustaw-w-celu-wzmocnienia-klimatycznego-wymiaru-polityki-miejskiej2>), it is planned to make development of municipal adaptation plans obligatory for towns with a population of more than 20,000, which may contribute to popularisation of adaptation plans also in smaller towns.

Analysis of the problems mentioned in the resolutions of the examined towns shows that the issues relevant from the perspective of climate change adaptation and/or mitigation were included on average in 5% of the resolutions. The percentage of such resolutions in all of the towns was similar and oscillated between approx. 4% in smallest Żerków and approx. 6.7% in Pleszew (Fig. 2).

It is worth noting that the relationship between the size of a town and its readiness to mitigate the effects of climate change has not been unequivocally confirmed so far (Heidrich et al., 2013; Kalbarczyk & Kalbarczyk, 2022; Otto et al., 2021b; Reckien et al., 2015).

On the other hand, the structure of the topics addressed by resolutions contributing to climate change mitigation or adaptation indicates some differences, related to the size of a town. Namely,

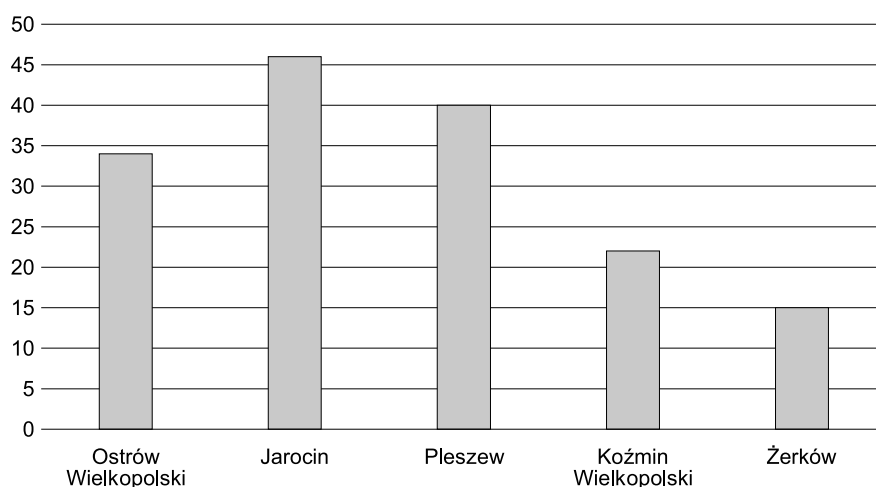


Fig. 2. Number of town council resolutions on climate change adaptation and/or mitigation in 2017–2021 in the selected towns of Wielkopolska

Source: own preparation.

a definite prevalence of adaptation actions over mitigation ones (53% vs 27%) was visible only in the smallest of the considered towns, i.e. Żerków (Fig. 3). In two other small towns, Koźmin Wielkopolski and Pleszew, the prevalence of adaptation actions over mitigation measures was kept, but it was not as distinct as in the previous example (in Koźmin Wielkopolski 54% and 41% respectively; in Pleszew 45% and 42% respectively). The reverse situation, i.e. the prevalence of mitigation measures over adaptation ones, was observed in the case of the two biggest

towns. The difference was particularly big in the second biggest town, Jarocin, (52% vs 28%), and in Ostrów Wielkopolski, the biggest town, was slightly less noticeable (47% vs 32%).

Mitigation measures include actions aimed at reduction of greenhouse gases, e.g. investment in thermal efficiency improvement of buildings, low-emission transport or renewable energy sources (Biagini et al., 2014; Salvia et al., 2021b; Walsh et al., 2011). This type of investment programmes are run on a large scale mainly in big Polish cities. Actions

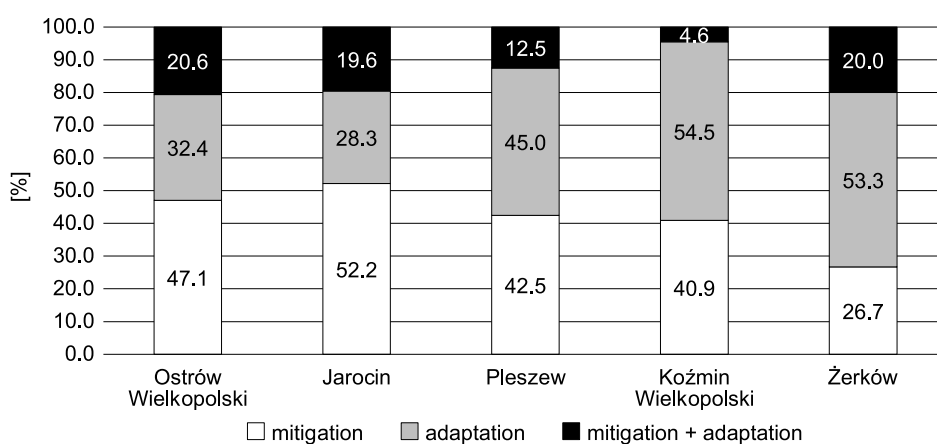


Fig. 3. Structure of action types contained in particular resolutions adopted by the selected towns of Wielkopolska in 2017–2021

Source: own preparation.

for reduction of greenhouse gas emission have a long history dating back to the end of the 1980s (Otto et al., 2021a). The prevalence of mitigation over adaptation measures in big cities was especially visible at the end of the 20th and the beginning of the 21st century (Hardoy & Lankao, 2011; Heidrich et al., 2013; Reckien et al., 2014). Municipal adaptation plans for about the 40 biggest towns and cities in Poland, developed in the late 2010s, also included mitigation measures (Kalbarczyk & Kalbarczyk, 2020). According to Reckien et al. (2015) or Roberts and O’Donoghue (2013), the prevalence of mitigation over adaptation measures is typical of the towns which begin pro-climate actions. However, it is worth noting that in each of the examined towns the planned actions included both mitigation and adaptation measures. A comprehensive approach and co-occurrence of the groups of actions is assessed positively and even recommended for planning practices (Ayers et al., 2014; Reckien et al., 2014; Roberts & O’Donoghue, 2013; Walsh et al., 2011).

An in-depth analysis of the identified adaptation actions shows that soft actions were planned more frequently than hard ones in two smaller towns, i.e. in Pleszew and Koźmin Wielkopolski (72% and 63% respectively), and as frequently as hard measures in medium-sized Jarocin (Fig. 4). Hard measures were most often planned in two towns, the most extreme

in terms of population, i.e. the biggest – Ostrów Wielkopolski, and the smallest – Żerków. In this situation it would be difficult to point to any regularity. In the typology of adaptation actions proposed by Biagini et al. (2014) the majority of the 10 differentiated types have an organisational and planning character; only two types are connected with development of infrastructure (technical infrastructure, green infrastructure). Also the research by Patterson (2021) shows a prevalence of soft over hard measures among the forms of institutional adaptation. It is emphasised that the prevalence of soft over hard actions is due to much lower costs of implementation. In the biggest Polish cities which have the plans of adaptation to climate change hard actions prevail over soft ones, which can be to a large extent caused by a big share of de facto mitigation actions in these plans. Such diverse approaches can be explained by individual investment policies of given towns.

More detailed information about the planned adaptation actions was provided by analysis of the structure of sensitive sectors referred to in adaptation resolutions of the examined towns. In this case a few regularities can be noticed.

In each of the examined towns, resolutions were related to at least several sectors sensitive to climate change. The most common topics put to the vote were water management, power engineering,

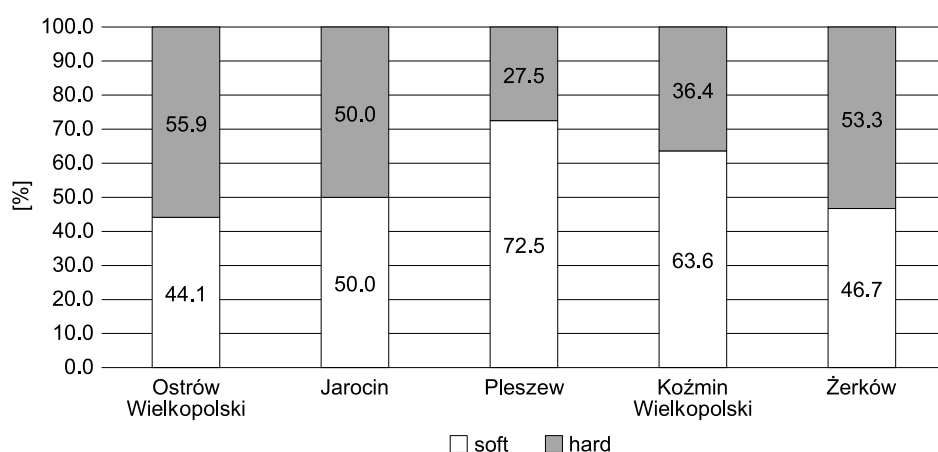


Fig. 4. Structure of types of adaptation actions in adopted resolutions of the selected towns in 2017–2021

Source: own preparation.

transport, spatial management, urbanised areas, biological diversity and environment protection (Fig. 5). Least often, namely only in one town, the vote regarded the sector of forestry (in Ostrów Wielkopolski); in two towns the vote regarded the sector of construction (Jarocin, Żerków); in four towns the adopted resolutions concerned health (with the exception of Ostrów Wielkopolski). Thus, out of the 9 sensitive sectors specified for Poland in the Strategic Plan of Adaptation (SPA, 2013) in the examined towns resolutions were related to 8 of them (agriculture not included).

In the three smaller towns the biggest number of resolutions were related to the water management sector (32–33% of resolutions; most in Żerków, 33.3%); power engineering was also an important sector (24–27% of resolutions). In the biggest of the examined towns, Ostrów Wielkopolski, the adopted resolutions were related to power engineering (33.3%) and water management (25%). On the other hand, Jarocin focused on development of transport (27% of the resolutions) and, like in Ostrów, water management (24%). In the two biggest towns, Ostrów Wielkopolski and Jarocin, the second most frequently considered sensitive sector was water management. Except for Jarocin, the share of resolutions on transport

was from almost 5% in Żerków to 16–20% in the remaining towns. In the study conducted by Reckien et al. (2014), in most cities in Europe the majority of measures mitigating climate change was related to power engineering and transport. Transport and power engineering are also the main sensitive sectors shown in municipal adaptation plans of the biggest Polish cities (Kalbarczyk & Kalbarczyk, 2020, 2022).

In the next stage of the study, other documents that can be regarded as pro-climatic which were adopted by particular towns became analysed. These were: a low-emission economy plan, a multiannual municipal development plan, a municipal programme for environmental protection, a multiannual development and modernisation plan for water supply and sewage facilities, a plan of sustainable municipal mobility, etc.

It was found that by far the biggest number of documents fitting in with the examined topics were developed in Jarocin; the number of documents of that type developed in Ostrów Wielkopolski and Pleszew was one third smaller; the smallest number of documents was prepared in the two smallest towns, i.e. in Koźmin Wielkopolski and Żerków (Fig. 6). In this case one can notice a clear link between town size (expressed as population size) and the number of prepared documents connected with pro-climate

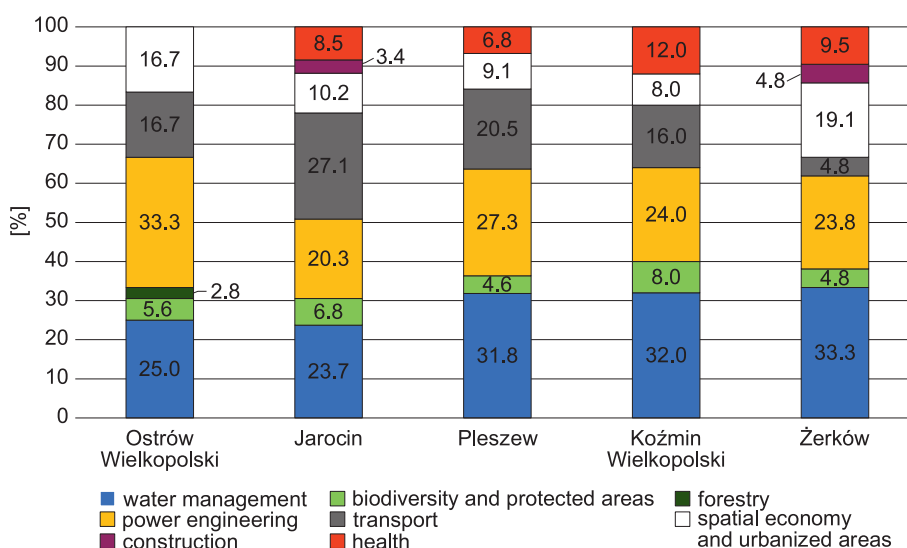


Fig. 5. Structure of sensitive sectors referred to in selected resolutions adopted by the examined towns in 2017–2021

Source: own preparation.

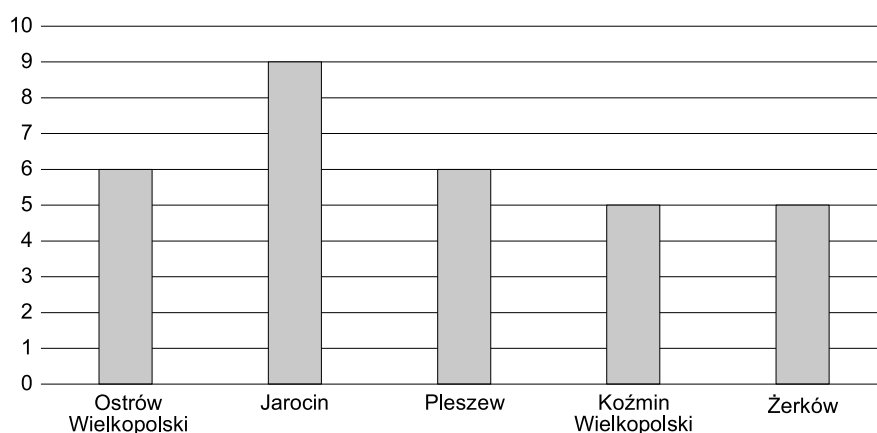


Fig. 6. Number of binding documents addressing pro-climate actions in the examined towns
Source: own preparation.

actions. As mentioned above, a lot of research studies have demonstrated a positive correlation between the size of a town and pro-climate activity (Kalbarczyk & Kalbarczyk, 2022; Otto et al., 2021a).

Out of the documents identified as pro-climate, none dealt solely with the issues of adaptation to climate change. Combining mitigation and adaptation actions also occurred in all the 44 municipal adaptation plans developed as part of the governmental program from 2015–2019 in Poland (Kalbarczyk & Kalbarczyk, 2022). The issues addressed in the studied documents can be classified either as entirely devoted to mitigation (from 40% in Żerków to 67% in Ostrów Wielkopolski) or both to mitigation and adaptation

(Fig. 7). A markedly big share of documents combining both issues was found in Jarocin and Żerków.

It seems that in these towns, a big percentage of documents combining pro-adaptation and pro-mitigation actions results from specific circumstances. As shown above, Żerków was a leader among the examined towns in terms of resolutions referring to the water management sector; also, special emphasis was put there on spatial management. These sectors fit in with adaptation actions (Biagini et al., 2014). In the case of Jarocin, the development of the municipal adaptation plan, which was published in April 2022, may have been of a considerable importance (<https://jarocin.pl/konsultacje-spoleczne/2032-wez-udzial->

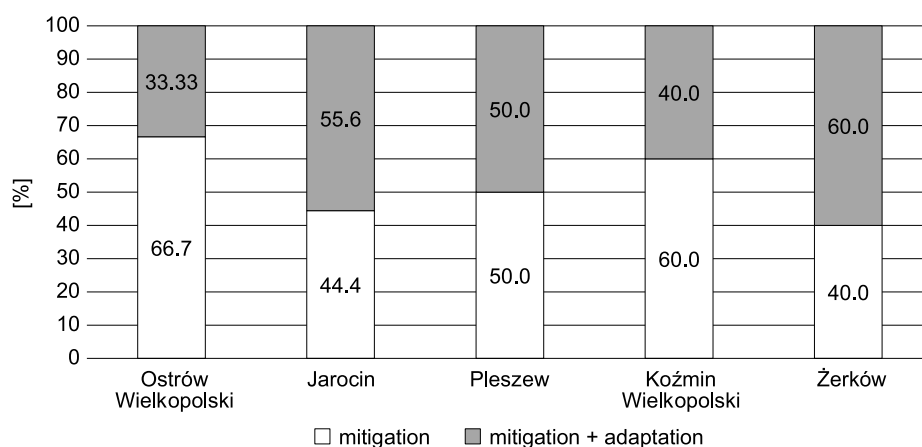


Fig. 7. Structure of pro-climate actions addressed in documents of the examined towns
Source: own preparation.

w-konsultacjach-w-sprawie-miejskiego-planu-adaptacji-do-zmian-klimatu). In big Polish cities which developed their adaptation plans, the planned actions also include mitigation measures. However, their share is much smaller and on average amounts to approx. 20% (Kalbarczyk & Piegat, 2021; Kalbarczyk & Kalbarczyk, 2022). Including pro-climate actions of climate change mitigation in planning and limiting negative effects of this change are regarded as appropriate. It is stressed that this approach is comprehensive and possibly has an effect of positive synergies (Hardoy & Lankao 2011; Masson et al. 2014).

CONCLUSIONS

The small and medium-sized towns located in southern Wielkopolska have planned actions intended to limit climate change and mitigate its negative effects.

Among the planned pro-climate actions the majority were mitigation measures. At the end of 2021, none of the examined towns developed a municipal plan of adaptation to climate change or any other document fully devoted to adaptation to climate change. It was noticeable that bigger towns (expressed as population size) prepared more documents connected with pro-climate actions.

The examined towns, regardless of size, focused on actions connected with transport and power engineering, and next on water management. The share of adaptation actions in the overall number of planned actions connected with climate change, in comparison to the Polish cities which developed municipal adaptation plans, was relatively small.

The obtained results can be a starting point for future, wider research. In the case of towns without an adopted plan of adaptation to climate change, it is possible to assess the advancement of preparations for climate change mitigation. However, it requires conducting time-consuming research. Due to increasing climatic risk, the research should be continued and extended to towns located in other parts of the country.

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