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Challenges and coping strategies for the Kraków Metropolitan Area related to the social dimension of energy transformation

Introduction

The Kraków Metropolitan Area was designated in 2014 for implementation in the Małopolska Province, utilizing the Integrated Territorial Investments (ITI) instrument within the framework of the EU Cohesion Policy for the period 2014–2020. Integrated territorial investments enable us to combine funding from different priority axes of one or several operational programs for multidimensional and cross-sectoral interventions, ensuring the implementation of an integrated strategy for a specific territory. To use the ITI instrument, it was necessary to decide the territory in which it will be implemented and to define,

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within the framework of the cross-sectoral strategy for integrated development, the needs of this territory. In Poland, it was concluded that integrated territorial investments will be used to implement sustainable urban development; therefore, areas of ITI realization will refer to urban functional areas (GUS 2025).

The establishment of a joint ITI Association by local governments for cooperation. It was an opportunity to transcend the rigid administrative boundaries of local governments and amplify the impact of implemented projects. Because many concepts and delimitations coexist in strategic and planning documents that decide the directions of regional policy and development of areas at various levels, it should be clearly emphasized here that the supra-local strategy in question concerns the area of the Kraków Metropolitan Area, i.e., fifteen communes. It includes the large city (metropolis) of Kraków and several neighboring communes, where there are villages and settlements linked to the metropolis by various interactive relationships (Figure 1).



Fig. 1. Administrative units belonging to the Kraków Metropolitan Area
Source: KMA 2025

Rys. 1. Jednostki administracyjne należące do Krakowskiego Obszaru Metropolitalnego

The Kraków Metropolitan Area (KMA) reflects the urban development and demographic changes occurring in many similar areas of Poland, which can also be observed as dominant trends in many urban centers worldwide. The region, as well as the rest of the country, is experiencing significant population changes, including the aging of society, changing demographic trends, and an influx of migrants, particularly from Ukraine, due to geopolitical circumstances. The rapid urbanization of the KMA has led to various challenges, including increased traffic congestion, environmental degradation, and conflicts between permanent residents and newcomers. In response to local and wider (national and international) housing demand in the region, investment in residential real estate is growing significantly. However,

due to rising prices, this investment does not contribute to solving the housing problems of the growing number of residents.

Environmental degradation is evident in the decline of green spaces, which are essential for maintaining biodiversity and providing recreational areas for the community. In addition, the rapid influx of new residents has created tensions between established communities and newcomers, often leading to social fragmentation and a sense of displacement among permanent residents.

As Kraków strives for sustainable development, the city faces the dual challenge of accommodating growth while supporting the quality of life of its residents. This balance is crucial as the city seeks to enhance living conditions and preserve its cultural heritage in the face of rapid change. The KMA approach to these challenges is not limited solely to urban planning issues, but also encompasses consideration of social equity issues, particularly in relation to how different demographic groups experience these changes.

This paper explores the multifaceted challenges facing the KMA, including urban sprawl, environmental sustainability, and social cohesion. It examines the coping strategies implemented by local authorities and community organizations to address these issues, including new transportation policies, the promotion of green spaces, and community engagement initiatives. Furthermore, the paper explores the gender dimensions that shape these dynamics, highlighting how diverse groups are affected by and respond to the challenges of urbanization. By analyzing these aspects, this study aims to contribute to a deeper understanding of the complexities involved in managing urban growth in the KMA and the implications for future policy development.

1. Overview of KMA as the carbon intensive territory

Kraków is a city with a rich history, boasting numerous monuments, universities, and cultural institutions. A city renowned for its traditions has become one of the most frequently visited Polish destinations by tourists from around the world. Traditionally, Kraków has been and remains an important commercial center in Europe.

The specificity of the city's development after the end of World War II was related to the intense industrialization of Kraków, which was intended to reduce, among other things, the percentage of people from the intellectual elite, often unfavorable to the communist government. In 1949, construction of Nowa Huta began, the most representative industrial enterprise of socialist realism in Poland. The giant metallurgical plant, Lenin Steelworks, attracted an influx of over 100,000 workers, who lived in housing estates built explicitly for them. For many years, the steelworks was the largest industrial plant in the city. Its operation was associated with significant emissions of air pollution, including harmful substances and unpleasant odors. In the 1990s, the most environmentally burdensome departments of the plant were closed. In May 2019, ArcelorMittal Poland, the steelworks' then-owner, decided to phase out the blast furnace and steelworks due to high electricity prices, the cost of carbon

certificates, and the global slowdown in the steel market. After many years of operation, the Steelworks were closed, as were the Solvay Soda Plant and the Chemical Plant. This improved the air quality in Kraków somewhat, but it also caused social tensions related to job losses.

After the war, an aluminum smelter was built in Skawina, a town near Kraków. For decades, it was one of the primary sources of pollution in the KMA area. Following numerous protests, the electrolysis department of the plant was closed in 1981, which significantly reduced the smelter's environmental impact. The special economic zone attracted companies from the IT sector, including Motorola, IBM, and Cisco.

From a historical perspective, Kraków has developed sectors such as metallurgy, chemicals, pharmaceuticals, tobacco, machinery, clothing, food, electronics, printing, leather, and footwear. Gradual modernization, ownership changes, and the liquidation of the most environmentally harmful industrial plants, which occurred after the country's political changes, have slightly improved the situation regarding emissions.

However, not everything has been done. In Kraków, there is a coal-fired CHP plant with a thermal capacity of 1118 MWt and an electrical capacity of 460 MWe, which produces electricity and heat distributed in the Kraków region. In the context of carbon dioxide emissions, the plant produces approx. 1.1 Mg CO₂/MWh. The total amount of CO₂ emitted in 2019 was 1.6 million metric tons. It is also worth mentioning that in Skawina, two CHP plants supply district heating to KMA.

A real and complex, difficult-to-combat nuisance of the KMA is the so-called "low emission". This emission comes from burning high-emission fuels in households (for heating and cooking). Low emissions and significant air pollution are also the result of the growing number of cars driving on the city streets. Clouds of smoke from car exhaust pipes are becoming a growing problem in the congested city. In Kraków, the problem of emissions from household chimneys has been solved. Since 2019, a ban on burning solid fuels has been in force. However, in the vicinity of Kraków, in municipalities belonging to KMA, over 50% of households still use hard coal to heat their homes. The phasing out of old coal boilers is ongoing, but there is still a considerable distance to go before this fuel is eliminated. Due to Kraków's specific location in a basin, smog from nearby villages penetrates the city, still constituting a problem.

Since Poland joined the European Union in 2004, the business and IT sector in Kraków has been developing dynamically. The city is becoming increasingly attractive to tourists, as well as to investors, particularly in terms of building business outsourcing and IT centers.

However, it was only over the last 10 years that improvements were made. During this time, social activities aimed at improving air quality and reducing sources of low emissions have intensified. Mass protests by residents and non-governmental organizations led to the introduction of the Anti-Smog Resolution in 2017 – i.e., the ban on burning coal and wood in Kraków, as already mentioned above. At that time, a program was also established to eliminate sources of low emissions from individual boilers.

The situation has also been improved by actions taken nationwide to reduce emissions, such as the introduction of eco-design requirements for boilers up to 500 kW.

2. Materials and methods

The issues presented here are the result of work carried out within the EU ENTRANCES project (ENTRANCES 2025) “ENergy TRAnsitions from Coal and carbon: Effects on Societies,” the aim of which was to examine the impact on society of changes caused by energy transformation in areas requiring a shift away from the use of emission-intensive energy sources. ENTRANCES was a three-year project funded by the European Union’s Horizon 2020 research and innovation program. The project was established within the framework of the topic “Social Sciences and Humanities (SSH) aspects of the Clean-Energy Transition” and the call: LC-SC3-CC-1-2018-2019-2020.

The KMA area was selected as a case study for this project and utilized to examine the multifaceted challenges faced by residents related to the city’s development and changes in the surrounding areas’ functions. The multitude of problems brought about by transformation processes requires local authorities and social organizations to develop and implement strategies for solving these problems. Managing the development of such urban areas is a complex process that involves not only solving technical problems, such as adapting communication systems or protecting and expanding green areas, but also directing social initiatives towards implementing sustainable solutions.

During the work on the ENTRANCES project, focus group studies and in-depth interviews were conducted in Kraków, which enabled the identification of the main problems related to environmental and social issues, as well as the challenges faced by the city and the entire Kraków Metropolitan Area. The analysis of the results obtained allowed the authors not only to identify the main challenges but also to make a diagnosis, and in consultation with experts, to develop ideas on how to address them.

The identified main challenges that the region must face, the desired directions of change, and ideas for implementing tasks leading to improvement are described in detail in the later chapters of this work.

3. Challenge 1 – intensive development of the KMA

3.1. The description of the challenge

The Kraków Metropolitan Area (KMA) has experienced a remarkable surge in population and investment, particularly in the residential real estate sector. Demographic expansion is not merely a statistic; it reflects broader socio-economic trends, including urbanization, migration, and economic development, which are reshaping the urban landscape. However, this rapid growth is accompanied by significant stressors that pose challenges to urban sustainability and quality of life.

One of the most pressing issues resulting from population growth is the substantial increase in vehicle traffic. The influx of new residents has led to a dramatic increase in the number of passenger vehicles on the roads, resulting in severe congestion during peak hours. This congestion not only affects the daily commute of residents but also contributes to heightened emissions of greenhouse gases and other pollutants, worsening air quality issues in the region (Danek and Zareba 2021; Janikowska 2025). The deterioration of air quality has profound implications for public health, as studies have shown a direct correlation between air pollution and respiratory diseases, cardiovascular conditions, and other health problems (WHO 2021).

Moreover, the ongoing suburbanization trend has led to conflicts between established residents and newcomers, creating social tensions within the community (Dudzic-Gyurkovich 2021). The population balance within the entire agglomeration is still positive, but there is a decrease in population density in the urban core and an increase in the suburban zone (Beim 2009; Musiał-Malago 2015; Palicki 2017). As new developments move into traditional neighborhoods, long-time residents often express concerns about changes to the character of their communities, increased competition for resources, and potential loss of cultural heritage. These tensions can manifest in various forms, including opposition to new housing projects, protests, and calls for stricter zoning regulations. Addressing these social dynamics is critical to fostering a cohesive community that values diversity while preserving its historical identity.

In response to these multifaceted challenges, the Kraków City Council has implemented a new transport policy aimed at enhancing safety, reducing environmental impact, and improving accessibility (Michnej and Zwoliński 2018). This policy is not an isolated initiative; it aligns national strategies for sustainable transport, which emphasize the importance of integrating public transportation, cycling, and pedestrian pathways into urban planning. By prioritizing public transport options, the city aims to reduce reliance on personal vehicles, thereby alleviating congestion and lowering emissions.

Additionally, the city has recognized the importance of preserving and expanding green spaces within the urban environment. Between 2015 and 2020, Kraków got 105 hectares of land for recreational use, a strategic move aimed at promoting a healthier urban environment (Butryn et al. 2019). Access to green spaces has been shown to enhance the quality of life for urban residents, providing opportunities for recreation, relaxation, and social interaction. Furthermore, green spaces play a crucial role in mitigating urban heat, enhancing air quality, and promoting biodiversity.

To further bolster community engagement and economic contribution, the city has introduced initiatives to promote KMA citizenship through tax incentives (krakow.pl 2021). These incentives are designed to encourage new residents to invest in their communities, fostering a sense of belonging and responsibility. By incentivizing local spending and participation in community activities, the city aims to create a more vibrant and interconnected urban environment.

In summary, the rapid growth of the KMA creates both opportunities and challenges. While the projected population growth signals economic vitality and urban dynamism,

it also requires initiative-taking measures to address the accompanying stressors, the most significant of which are:

- ◆ growth in personal car traffic causing traffic jams, higher low emissions (primarily secondary), increased noise, and a lack of parking spaces;
- ◆ development of housing estates in green areas;
- ◆ conflicts between old and new residents.

Through a comprehensive transport policy, acquisition of green areas and community engagement initiatives, the Kraków City Council is taking significant steps to create a sustainable and inclusive urban future. Further research and cooperation between stakeholders will be crucial to understanding the complexities of urban development and ensuring that the KMA remains a growing and livable region for all its residents.

Currently, Kraków is one of the few Polish cities with moderate positive demographic growth (Metropolia Krakowska 2022). However, these values do not consider that the suburbanization process is ongoing, which is associated with the intensive development of municipalities next to Kraków. Additionally, these data do not consider migration processes. All calculations do not consider, for example, the wave of immigration from Ukraine. This process was intensified by the geopolitical situation (war in Ukraine). It is estimated that in February 2022, the Kraków region welcomed approximately 177,000 emigrants, resulting in a population increase of about 19% in the KMA.

The desired direction for counteracting this is to achieve sustainable development of all city districts and adjacent municipalities, thereby increasing the indicators of quality of life and resident satisfaction. In these categories, Kraków is currently not rated well (Urbnews 2015; Polityka 2018).

3.2. Coping strategies

3.2.1. Implementation of the new transport policy

Sustainable transport development is a strategic direction of the Polish government. In 2013, the Strategy for the Development of Transport in Poland until 2020 (with a perspective until 2030) was created (MT 2013). In 2019, the government adopted another document outlining the country's sustainable transport development plan until 2030 (RM 2019).

In relation to the defined challenges facing Kraków, the Kraków City Council adopted the “Transport Policy for 2016–2025” in 2016 (KCC 2016). This is a basic document that outlines the directions for transport development in the city in relation to the national strategy. The reference point for the transport policy was also the document “Low-emission economy plan for the Municipality of Kraków” (KCC 2015), together with its subsequent updates (KCC 2017; KCC 2018).

The general objective of the transport policy is creating conditions for the efficient and safe movement of people and goods, while limiting the harmful impact on the natural

environment and the living conditions of residents, improving communication accessibility within the city and within the metropolitan area, province, and country in the conditions of sustainable mobility of the urban transport system. The city implements this policy in consideration of the defined tasks.

- ◆ Ensuring the possibility of convenient movement for users of the transport system, both within and outside connections.
- ◆ Development and promotion of ecological forms of travel.
- ◆ Improving the condition of the natural environment, reducing the inconvenience of transport for residents and increasing safety.
- ◆ Improving the efficiency of spatial management and transport.
- ◆ Improving the image of the city and building its prestige.

4. Challenge 2 – shrinking of urban greenspace

4.1. The description of the challenge

Kraków is among the cities with the most significant increase in the number of apartments delivered. Between 2009 and 2019, the number of apartments per 1,000 residents increased by 21%, rising from 426 to 517. Only Wrocław (26%) and Gdańsk (23%) recorded better results.

In parallel with the city's development, there is also a strong tendency to build modern office spaces. In 2024, the office resources in the city totaled 1.83 million square meters (Knight Frank 2025).

This rapid pace of construction is linked to the need to acquire land for development. This has resulted in a decrease in the share of green areas in the city from 76.1% in 2006 to 71.3% in 2021 (Gorzelański et al. 2023). This not only causes a loss of habitats for various species of fauna and flora but also worsens the overall quality of life for residents. Green areas are essential in cities, providing residents with recreational opportunities. Green areas improve the mental health of residents who use them and contribute to the formation and strengthening of social cohesion among community members.

The Scientific Council of the Institute of Nature Conservation has called for the expansion of green areas to counteract this decline, emphasizing the need for a holistic approach to urban planning that prioritizes ecological sustainability (Kalbarczyk and Kalbarczyk 2020).

In light of the increasing elimination of green areas in Kraków, in November 2020, the Scientific Council of the Institute of Nature Conservation of the Polish Academy of Sciences adopted a resolution in which it appeals to the authorities of Kraków to expand green areas gradually, and not to reduce the existing ones (IOP PAN 2020).

4.2. Coping strategies

4.2.1. Development of a detailed city policy on green areas

In response to these challenges, the city has established the Municipal Greenspace Authority, which oversees the management of parks and green spaces, ensuring that urban development does not compromise environmental sustainability (Butryn et al. 2019). This authority plays a critical role in implementing policies that promote the preservation and enhancement of existing green areas while also advocating for the creation of new ones. The authority's initiatives include the restoration of degraded landscapes, the introduction of urban gardening programs, and the promotion of biodiversity-friendly practices among residents.

Moreover, Kraków has made strides in increasing the share of land covered by local spatial development plans, achieving a coverage rate of 7.29% as of April 2022, the highest among major Polish cities (Porębska et al. 2019). This increase in spatial planning coverage is a positive step toward ensuring that future urban developments incorporate green spaces and adhere to sustainable practices. However, the effectiveness of these plans hinges on their implementation and the active involvement of local communities in the planning process.

Public relations campaigns have also been started to raise awareness about the importance of sustainable urban development and the preservation of green spaces (Danek and Zaręba 2021). These campaigns aim to educate residents about the ecological, social, and health benefits of green areas, encouraging them to advocate for their protection. However, despite these efforts, the policies have not adequately addressed gender equality issues, as the initiatives do not specifically target the needs and perspectives of women and marginalized groups (Dudzic-Gyurkovich 2021). This oversight is concerning, as women often experience urban spaces differently than men, and their unique needs must be considered in the planning and management of green spaces.

As a result of the actions taken in the years 2015–2020, 550 “green” investments worth PLN 160 million were implemented in Kraków, which is the largest share (2.1%) in the total expenditure in the group of large cities analyzed (NIK 2022).

4.2.2. Increasing the share of land that is included in local plans as green areas

Green areas included in Kraków's local plans (i.e., Local Spatial Development Plans) play a significant role in both spatial planning and the functioning of the city. In local plans, green areas can be categorized into various types of space, including public greenery, unmanaged greenery, allotment garden areas, and managed greenery areas near public utility buildings.

The green areas included in Kraków's local plans play a key environmental, social, and spatial role. Their purpose cannot be changed at will – each change requires a formal, often multi-year planning procedure. Preserving existing green areas is a condition for the

sustainable and healthy development of Kraków. The share of greenery included in local plans is the highest in Kraków among large Polish cities.

The change of purpose of green areas may take place if:

- ◆ the initiative is taken by the Kraków City Council (at the request of the mayor, investor, or residents);
- ◆ the procedure for changing the MPZP is carried out following the Spatial Planning and Development Act;
- ◆ environmental and urban requirements are met.

Often, changes to plans that harm greenery arouse social protests as residents fight to preserve parks, meadows, and urban forests.

4.2.3. Intensification of activities aimed at the education of residents on the sustainable development of the city.

The city conducts information campaigns on planning topics and promotes “green initiatives” in the Kraków Metropolitan Area. An information policy is being implemented on the city’s natural assets. Particularly valuable natural areas are under strict protection. An Ecological Education Center and various environmental education points have been established. The city (in 2022 and 2024) applied for the title of European Green Capital (unfortunately unsuccessfully).

5. Challenge 3 – Kraków as a pioneer of decarbonization activities in Poland

5.1. The description of the challenge

Kraków has proven itself to be a leader in decarbonization initiatives, implementing several pioneering projects aimed at reducing emissions and promoting sustainable transportation (Oleniacz et al. 2018). Notable achievements include the creation of the first clean transport zone in Poland and the transition away from solid fuel heating in the city’s households (Michnej and Zwoliński 2018). These initiatives demonstrate a commitment to combating climate change and enhancing air quality, a significant public health concern in Kraków. However, these ambitious initiatives have been met with resistance from residents due to a lack of transparency and communication about the impacts of these changes (Szpakowska-Loranc 2021). For example, a pilot project for a clean transport zone was suspended after only three months due to public dissatisfaction (Gyurkovich and Gyurkovich 2021).

Kraków is a pioneer and innovator of numerous processes aimed at profound transformation. Several actions that have been successfully implemented are being replicated in other Polish cities. The following initiatives were the first to be started in Kraków:

- ◆ designation of the first lane for bus transport;
- ◆ 2008: the first tram tunnel in Poland as part of the Kraków Fast Tram;
- ◆ 2009: the first public bicycles in Poland (100 bicycles left for rent in 12 base stations);
- ◆ the idea of the first clean transport zone in Poland. In 2019, a pilot solution took place in Kazimierz;
- ◆ final implementation of the first ban on burning solid fuels in Poland.

Such activities, which are pioneering in a country or region, mean that their implementation is exposed to misunderstanding by society. This makes their realization even more difficult, even if the program is designed correctly. However, without the possibility of relying on already implemented examples, it is easy to make mistakes that will cause deep opposition from society, resulting in an extension of the implementation time and often also their abandonment.

These types of initiatives often require more financing and can often constitute an argument for opponents of change.

5.2. Coping strategies

5.2.1. Promotion of KMA citizenship – new taxpayers in Kraków

Since 2011, the “Pay taxes in Kraków” campaign has been conducted in Kraków. It should be noted that part of the taxes paid in the city remains at the disposal of local authorities, contributing to the increase in the local budget and thus enabling them to decide on the direction of spending. Since 2018, this program has been integrated into the Kraków Card, which offers discounts and benefits in public transportation, cultural institutions, and access to select goods and services. In 2021, approximately 658,000 people paid their tax in the city, and 25,000 did so for the first time (krakow.pl 2021). The city’s strategy is an element of the financial policy and enables the implementation of public policies, including decarbonization programs.

5.2.2. Involvement of residents in testing novel solutions

Testing proposed transformational solutions by conducting small-scale tests while simultaneously collecting residents’ opinions on the quality of the introduced changes significantly increases social acceptance of innovations. An example of such an action was allowing fully occupied passenger cars to drive on bus lines. The experiment was conducted on only one communication line.

5.2.3. Participation of citizens in decision-making processes

The resolution of the Kraków City Council imposes an obligation to conduct social consultations for changes introduced that affect the quality of life of citizens. In addition,

a particularly crucial element of increasing citizen involvement is the possibility for them to propose specific investments or changes that can be financed from a separate special participatory budget (Civic Budget) if a larger number of residents appreciates the present ideas for improvements. This gives residents a voice in decision-making.

6. Challenge 4 – conflict between Kraków and adjacent municipalities – low emission policies

6.1. The description of the challenge

The primary reason for Kraków's poor air quality is its location in a basin that collects smoke and smog from the surrounding municipalities. Although coal is not used for heating and cooking in households in Kraków itself, the remaining parts of the Kraków Metropolitan Area still primarily use solid fuels. Furthermore, these areas often rely on outdated heating systems, which contribute to local emissions of particulate matter and other harmful pollutants (Kou et al. 2019). The reliance on such antiquated technologies is not merely a technical issue; it reflects broader socio-economic challenges, including financial constraints and a lack of awareness on the environmental and health impacts of poor air quality.

The slow pace of change in adjacent municipalities raises concerns about the effectiveness of current policies and the potential for continued environmental degradation (Bonenberg et al. 2022). The disparity in regulatory frameworks and enforcement mechanisms between Kraków and its neighboring areas can lead to a situation where progress in one municipality is undermined by inaction in another, perpetuating a cycle of pollution and public health risks.

Institutional support for neighboring communes is critical to accelerating the transition to cleaner energy sources. The Kraków Smog Alert, a grassroots organization dedicated to raising awareness about air quality issues, has been vocal in urging municipalities to follow anti-smog regulations. Their advocacy emphasizes the need for collective action to improve air quality across the region, highlighting that air pollution is a shared problem that requires a coordinated response (Murzyn-Kupisz and Hołuj 2020). The organization has also called for increased funding and resources to support municipalities in upgrading their heating systems and implementing sustainable energy solutions. However, despite these efforts, the gender dimension stays unaddressed. Research shows that the impact of air pollution disproportionately affects vulnerable populations, including women, children, and the elderly, who may be more susceptible to respiratory diseases and other health complications (Makri and Stilianakis 2008).

In conclusion, the conflict between Kraków and its adjacent municipalities over low-emission policies highlights the complexities of addressing air quality issues in

a metropolitan context. While there are concerted efforts to promote cleaner energy sources and stricter emission standards, the slow pace of change in neighboring areas poses significant challenges. A collaborative approach that incorporates institutional support, community engagement, and a focus on gender equity is crucial for achieving significant improvements in air quality across the KMA. By fostering cooperation among municipalities and ensuring that the voices of all community members are heard, Kraków can work towards a healthier and more sustainable urban environment.

A significant source of air pollution in Kraków is the influx of combustion vehicles from neighboring municipalities. The suburbanization process of Kraków is intensifying, and more people are choosing municipalities surrounding Kraków as their place of residence. Meanwhile, the city is still their place of work, which is why more people commute to work in Kraków from their places of residence. Every day, a total of 246,000 vehicles enter Kraków. Additionally, approximately 40,000 vehicles pass through the city in transit traffic. Of these cars, about 16,000 travel through the city center. The yet unfinished investment in the construction of the Kraków bypass contributes to this.

6.2. Coping strategies

6.2.1. Support for neighboring municipalities

Kraków may support neighboring municipalities using an institutional program for replacing coal furnaces and improving their efficiency. The funds earmarked for combatting smog, e.g., the Clean Air Program, may be used for this purpose. Pressure on neighboring municipalities is exerted, for example, by the activities of the Kraków Metropolitan Association.

6.2.2. Adapting local policy to the upcoming energy crisis

The Kraków Smog Alert suggests that it is possible to sue municipalities for pollution (Smoglab 2021). If the replacement of coal furnaces is not accelerated, it will be possible for the Kraków authorities, as well as the citizens of Kraków, to take legal action. Such warnings serve as a means to put pressure on the authorities of neighboring municipalities. The Kraków Municipality and ecological organizations (including the Kraków Smog Alert) want the use of solid fuels to be prohibited throughout the Małopolska Province. Then the replacement of coal furnaces would be pointless. Such regulations were not finally adopted because the energy market crisis caused the postponement of the provisions' validity. Due to the difficulties and the increase in energy prices, the activity of organizations opposing programs cutting low-emission sources in the province has increased.

6.2.3. Clean Transport Zone

The Clean Transport Zone is a way to limit the number of cars entering the city. Several draft resolutions have been prepared so far, with the aim of prohibiting vehicles that do not meet emission standards from entering such zones. For example, the sixth draft act assumed that from January 2024, cars with diesel engines below the EURO 3 standard and diesel engines below EURO 2 would not be allowed to enter the very center of Kraków. Moreover, from January 2030, only vehicles with EURO 5 and EURO 6 (diesel) standards would be allowed to enter the city center. The project was to be supported by the expansion of the agglomeration railway and the Park and Ride parking system. This was to happen simultaneously with the completion of the city's northern bypass. Such a convergence of dates should guarantee that transit cars would bypass the city center.

7. Discussion

This material presents the results of research conducted in the Kraków Metropolitan Area, obtained during interviews and focus group meetings conducted as part of the ENTRANCES project. The results obtained depend, of course, on the precision of the focus group selection and the extent to which they are representative of the entire Kraków Metropolitan Area community. The authors employed a procedure for selecting group members and resident categories, which was developed in detail within the ENTRANCES project to facilitate its application in deliberative processes. It is therefore essential to note that the heterogeneity of groups and categories of residents significantly influences the outcome. Most respondents believed that representatives of various interest groups influence the policymaking process. It was also emphasized that greater engagement of various resident groups and strengthening their position and right to participate in decision-making is crucial for implementing the various stages of the transformation process. Regarding the identified challenges, research participants emphasized that the most crucial element of the energy transformation process in the Kraków Metropolitan Area is the issue of air quality. They emphasized that:

1. Kraków has been fighting with the towns surrounding it for an exceptionally long time. For many years, this was an ecological problem resulting from the proximity of Huta Skawina and Nowa Huta (once treated as a separate town). Currently, due to the actions taken in the city to reduce low emissions, smog from surrounding municipalities that constantly use coal and a significant number of vehicles (often ancient) used by people commuting to work in the surrounding areas has become Kraków's ecological conflict with its surroundings, which has a long tradition.
2. The large-scale development of the city has its consequences in the form of shrinking green areas and significant problems with the city's ventilation. This is caused by significant investments in the construction of apartments and offices, often in areas that are important for keeping healthy air quality.

3. The protection of the city's green areas can be achieved by securing their purpose in the proper planning documents. However, this violates the interests of landowners who see their financial interest in selling them to investors. Although it is challenging, it is necessary to revise the spatial development documents to provide the city with proper ventilation conditions and preserve its natural values.
4. Coordinated actions are necessary between Kraków and neighboring municipalities to improve air quality in the entire Kraków Metropolitan Area. One of the strategic actions should be institutional support for accelerating the program to replace coal-fired boilers in municipalities neighboring Kraków.
5. Although the effects of environmental pollution affect all citizens regardless of their gender, women feel the effects of environmental degradation more strongly due to their roles related to childcare. On the other hand, women are often underrepresented in decision-making processes related to environmental policy, resulting in a lack of consideration for their unique needs and perspectives.
6. Addressing gender disparities in the city's decision-making bodies is essential to creating fair and effective air quality policies that protect all members of the community.
7. Addressing the challenges of transformation requires coordinated action at the metropolitan level. Uneven efforts to promote cleaner energy sources and stricter emission standards pose significant challenges in terms of diluting the effectiveness of these actions. Collaboration, including institutional support, community engagement, and a focus on gender equality, is essential to achieving significant improvements in air quality throughout the metropolitan area. By supporting cooperation between municipalities and ensuring that the voices of all community members are heard, Kraków can work towards a healthier and more sustainable urban environment.

Conclusions

The Kraków Metropolitan Area (KMA) faces a range of complex challenges stemming from rapid urbanization, environmental degradation, and social tensions. Pressures from population growth and economic development have led to significant transformations of the urban landscape, often at the expense of green spaces and air quality. These changes have not only environmental but also social consequences, as they can exacerbate inequalities and create tensions between permanent residents and newcomers. Although the city has implemented various strategies to address these issues, such as establishing a Municipal Green Areas Authority and promoting decarbonization initiatives, significant gaps remain, particularly in gender equality and the representation of marginalized voices in decision-making. The lack of a gender-sensitive approach to urban planning and environmental policy is particularly concerning, as women and other marginalized groups often experience the impact of urban challenges differently. For example, air pollution disproportionately

affects vulnerable groups, including women, children, and the elderly, who may be more susceptible to health problems related to poor air quality. Moreover, the underrepresentation of these groups in policy discussions can lead to a lack of consideration for their unique needs and perspectives. Therefore, the need for sustainable development that prioritizes both environmental and social justice is paramount. Future initiatives must incorporate a gender-sensitive approach to ensure that the diverse needs of all residents are met, thus fostering a more inclusive and sustainable urban environment. As Kraków addresses these challenges, strong leadership, community engagement, and collaboration with neighboring municipalities will be crucial to achieving a sustainable and equitable future for the Kraków Metropolitan Area (KMA). This includes not only implementing effective environmental policies but also creating participatory governance structures that empower residents to participate in decision-making processes. By fostering collaboration among diverse stakeholders, including local government, community organizations, and residents, Kraków can create a more resilient urban environment that addresses the interconnected challenges of urbanization, environmental degradation, and social inequality. Moreover, Kraków must leverage its leadership in sustainable development initiatives to inspire neighboring municipalities to adopt similar practices. Establishing regional partnerships focused on improving air quality, protecting green spaces, and sustainable transport can create a unified approach to addressing these pressing issues. Through collaboration, municipalities can share best practices, resources, and knowledge, leading to more effective and comprehensive solutions.

In summary, KMA is at a pivotal moment where decisions made today will shape the urban landscape for generations to come. By prioritizing sustainable development, encompassing environmental integrity, social equity, and community engagement, Kraków can pave the way for a more inclusive and resilient future. The challenges are significant, but with collective efforts and a commitment to equity, KMA can become a model for sustainable urban living.

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**CHALLENGES AND COPING STRATEGIES FOR THE KRAKÓW METROPOLITAN AREA
RELATED TO THE SOCIAL DIMENSION OF ENERGY TRANSFORMATION****Keywords**

environmental degradation, sustainable urban development, community engagement, gender equality in urban planning, urbanization challenges

Abstract

The article discusses the complex challenges facing the Kraków Metropolitan Area (KMA) due to rapid urbanization, environmental degradation, and social tensions. Population growth and investment in urban infrastructure are leading to significant changes in the urban landscape, with negative impacts on air quality and the availability of green spaces. Although city governments have introduced various strategies to mitigate these problems, such as the creation of the Urban Greening Agency and decarbonization initiatives, significant gaps exist, particularly in terms of representation of marginalized groups in decision-making processes.

The article emphasizes the necessity of an approach that takes into account the diverse and sometimes conflicting interests and perspectives of various social groups in urban planning and environmental policy. In this respect, meeting the diverse needs of all residents becomes challenging, highlighting the need for strong leadership, community involvement, and cooperation with neighboring municipalities in striving for a sustainable and just future for the KMA. Regional cooperation in improving air quality, protecting green spaces, and promoting sustainable transportation can address these issues more effectively. The article's message is that the choices made today will have a long-term impact on the quality of life in the KMA, and sustainable development, which combines environmental integrity with social justice, is crucial for the region's future.

The article concludes with a summary of the key findings and recommendations for future metropolitan policy and practice.

**WYZWANIA I STRATEGIE ICH POKONANIA DLA KRAKOWSKIEGO OBSZARU METROPOLITALNEGO
ZWIĄZANE ZE SPOŁECZNYM WYMIAREM TRANSFORMACJI ENERGETYCZNEJ****Słowa kluczowe**

degradacja środowiska, zrównoważony rozwój miast, partycypacja społeczna, równość płci w planowaniu przestrzennym, wyzwania urbanizacyjne

Streszczenie

W artykule omówione są złożone wyzwania, przed którymi stoi Krakowski Obszar Metropolitalny (KOM) w związku z gwałtowną urbanizacją, degradacją środowiska i napięciami społecznymi. Wzrost liczby ludności oraz inwestycje w infrastrukturę miejską prowadzą do istotnych zmian

w krajobrazie miejskim, negatywnie wpływając na jakość powietrza i dostępność terenów zielonych. Pomimo wprowadzenia przez władze miejskie różnych strategii łagodzenia tych problemów – takich jak utworzenie Agencji Zieleni Miejskiej czy inicjatywy dekarbonizacyjne – nadal istnieją istotne luki, szczególnie w zakresie reprezentacji grup marginalizowanych w procesach decyzyjnych.

W artykule podkreślona została potrzeba podejścia uwzględniającego różnorodne, a czasem sprzeczne interesy i perspektywy różnych grup społecznych w planowaniu przestrzennym i polityce środowiskowej. W tym kontekście zaspokojenie zróżnicowanych potrzeb wszystkich mieszkańców staje się trudne, co wskazuje na konieczność silnego przywództwa, zaangażowania społeczności oraz współpracy z sąsiednimi gminami w dążeniu do zrównoważonej i sprawiedliwej przyszłości dla KOM. Współpraca regionalna w zakresie poprawy jakości powietrza, ochrony terenów zielonych i zrównoważonego transportu może skuteczniej pomóc w rozwiązywaniu tych problemów. Przesłaniem artykułu jest to, że decyzje podejmowane dziś będą miały długofalowy wpływ na jakość życia w KOM, a zrównoważony rozwój łączący integralność środowiskową ze sprawiedliwością społeczną jest kluczowy dla przyszłości regionu.

Artykuł kończy się podsumowaniem kluczowych ustaleń i zaleceń dotyczących przyszłej polityki i praktyki metropolitalnej.