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Michał Kudłacz

City Intelligence as Adaptive and Strategic Capacity: A Comparative Study of Kraków and Prague

Abstract

Objective: The aim of this study is to determine how urban intelligence – understood as collective adaptive and strategic capacity – is manifested in urban development management practices, based on the example of Kraków, and how this translates into the city's responses to climate change challenges, compared to Prague.

Research Methods & Design: A comparative case study approach was used, analysing the latest urban strategies and climate policies of both cities (ca. 2018–2023) to test the hypothesis that a higher level of urban intelligence fosters more effective crisis management.

Findings: Both Kraków and Prague demonstrate key manifestations of urban intelligence in climate policy. Owing to proactive anti-smog policies (including a ban on burning coal in household furnaces), Kraków has reduced particulate matter concentrations by approximately 45% over the last decade, while Prague has implemented a coordinated climate plan targeting a 45% reduction in CO_2 emissions by 2030, demonstrating ambitious, long-term planning. Both cities combine reactive measures with anticipatory adaptation.

Implications / Recommendations: The results highlight the importance of a holistic, forward-looking approach to urban management; integrating *ad hoc* actions with strategic planning increases the effectiveness of responses to climate crises.

Contribution / Value Added: The study offers a new comparative perspective, demonstrating how the concept of urban intelligence can be used to assess and improve cities' adaptive capacity to contemporary challenges (using the climate crisis as an example).

Keywords: city intelligence, urban management, climate change, adaptation, sustainable development, public management, urban resilience, smart city

Article classification: research article

JEL classification: H83, Q01, Q54, Q58, R58.

Michał Kudłacz – Faculty of Public Economy and Administration, Cracow University of Economics; ul. Rakowicka 27, 31-510 Kraków, Poland; e-mail: mkudlacz@uek.krakow.pl; ORCID: 0000-0001-6746-4182.

Introduction

Contemporary cities operate under the conditions of a growing complexity and uncertainty. Digitalisation, globalisation, climate change, and sociodemographic processes place pressure on urban centres, forcing them to seek new ways of management and development. The concept of **city intelligence** emerges as a theoretical framework describing a city's capacity to respond effectively to these challenges through learning, innovation, and long-term planning. This article focuses on city intelligence understood as the urban community's collective adaptive and strategic capacity. The aim of the article is to determine how city intelligence is manifested in urban management practice based on the example of two large Central European cities – Kraków and Prague – and how it translates into those cities' responses to selected contemporary developmental challenges. The research hypothesis was formulated as follows: cities with a higher level of city intelligence (i.e. better integrated resources and learning mechanisms) face crises such as climate change or the erosion of social cohesion in a more proactive and effective way. The objects of analysis for verifying this hypothesis includes cities initially regarded as those with high intelligence.

Literature review

This literature review defines the concept of 'city intelligence' and examines the major challenges facing contemporary cities (such as climate change and social cohesion) that form the context of this study.

Urban intelligence is a concept analogous to individual intelligence, transferred to the level of a complex system such as a city. In psychology, intelligence is classically defined as an individual's general mental ability to reason, solve problems, learn from experience, and adapt to new conditions (Neisser et al., 1996). In relation to a city, one can speak of collective capability – a smart city is one that effectively utilises its resources, learns from experience, and can adapt to dynamic changes in its environment. Initially, the popular term 'smart city' focused on the use of information and communication technologies (ICTs) to improve city services. However, the contemporary understanding of urban intelligence goes beyond the technological dimension – it encompasses the holistic ability of a city to achieve developmental goals through the integration of multiple components: technology, human and social capital, infrastructure, and efficient management.

Caragliu and colleagues (2011) define **a smart city** as one in which investments in human and social capital – as well as modern and traditional infrastructure (ICTs and transport) – translate into sustainable growth and a high quality of life, with wise resource management through participatory governance. Urban intelligence can also be defined as the ability to concentrate and integrate all resources to effectively achieve set goals. In this approach, a smart city harmoniously combines hard resources (technologies, infrastructure, data) with soft resources (knowledge, residents' creativity, social capital) and good governance. Nam and Pardo (2011) as well as Komninos (2014) emphasise the multidimensional and systemic nature of urban intelligence – it encompasses capabilities in infrastructure and technology, the economy, human capital, the quality of life, the environment, culture, institutions, and governance. In other words, urban intelligence is an emergent feature resulting from the synergy of various domains of urban development. It is worth distinguishing the instrumental understanding of a smart city from the strategic concept of urban intelligence. The former, aptly synthesised in Polish literature by Dorota Sikora-Fernandez (2018), primarily concerns digital tools and the reorganisation of public services. 'City intelligence,'

in the approach proposed here, is situated above 'smart', because it emphasises the ability to learn, social deliberation, and strategic leadership (Markowski & Stawasz, 2013). At the same time, it differs from the creative city paradigm, in which Charles Landry (2000) and – from a different perspective – Richard Florida (2002) emphasise the importance of creativity and the creative class as the engine of growth. A smart city combines these three dimensions: it utilises technologies (*smart*), mobilises creative resources (*creative*), and transforms them into strategic, inclusive public decisions (*intelligence*) (Sikora-Fernandez, 2018; Markowski & Stawasz, 2013; Landry, 2000; Florida, 2002). It is worth noting that the concept of urban intelligence integrates and complements several related ideas developed in recent decades. These include:

- **a smart city** – an approach emphasising the use of modern technologies (sensors, big data, AI) in city management. Currently, this concept has evolved towards a more integrated perspective, taking into account social and institutional factors, not just the level of digitalisation. In today's perspective, a smart city does not boil down to being 'packed with electronics'; inclusivity and a tangible improvement in the well-being of residents through technology are equally important. In other words, technology is a means, not an end in itself – a city can be highly digital and yet unintelligent if it lacks a strategic vision or community participation (Hausner & Kudłacz, 2017);
- **sustainable urban development** – the concept of balancing the needs of current development with the opportunities of future generations. Urban intelligence is strongly linked to the concept of sustainable development, as a smart city manages resources in a long-term and responsible manner (e.g. by caring for the environment while simultaneously achieving economic growth). Caragliu and colleagues (2011) define sustainable economic growth and a high quality of life as the central goals of a smart city (Obrębalski, 2016a, 2016b);
- **urban resilience** – the ability of a city to survive and thrive despite shocks (natural disasters, economic crises, etc.) Urban intelligence largely overlaps with resilience: smart cities are also more resilient to crises owing to scenario-planning, economic diversification, early warning systems, and innovations that increase flexibility. However, resilience is a more reactive concept (i.e. survival after a crisis), while intelligence emphasises also the ability to predict and learn for the future (i.e. anticipate crises) (Nam & Pardo, 2011);
- **a circular economy** – an economic model that minimises resource waste. Smart cities are increasingly implementing circular economy principles such as waste recycling, material reuse, and energy conservation. This is a manifestation of a city's economic and environmental intelligence – the ability to innovatively reorganise the city's economic system to reduce its negative impact on the planet and increase self-sufficiency (Caragliu et al., 2011);
- **value economy** – a concept developed by Jerzy Hausner (2019); it postulates that socioeconomic development should be based on respect for values (social, environmental, cultural) rather than solely on the logic of profit. In a city, this means management focused on the residents' quality of life and the common good rather than solely maximising economic indicators. Hausner (2019) eloquently stated (using the example of Kraków) that when permanent residents are driven out of a city by mass tourism, the city loses its vitality and identity. A smart city should therefore balance economic benefits (e.g. from tourism or investment) with the protection of local values and community needs.

The concept of intelligence of cities provides a framework that integrates these approaches, creating a coherent perspective on the city as a learning and adaptive organism. A smart city is a multidimensional system in which technologies interact with human and social capital, and

the entirety is held together by strategic leadership and participatory governance. This approach fills a gap in urban research: traditionally, smart infrastructure, social participation, and disaster resilience have been analysed separately, whereas the concept of smart cities integrates these elements and asks what determines why some cities develop better and recover more quickly from crises than others. This proposed perspective allows a holistic assessment of a city's ability to cope with challenges, taking into account both hard indicators (e.g. CO_2 emissions, the number of start-ups, the availability of e-services) and soft indicators (e.g. social capital, leadership style, innovation culture) (Hollands, 2008).

The concept of urban intelligence differs from both the popular idea of a smart city and the creative city paradigm. The concept of a smart city (often translated as an 'intelligent city') had historically focused on the use of information and communication technologies to improve the functioning of cities – from infrastructure to the management of urban services (Nam & Pardo, 2011). However, critics point out that many so-called 'smart cities' reduce urban intelligence primarily to technical and commercial aspects, omitting the social and institutional dimensions (Hollands, 2008). Hollands (2008) points out that the term 'smart city' is often overused for marketing purposes, and cities described as smart often pursue only a technocratic vision of urban development. Similarly, Kitchin (2014) notes that in the smart city approach, an excessive emphasis on data collection and real-time management can obscure the actual needs of residents and long-term developmental goals.

In contrast, the concept of urban intelligence emphasises the adaptive and strategic capabilities of a city as a complex socioeconomic system. Urban intelligence is not just about infrastructure or urban applications but, above all, the ability to learn and creatively respond to developmental challenges. This means mobilising human capital, knowledge, and institutions to solve problems innovatively and engaging residents in co-creating solutions (Komninos, 2014). The literature emphasises that smart cities, in this sense, are characterised by knowledge-enabling governance, which distinguishes them from narrowly defined smart cities focused solely on implementing new technologies (Ochojski, 2022; Komninos, 2014). In other words, cities with high 'intelligence' are able to integrate the use of modern tools with the development of social and cultural capital, allowing them to better adapt to change and shape their own future in a sustainable manner (Ochojski, 2022).

A different developmental emphasis is found in the concept of **a creative city**. Landry (2000) proposed this paradigm, pointing to the key role of creativity, culture, and creative industries in the development of contemporary cities. A creative city attracts and develops creative talent, fostering social and cultural innovation rather than focusing solely on technology. Unlike a typical smart city, where the main distinguishing feature is 'intelligent' infrastructure and management systems, a creative city emphasises creative capital – the presence of artists, scientists, and the creative sector – as well as climate conducive to the emergence of new ideas and grassroots initiatives (Landry, 2000). Such intangible factors translate into a city's ability to continually renew itself and generate value (e.g. new jobs in creative sectors, improved quality of life through cultural events), which is something that even the most modern technological infrastructure alone cannot provide.

Urban intelligence takes on particular importance when confronted with the real challenges and crises that contemporary urban centres are facing. It could even be said that crises test a city's intelligence – they reveal whether urban systems can effectively, innovatively, and timely address a problem, or whether they respond chaotically and ineffectively. Below, I summarise the key

challenges of our time that test cities, outlining how a highly intelligent city might respond differently than a 'non-intelligent' one.

1. *Climate change and environmental threats*. Global warming and related phenomena – more frequent heatwaves, droughts, heavy downpours, floods, and rising sea levels – pose an unprecedented challenge to both infrastructure and urban residents (Komninos, 2002). A highly intelligent city takes proactive measures to mitigate (i.e. limit its own contribution to climate change, e.g. reducing emissions through electric transport, renewable energy sources, and building thermal modernisation) and adapt (i.e. adapt to changes already underway, e.g. developing green-blue infrastructure: parks, green roofs, rain gardens) (Komninos, 2014). The ability to integrate various policies is crucial – a smart city ensures that spatial planning takes into account climate risks (e.g. avoiding new housing developments in floodplains and ensuring adequate ventilation for cooling the city). Resident participation is also crucial – smart cities engage the community in greenery planting, climate education, and consultations on adaptation plans. These actions are data-driven (e.g. hazard maps, early warning systems for extreme events) (Ochojski, 2017). A low-smart city, on the other hand, often downplays threats or responds only after a disaster occurs (e.g. building flood embankments afterwards). It lacks a long-term vision, resulting in infrastructure remaining inadequate (increasing grid failures during heatwaves, water shortages, overheating buildings, etc.), in which case the costs of environmental crises are significantly higher.
2. *Demographic change and an ageing population*. Many cities (especially in Europe) are grappling with declining fertility rates, an ageing population, and migration (the influx of young people to metropolises, the depopulation of smaller towns). This results in, among other things, a shrinking tax base, labour shortages, a growing number of seniors requiring care, and social depopulation (abandoned homes, the dissolution of local ties) (Ochojski, 2022). A smart city anticipates these trends and pursues an active demographic policy: it supports young families (nurseries, accessible apartments), adapts spaces and services to the needs of the elderly (accessible apartments, geriatric care, telemedicine), and promotes an 'age-friendly city.' Highly intelligent cities view seniors not as a burden, but as a resource – they activate them through, for example, Universities of the Third Age, volunteering, or youth mentoring. At the same time, they strive to attract new residents – e.g. by creating conditions for settlement and enhancing human capital. A city that is not intelligent remains passive in the face of unfavourable demographic changes, which over time leads to uncontrolled city shrinkage as well as spatial and financial degradation (emptying schools, declining municipal revenues, collapsing local services). Failure to adapt means that infrastructure remains inadequate (e.g. public transport does not provide facilities for persons with limited mobility), which only accelerates population outflow and deepens the problem.
3. *Digitisation, automation, and artificial intelligence (AI)*. Technological progress brings cities both opportunities (improved services, new economic sectors) and threats (digital exclusion, job losses, privacy threats) (Kitchin, 2014). A highly intelligent city strives to utilise digitisation inclusively – e.g. through implementing e-government accessible to everyone, data analysis systems, and AI that optimises traffic, energy management, and security (e.g. intelligent monitoring for incident detection). Smart cities invest in their residents' digital competencies (trainings for seniors, public Internet, designing digital services with persons with disabilities in mind – i.e. a 'design for all' approach). At the same time, they consciously address AI threats, establishing, for example, data privacy policies and ethical frameworks for the use

of algorithms. A non-smart city may either delay the implementation of new technologies (falling into digital backwardness at the expense of the residents and competitiveness) or implement them haphazardly and without considering the consequences (Albino et al., 2015). This can lead to a deepening digital divide (when a portion of society does not use e-services), a lack of system interoperability, and cybersecurity risks (implementing the Internet of Things without security). Furthermore, the lack of economic transformation planning can result in sudden unemployment (e.g. truck drivers replaced by autonomous vehicles). A smart city invests in employee retraining and the development of new industries in advance, ensuring that technological change becomes a development stimulus rather than a social shock (Giffinger et al., 2007).

4. *A crisis of the city identity and social cohesion*. Under the influence of globalisation, mass tourism, and cultural homogenisation, many cities are grappling with the following question: who are we as a community? Historic city centres are being gentrified or transformed into open-air museums, weakening the residents' ties to their homes. Unique local characteristics are disappearing under the pressure of global trends (the same chain stores, uniform architecture). At the same time, social bonds are eroding – residents are feeling more and more alienated, while social capital and trust are both declining (Schaffers et al., 2011). A smart city consciously nurtures its identity and cohesion. It understands that cultural heritage, local traditions, and a sense of community are as important as infrastructure investments. Therefore, it supports the revitalisation of authentic spaces (without displacing the existing residents), invests in local culture, and protects the inhabitants against the negative effects of overtourism or commercialisation (Chourabi et al., 2012). As Hausner noted, excessive subordination of a city to tourists or external investors leads to a loss of its vitality; a smart city learns from such situations and strives to preserve local authenticity. In practice, this means, for example, supporting local crafts, organising unique cultural events that build resident pride, or promoting historical education and dialogue between different groups (newcomers versus 'older' residents, ethnic minorities, different generations) (Neirotti et al., 2014). A smart city uses participation tools – participatory budgets, consultations, and dialogue forums – to make the residents feel like co-owners of their space. A low-smart city, on the other hand, neglects the 'soft' aspects of development. The pursuit of capital and investors while ignoring the needs of the local community results in a decline in residents' identification with the city, a loss of trust in the authorities, and social conflicts (e.g. between permanent residents and tourists or immigrants). This erosion of cohesion weakens the urban fabric and makes the city less resilient to other crises.
5. *The linear economy model and excessive consumerism*. The traditional model of urban development was based on the assumption of unlimited growth in consumption and resource use. This leads to a number of problems: congested streets (the dominance of cars), massive waste production exceeding disposal capacity, air and water pollution, and the sprawl of development into suburban areas at the expense of nature (Allwinkle & Cruickshank, 2011). Smart cities attempt to break this paradigm by moving towards a circular economy and more responsible consumption patterns. Public and shared transport is promoted instead of individual cars, incentive systems are introduced to reduce waste and segregate it, and green spaces are protected from development (urban planning to limit urban sprawl). These actions require innovative urban policies, resident education, and often also support for technological solutions (e.g. intelligent energy and waste management systems). A non-smart city often

ignores these problems, leading to an accumulation of negative consequences: a declining quality of life (noise, smog), rising infrastructure costs (the exploitation of new areas), and, ultimately, the need for painful adjustments in the future (Meijer & Rodríguez-Bolívar, 2016).

6. *Economic and financial crises*. Cities operate within a broader macroeconomic context, which makes them vulnerable to recessions, sectoral downturns, and public finance crises. The collapse of a single large employer or an industry (e.g. heavy industry in post-industrial cities) can undermine the foundations of local development. A smart city is characterised by economic flexibility – it diversifies its sources of growth as well as supports innovation and new industries in order to avoid dependence on a single sector. It builds resilience through developing small and medium-sized enterprises (SMEs) and science-business partnerships as well as through attracting creative sectors (e.g. green technologies). Equally important is an intelligent city's financial management, i.e. creating reserves in times of prosperity and utilising innovative financing instruments (public-private partnerships, city bonds, EU funds) (Harrison et al., 2010). During a budget crisis, a smart city can prioritise spending when protecting key services and the most vulnerable populations. By contrast, when an unintelligent city is faced with a crisis, it panics or its decision-making system becomes paralysed – for example, all investments are cut abruptly (the deepening of the local recession) or excessive debt is accumulated without a repayment plan (Batty et al., 2012). The lack of economic diversification means that shocks (such as plant closures) lead to long-term unemployment and degradation (e.g. the so-called shrinking cities). In this context, urban intelligence is demonstrated by the ability to continuously learn and innovate. Some cities have managed to reshape themselves despite the decline of traditional industries (e.g. Eindhoven developed new technologies after the loss of the Philips plant, while Pittsburgh became a centre of education and high-tech after the collapse of the steel industry). This proves that human capital, collaborative networks, and conscious local leadership – i.e. the elements of urban intelligence – make it possible to overcome even profound crises.

The above list does not exhaust all the significant phenomena that may be considered challenges to the functioning and development of cities in the third decade of the 21st century. One could also mention sudden health crises (e.g. pandemics), migration crises, cybersecurity threats, and the crisis of local democracy (declining voter turnout, political polarisation). Each of these also poses a test for the city. Generally, however, from a comparative perspective, a certain pattern emerges: highly intelligent cities are characterised by a greater capacity to survive and thrive in the face of crises, while non-intelligent cities or those of lesser intelligence suffer more severe consequences and recover from crises more slowly. The difference lies in proactivity, the ability to learn, and the ability to coordinate actions: smart cities invest in solutions that pay off later (e.g. green infrastructure, a diverse economy, crisis management systems), while less intelligent cities focus on immediate responses or – worse still – ignore warning signs.

Thus, urban intelligence is a multidimensional collective capability that enables a city to effectively and flexibly address developmental challenges. It encompasses both the ability to react quickly (responsiveness) and the capacity for strategic adaptation – anticipating trends, planning, and continuously improving policies. In the following sections of this article, I will focus on two selected challenges – namely climate change and the identity/cohesion crisis – to empirically examine how urban intelligence manifests itself in the specific actions of Kraków and Prague.

Contemporary approaches to city intelligence increasingly emphasise the people-centric perspective alongside technological innovation. Critics of early smart city models have observed

that many initiatives were overly technocratic, prioritising data and infrastructure while neglecting social capital and community needs. In response, researchers and planners have shifted towards people-oriented analysis, which foregrounds the experiences and demands of citizens. This approach posits that an intelligent city is not defined solely by its sensors or digital platforms, but by how effectively it improves its residents' quality of life and engages them in governance. Notably, Nam and Pardo (2011) conceptualise a smart city as one encompassing not only technology and institutions but also the 'people' dimension, i.e. human and social factors that drive innovation and collaboration. A people-oriented framework thus calls for evaluating urban initiatives through the metrics of citizen well-being, satisfaction, and participation. For example, recent studies propose evaluation models that explicitly integrate user demand and experience; e.g. Fang and Shan (2024) argue that optimising smart city development requires an analysis of public needs and feedback, which, in turn, enhances user experience and guides targeted improvements. In practice, this could mean co-designing services with residents, using surveys and civic tech platforms to gauge satisfaction, and adjusting strategies based on community input. Such an approach ensures that city intelligence remains grounded in inclusivity and social value. By focusing on people-oriented indicators – from citizen satisfaction and trust in local authorities to the level of civic engagement – urban managers can better align smart city projects with the actual priorities of those who live and work in the city. In sum, a people-oriented analysis enriches the concept of city intelligence by ensuring that technological advances translate into tangible benefits for citizens and by making residents active contributors to a city's learning and adaptation processes. Similarly, recent studies highlight that the intelligent city paradigm is an evolution of the smart city concept – one that positions human factors at the centre and aligns technological innovation with sustainability, equity, and resilience goals (Bittencourt et al., 2025).

From the broad spectrum of challenges outlined above, two key issues were selected for in-depth analysis here: (1) climate change, and (2) the crisis of urban identity and social cohesion. This choice requires justification both substantively and in the context of the cities under scrutiny.

Climate change has been recognised as one of the most universal and pressing challenges for cities worldwide. It is a global crisis, whose effects are particularly acute in urban areas (heat islands, extreme weather events, air pollution). At the same time, it requires innovative, systemic solutions that engage multiple dimensions of urban intelligence – technological (e.g. energy innovations), environmental (infrastructure adaptation), institutional (climate policies), social (education and changing residents' behaviours), and spatial (resilience-oriented development planning). Climate change therefore provides an ideal testing ground for cities' ability to think strategically and long-term, transcending the logic of short-term responses. Both Kraków and Prague – although not located on the coast and not directly threatened by, for example, rising sea levels – are already experiencing the effects of climate change (smog episodes and heat waves in Kraków; flash floods and droughts in Prague). In recent years, both cities have adopted significant documents and initiatives in this area (discussed in the empirical section below), which provides grounds for their comparison (Florida, 2002).

The crisis of identity and social cohesion was chosen as the second study, because it represents a challenge from a different sphere – the sociocultural one – complementing the environmental perspective. This issue is often underestimated in the smart city discourse (focused more on technologies and hard metrics), whereas my concept of a smart city treats them as equal. By identity crisis, I mean, among other things, the loss of local character due to global homogenisation, the decline of residents' pride and identification with the place, conflicts between social groups,

and, finally, the negative effects of mass tourism (overcrowding, the commercialisation of public space, the displacement of local communities from city centres) (Landry, 2000). Kraków and Prague constitute an exceptionally good pair for analysing this problem: both cities have a rich historical heritage and a strong tourist brand, which on the one hand is an economic asset, but on the other, it creates problems such as the overtourism in city centres and rising living costs for residents. In both cities, discussions have been held in recent years and certain remedial measures have been taken – for example, in Prague, initiatives to limit short-term rentals (Airbnb) have emerged, and in Kraków, night-time alcohol sales restrictions have been introduced due to complaints about tourist disturbances. Furthermore, both cities face the challenge of integrating new residents (e.g. economic migrants, international students), which is related to social cohesion and integration policies. Analysing this challenge will make it possible to assess the city's '**social intelligence**', i.e. its ability to maintain community, build social capital, and manage value conflicts (Townsend, 2013).

By selecting two such distinct domains (climate–environment versus identity–society), I gain the opportunity to demonstrate that urban intelligence is not a concept limited to a single sphere; instead, it manifests itself in multiple dimensions simultaneously. Furthermore, this allows me to examine whether a city's potential 'smartness' is consistent across these spheres – i.e. whether a city that leads in climate policy also copes equally well with social challenges, or whether there are discrepancies.

Therefore, the study encompasses two thematic dimensions (climate and social cohesion), analysed in two case studies (Kraków and Prague) over the last ~5 years (2018–2023). Moving on, I will present the research approach and analytical tools used.

Research methodology

The study is a qualitative and quantitative comparative analysis of two cities. The case study approach with elements of comparative analysis was used, making it possible to compare the experiences of Kraków and Prague in the context of two common challenges. This design (two cities × two challenges) enables the so-called contrasting cases method within challenges (one can assess how different cities cope with the same problem) as well as a symmetrical method across cities, i.e. how the same city copes with different challenges (whether it demonstrates intelligence in all dimensions or only selected ones, or none).

As to case selection, Kraków and Prague were deliberately selected as large cities with a similar regional context (Central Europe, post-socialist background, EU members) and certain functional similarities (strong historical heritage, important tourist and academic centres). At the same time, they differ in administrative status and size (Prague is the capital and a metropolis of ~1.3 million inhabitants; Kraków is a regional city of ~0.8 million inhabitants). These differences make it possible to consider whether the role of the capital city influences urban intelligence (e.g. greater financial resources, but also a wide variety of problems). The selected pair fits the 'most similar cases' approach – Kraków and Prague share many common features, which enables a better visualisation of how urban policies and governance (the primary research interest) translate into differences in coping with problems, given the relatively similar background (Kitchin, 2015).

The analysis primarily focused on official city strategies and planning documents for both cities, either in force or adopted in recent years. For Kraków, the key documents included: the "Kraków Developmental Strategy. I Want to Live Here. Kraków 2030" (adopted in 2018); the Kraków

Climate Change Adaptation Plan by 2030 (developed in 2018, adopted in 2020); the Environmental Protection Programme for the City of Kraków 2020–2030; and sectoral documents such as the Culture Development Strategy in Kraków until 2030. For Prague, the following documents were analysed: the Strategic Plan of the City of Prague 2030 (adopted around 2016, with a development vision until 2030); the Capital City of Prague Climate Change Adaptation Strategy (approved in 2017), together with the Implementation Plan 2020–2024; the Prague Climate Plan 2030 (adopted in 2021, specifying CO_2 emission reduction targets); and the Prague City Social Integration Policy (Metropolis for All) for 2022–2027. In addition, available statistical data and indicators illustrating the effects of policies were taken into account (for instance, in order to systematise the analysis, a tabular database of city intelligence metrics was developed (see Table 1). These metrics were grouped into dimensions corresponding to key aspects of urban development: technological, environmental, social, institutional, spatial, economic (and, optionally, cultural – partially included in 'social'). The set of indicators was based on a review of the literature on measuring smart cities (see Caragliu et al., 2011; Giffinger et al., 2007 – for 6 domains of a smart city) and the availability of data for the cities under scrutiny. Table 1 presents examples of such metrics – it serves as a research tool for assessing in which dimensions cities achieve high scores and where gaps exist. The empirical analysis focused on a subset of indicators specifically related to the challenges under study (e.g. *environmental* – CO_2 emissions, renewable energy share, green spaces; and *social* – local cohesion indicators, etc.) However, the overall database served as a context for broader comparative analyses of Kraków and Prague (GPC, 2014; EEA, 2020). The content analysis of strategic documents was used (identifying goals, actions, and narratives related to the challenges under study), with simultaneous reference to quantitative measures (hard data). For each city, a 'profile' of actions addressing climate change and the identity/cohesion crisis was developed, followed by a cross-city comparison. The comparison considered four perspectives: (a) *the scope and ambition of the strategy* (whether cities have comprehensive strategies or, rather, fragmented actions); (b) *implementation and outcomes* (what was actually implemented and with what effect, based on indicators); (c) *the nature of the response* (to what extent actions were reactive versus anticipatory); and (d) l*earning and adaptation* (whether cities modified their approaches in response to experience, e.g. strategy updates). The principle of source triangulation was applied – for example, information from documents was confronted with independent data (for climate – air quality measurements, carbon footprint; for consistency – resident opinion surveys, migration statistics, etc.) and with the literature on the subject. These data were obtained from city reports (e.g. reports on the state of the city), national databases, and scientific sources (GUS, 2023; Eurostat, 2024; Kraków City Hall, 2023; HMP Praha, 2024).

To fully operationalise urban intelligence, it is justified to include two additional categories. The first one is territorial capital, understood as a bundle of endogenous tangible and intangible resources that support long-term development capacity (Kudłacz, 1999). The second one involves culture as a resource and mechanism for coordinating activities – a component that builds identity, trust, and the ability to cooperate, thus influencing the productivity of urban policies (Karwińska et al., 2013). In measurement practice, this means adding to the database indicators, among others: (i) the density of cultural institutions per 10,000 residents; (ii) the measures of cultural participation and participation (e.g. turnout in participatory budgeting); and (iii) a proxy for policy co-creation (the number of NGO–city co-projects). The inclusion of these variables strengthens the institutional and social dimension and allows a better identification of differences between cities with similar infrastructure but different coordination efficiency (Kudłacz, 1999; Karwińska et al., 2013).

Table 1. Proposed indicators of city intelligence (by dimension)

The dimensions of the analysis of urban-intelligent areas	The description of the elements of intelligent urban areas
Technological	• *the availability of digital infrastructure* (the share of residents with broadband access; 5G coverage); • *the level of e-administration* (the number of public services available online; the share of residents using e-services); • *technological innovation* (municipal spending on research and development; the deployment of intelligent lighting; traffic management based on the Internet of Things (IoT); • *residents' digital skills* (the share of people regularly using the Internet; programmes for digitally-excluded groups); • *cybersecurity and open data* (the existence of a cybersecurity policy; the number of public datasets released as open data).
Environmental	• *greenhouse gas emissions per capita* (tons of CO_2 per resident per year) and the reduction target (e.g. −45% by 2030); • *the share of renewable energy in municipal energy consumption* (%); • *air quality* (average $PM_{2.5}$/PM_{10} concentrations; the number of smog days per year); • *green infrastructure* (square metres of green areas per resident; the number of parks; the length of green corridors); • *waste and water management* (the share of waste recycled; water consumption per resident; the degree of stormwater retention); • *adaptation actions* (the number of adaptation projects implemented, e.g. rain gardens, flood embankments, early warning systems).
Social	• *human capital* (the share of residents with tertiary education; educational outcomes; the presence of universities and research institutions); • *social capital and participation* (voter turnout in local elections; the number of NGOs per 10,000 residents; participation in civic processes); • *social inclusion and equality* (poverty rate, the Gini index; access to services; migrant integration programmes; gender equality); • *public health and well-being* (life expectancy; physical activity indicators; mental health programmes; access to green spaces); • *culture and identity* (the number of cultural institutions per 10,000 residents; heritage protection; measures to protect authenticity and prevent overtourism; actions to promote local history and traditions).
Institutional	• *strategic management* (current development strategy and sectoral policies; the monitoring of the results); • *transparency and good governance* (placement in transparency rankings; civic budget track record; anticorruption mechanisms; open access to information); • *participation and deliberation* (citizens' panels/juries; budget consultations; participatory spatial planning processes; the representativeness of participation); • *inter-sectoral coordination* (the coherence of strategies; cooperation with districts, public entities and NGOs; the quality of coordination mechanisms); • *the public–private–civic collaboration* (partnerships with universities and business, e.g. technology clusters with city involvement).
Spatial	• *spatial order* (current master plan; the share of areas covered by local plans; the spatial coherence index); • *urban mobility* (the share of public and non-motorised transport in the modal split; the length of rail-based transport; the number of electric public transport vehicles); • *accessibility and spatial inclusion* (the share of residents within a 10-minute-walk distance of basic service clusters; universal design standards and accessibility in public space); • *spatial development management* (the urbanisation rate of greenfields; the control of sprawl; the revitalisation of degraded areas); • *spatial safety* (the number of crimes per 1,000 residents; urban monitoring; intelligent street lighting).

Table 1 – continuation

The dimensions of the analysis of urban-intelligent areas	The description of the elements of intelligent urban areas
Economic	• *city economic condition* (city-level GDP or per capita income; local unemployment; city credit rating); • *the structure and innovativeness of the economy* (diversification; the share of the largest sector in employment; the number of start-ups and tech firms; innovation spending as a percentage of the city budget); • *investment and entrepreneurship* (the value of municipal investments per capita; the number of new business registrations per 1,000 residents annually; the presence of foreign investors); • *fiscal sustainability* (public debt to revenue ratio; financial reserves; budget execution, e.g. the percentage completion of the investment plan); • *the labour market and human capital* (labour force participation; average wages; city-supported reskilling and lifelong learning programmes).

Notes: The table contains sample measures in each category, but in practice, the list can be expanded. Quantitative indicators (e.g. numerical values of emissions, percentage share) should be interpreted in the context of the given city and its strategic goals.

Source: Own study based on the literature indicated in this article.

Table 1 above illustrates the broad perspective on urban intelligence – it encompasses issues ranging from digital infrastructure, through climate change and the environment, to culture and civic participation. In further analysis, I will use selected indicators from this database, particularly those related to the environmental dimension (for the climate challenge) as well as the social and institutional dimension (for the identity/cohesion challenge).

Research and discussion

This section presents the results of the empirical analysis focused on the actions of Kraków and Prague with respect to the two selected challenges. The comparison concerns the scope and ambition of strategies, their implementation and effects, the reactive versus adaptive character of responses and the presence of learning mechanisms (updates, evaluations, participation). The aim is to determine whether elements of city intelligence (learning, anticipation, coordination, participation) are visible in these responses.

Response to climate change – a comparison of Kraków and Prague

Just a decade ago, Kraków struggled with the reputation of being one of the most polluted cities in Europe in terms of smog. Air quality problems (high concentrations of PM10 and benzo(a) pyrene) resulted primarily from the widespread use of coal and wood for home heating, as well as from pollutants entering from the surrounding municipalities (EEA, 2019; GIOŚ, 2020). Faced with the growing health and social crisis, Kraków, under pressure from civic movements (the Polish Smog Alert, initiated in Kraków), emerged as a leader among the intelligentsia in this area: in 2016, a complete ban on burning coal and wood in home fireplaces was passed, which came into effect in September 2019. This was a radical, pioneering step on the national scale – Kraków was the first city in the country to introduce such a regulation. Implementing this ban required a huge organisational and financial effort: between 2016 and 2019, over 14,000 coal-fired

furnaces and boilers were closed down, replaced with district heating, gas, or electric heating (Polish Smog Alarm, 2020). The effects proved measurable: according to data from the Provincial Inspectorate for Environmental Protection, within a few years, PM10 dust concentrations in Kraków dropped by approximately 45%, and benzo(a)pyrene by over 50%. This is also confirmed by an independent analysis – according to the Polish Smog Alarm, after the ban came into force, emissions from the municipal and residential sector dropped drastically, which "can literally be felt in the air" (Polish Smog Alarm, 2020; GIOŚ, 2023). Kraków can therefore be considered to have demonstrated a high degree of urban intelligence, able to learn from data and scientific opinion, engage the public (educational campaigns about smog), and introduce politically unpopular but necessary regulations for the long-term common good. Importantly, Kraków's success inspired other cities and regions – by 2023, over 20 cities/municipalities in Poland had passed similar bans (though not all of them came into effect).

In parallel, Kraków has expanded its climate action plans. As part of the nationwide 44 Municipal Adaptation Plans (MPA) project, a comprehensive Climate Change Adaptation Plan for Kraków was developed in 2018. This document, formally adopted in 2020, includes a threat assessment (including extreme heatwaves, flash floods, and droughts – all specifically mentioned) and a catalogue of adaptation measures. In 2023, the plan was updated and its timeline extended to 2035. The implementation budget was estimated at 11.2 billion PLN. Priority actions within this Plan include: the expansion and modernisation of rainwater drainage systems (e.g. new relief channels, pumping stations); the development of green and blue infrastructure (new parks, rain gardens, green roofs, street greening); the adaptation of public transport to thermal insulation (low-emission rolling stock with air conditioning, new tram lines); the promotion of electromobility (creating a Clean Transport Zone, which would limit the traffic of the most emission-intensive vehicles); and the continuation of programmes to reduce so-called low emissions (the replacement of furnaces, the development of renewable energy sources such as photovoltaic farms, geothermal energy) (Kraków City Hall, 2020, 2024). Many of these initiatives are already being implemented: for example, Kraków launched Poland's first clean transport zone (i.e. a pilot project in the Kazimierz district in 2019, and a citywide one from 2024), is intensively developing its network of bicycle paths (an increase of several dozen kilometres in recent years), and is investing in electric transport (purchasing electric buses and building charging stations). In this way, Kraków is working to change its residents' mobility model, which benefits both climate (reducing CO_2 emissions and pollutant emissions) and the quality of life (Kraków City Hall, 2018; ZTP Kraków, 2019).

In 2021, Kraków also adopted the Kraków 2030 Strategy document on climate neutrality, a local response to the European Green Deal – the goal is to achieve carbon neutrality by 2050. As a signatory to international initiatives (e.g. the Covenant of Mayors for Climate and Energy), the city reports its progress: according to official data, between 2005 and 2020, Kraków reduced CO_2 emissions by approximately 18% and is planning to further accelerate this reduction, including through the modernisation of the heating network (gradual phasing out of coal in the CHP plant) and improve the energy efficiency of buildings. Kraków's climate intelligence is reflected in: (a) *vision and goals* (strategic documents with measurable targets, e.g. emission reduction, adaptation); (b) *policy integration* (linking spatial planning, transport, energy, and public health with the climate perspective); (c) *participation* (e.g. the first citizens' climate panel in Poland took place in Kraków in 2021 – residents developed recommendations for the city); and (d) *implementation and learning* (the actual implementation of numerous measures and their adjustments based on evaluation, e.g. updating the adaptation plan in 2023 to incorporate new data).

Prague's authorities also recognised the threats posed by climate change relatively early and began developing an adaptation plan. In 2017, the Prague City Council adopted the strategic document, namely the Adaptation Strategy of Prague to Climate Change. This strategy identifies the main climate risks for the Czech capital: heat waves (Prague is experiencing an intensification of the urban heat island phenomenon), periodic droughts and water shortages, heavy rainfall resulting in flooding, as well as storms and wind hazards (Magistrát hl. m. Prahy, 2017). The document places significant emphasis on nature-based solutions – greening the city, protecting and restoring watercourses, creating rain gardens, pocket parks, etc. (Magistrát hl. m. Prahy, 2020). Already in the early years of the strategy's implementation, initiatives were undertaken, among other things, to establish flower meadows in parks for water retention, build retention reservoirs, and rearrange some streets to improve city ventilation. Water management is also an important component – Prague is investing in water-saving systems and grey water utilisation, which is important considering the periodic droughts affecting the Czech Republic (Magistrát hl. m. Prahy, 2017).

In 2019, the city went a step further by adopting the Climate Commitment of Prague – a formal climate commitment, according to which Prague pledged to reduce CO_2 emissions by 45% by 2030 (relative to 2010) and achieve climate neutrality by 2050. This very ambitious goal places Prague among the leading cities in implementing the Paris Agreement. To translate these goals into concrete actions, the Prague Climate Plan 2030 was developed in 2021 – a comprehensive plan containing 69 reduction measures approved by the City Council (Magistrát hl. m. Prahy, 2021). The plan was created after extensive debate (the City Council held a lively discussion for four hours before its adoption, demonstrating the high level of interest and the need to build consensus on the topic). The plan's main projects include: the construction of a municipal biogas plant (for the utilisation of organic waste and the production of biomethane as fuel); the use of heat from sewage treatment plants for building heating (an innovative energy recovery project); extensive thermal modernisation programmes for public buildings (energy savings); and the conversion of streetlights into electric vehicle charging stations (which supports the development of electromobility). The plan also envisages increased tree planting – a programme to plant 1 million trees within a decade – and the development of renewable energy in municipal resources (photovoltaic installations on public buildings) (Magistrát hl. m. Prahy, 2021).

Unlike Kraków, Prague has less of a problem with low emissions from household furnaces (the majority of the residents of Prague have long used district heating or gas). However, traffic emissions (car traffic in the city and transport around the city) pose a significant challenge – here, the climate plan envisages the development of the metro (the construction of a new line D), the expansion of the P+R network for out-of-town commuters, and a limited traffic zone in the city centre. In terms of adaptation, Prague boasts a significant achievement: since the catastrophic flood on the Vltava River in 2002, the city has successively expanded its flood protection system (including mobile barriers, polders, and the increasing of the retention capacity of floodplains). When a very high flood wave occurred again in 2013, losses were much smaller owing to the implemented measures. This demonstrates the ability to draw conclusions from the crisis – and thus institutional learning, which is a component of the city's intelligence (Magistrát hl. m. Prague, 2013).

Currently, Prague is perceived as one of the climate leaders in Central Europe. It has been selected for the EU's "100 Climate-Neutral Cities by 2030" mission (Kraków was also included on this list, confirming the ambitions of both cities). Progress is regularly monitored with the use

of indicators – for example, Prague reports that it managed to reduce emissions by approximately 20% between 2010 and 2020, which means that it needs to accelerate its efforts in subsequent years to achieve –45% by 2030 (European Commission, 2022; Prague Magistrate, 2021).

Both Kraków and Prague present examples of urban climate intelligence, albeit with slightly different emphasis. Kraków distinguished itself by effectively reducing local air pollution – a response to a very serious health problem, but one requiring political courage and integrating various measures (legal, financial, educational). This action was initially a response to the smog crisis (situation-enforced decisions), but its implementation demonstrates elements of proactive, systemic thinking (e.g. providing subsidies for residents to replace furnaces, planning the expansion of the heating network). Moreover, Kraków is investing heavily in adaptation (the '2030 Adaptation Plan') – here, it demonstrates proactivity, as many of these adaptation projects are implemented before a disaster occurs (e.g. the construction of water retention systems before an extreme drought). Prague, on the other hand, is characterised by a more visionary emissions reduction strategy aligned with global climate goals. The declaration of a 45% CO_2 reduction by 2030 and the plan containing specific projects both constitute examples of a conscious and strategic approach – it goes beyond simply reacting and anticipates the demands of the future (the EU is striving for carbon neutrality by 2050 and Prague is already implementing this locally). Adaptation measures (green infrastructure, flood protection) also demonstrate proactivity in the vein of the belief that 'prevention is better than cure' (Sikora-Fernandez, 2018).

In both cities, residents' integration into climate action is also evident: Kraków has a citizens' panel as well as active NGOs (Smog Alert), while Prague organises plan consultations or social campaigns (e.g. on saving water) and the integration of climate and social policy (the city even mentions the environment in its integration policy for foreigners, teaching new residents the principles of waste separation, etc., demonstrating holistic thinking).

Regarding reactivity versus adaptability, Kraków first had to respond to years of neglect in its anti-smog policy, which it effectively did by banning solid fuels. After this reactive move, the city shifted to an adaptive approach (planning further actions in advance). Prague, on the other hand, not having experienced such a severe air crisis, could have immediately pursued a more adaptive path, planning for the long term. As a result, both cities are currently quite proactive – they have strategies, measures, and investments to prepare for a climate-sensitive future, not just for short-term firefighting. It could be said that in the environmental and climate dimensions, Kraków and Prague have both achieved a high level of urban intelligence, demonstrated by their ability to coherently act across multiple sectors (energy, transport, urban planning, education) in the name of resilience to climate change.

It is worth noting a certain difference, though. Prague, as a wealthier city and a capital city, has a larger budget, which allows costly investments (the metro, a biogas plant). Kraków, with fewer resources, has focused on relatively less expensive but effective measures (legal and regulatory – such as the fire ban – or organisational, such as the citizens' assembly). Both approaches are tailored to local capabilities, which in itself is a manifestation of intelligence – the ability to select tools appropriate to their own resources.

In summary, in the area of climate change, Kraków and Prague have both demonstrated their ability to be 'learning' urban organisms: recognising threats, utilising expert knowledge, engaging the community, and implementing actions that deliver tangible results (lower emissions, cleaner air, greater resistance to heat and floods).

A response to the crisis of identity and social cohesion – a comparison between Kraków and Prague

As a city with a centuries-old history and unique heritage (the former capital of Poland and its Old Town, a UNESCO World Heritage Site), Kraków benefits significantly from tourism and a vibrant cultural life. However, the last two decades have witnessed phenomena suggesting a certain identity crisis and social tensions. The historic city center has become one of the main destinations for mass tourism in Central Europe, which has led to tourism: the center has become filled with short-term rental apartments (Airbnb), hostels, and nightclubs, at the expense of ordinary residents, many of whom have moved to the outskirts. Professor Jerzy Hausner has described this phenomenon as a kind of loss of the city's authenticity. The challenge has become preserving its "genius loci"—its soul, unique atmosphere, and identity. At the same time, there were tensions between different groups of residents in Kraków: complaints about noisy groups of tourists, a sense of alienation in the city center (overcrowded with tourists), as well as social problems such as spatial segregation (the contrast between the affluent city center and neglected districts such as Nowa Huta) (Zukin, 2010; Hausner, 2019).

The experience of historic cities demonstrates that a city's intelligence in the sphere of identity is revealed in its ability to maintain authenticity while simultaneously leveraging its tourism assets. Landry (2000) points out that creative urban policy relies on harnessing local talent and the communities of practice, not simply importing 'attractions.' According to Florida (2002), long-term attractiveness stems from openness, diversity, and tolerance, which attract human capital. From the Polish perspective, Hausner (2019) as well as other authors point out that the excessive commercialisation of space and its subordination to tourism erodes shared values and trust, which ultimately reduces the city's ability to reach developmental compromises. Therefore, tourism management should balance the interests of residents and visitors, and tools to protect authenticity should be integrated with cultural and housing policies (Landry, 2000; Florida, 2002; Hausner, 2019). Kraków's authorities have gradually begun to address these issues, although it must be admitted that these actions were often reactive – they emerged in response to media criticism as well as a growing number of complaints from the residents. One of the most notorious moves included the introduction of a nighttime ban on alcohol sales in stores throughout the city in 2023 (the so-called nighttime prohibition from midnight to 5:30 a.m.) This resolution, adopted unanimously by the City Council, was motivated by numerous petitions and protests from the residents of the city centre (Old Town, Kazimierz), whose nighttime peace was repeatedly disturbed by parties and drunk tourists returning from clubs. The ban applies to retail sales (shops, gas stations); alcohol can still be consumed in nighttime eateries, but it cannot be purchased 'to go' (Business Insider Polska, 2023). The authorities' justification emphasised that the goal was to reduce nuisance and improve the quality of life for the residents, especially in the busiest districts. This solution represents a compromise (clubs were not closed, but access to cheap street alcohol at night was made more difficult), and observations after more than a year of its implementation indicate that the number of nighttime disturbances has actually decreased. This is an example of a policy that combines regulatory and social dimensions: through regulatory changes, it attempts to protect certain local values (peace, safety, and the residents' opportunities for recreation). It is worth noting that other large Polish cities are also introducing similar night-time restrictions (Warsaw in selected districts, while Wrocław is planning it), which means that Kraków has once again proven to be

a pioneer of a solution that is a reaction to a negative phenomenon related to the globalisation of lifestyle (tourist partying) (Warsaw City Hall, 2023).

Another issue is the mass short-term rental of apartments for tourists (Airbnb). In Kraków, at its peak (2019), sites like Airbnb/Booking offered several thousand accommodations, a significant portion of which were concentrated in the city centre (Inside Airbnb, 2019). This pushed out the residents and led, among other things, to an increase in long-term rental prices. Unfortunately, Polish law does not provide cities with tools to regulate this phenomenon (until recently, there was no legal basis for, for example, limiting the number of listings or rental days). Therefore, Kraków, along with other cities, is seeking legislative changes at the national level – in 2022, the mayor of Kraków, along with the mayors of Gdańsk and Poznań, called for a regulation of rental platforms. Here, one can see that the city's institutional intelligence is encountering a barrier – certain issues require supra-local action. Kraków's adaptability in this area is rather subtle: the city has begun developing support programmes for city centre residents (e.g. grants for tenement renovations for permanent residents) as well as it runs campaigns promoting responsible tourism and, during the COVID-19 pandemic (when tourists disappeared), it encouraged its residents to discover the city's local charms themselves. This was a spontaneous adaptation to the sudden change and as such demonstrates a certain flexibility: when tourists were absent, the city turned to initiatives that integrated the local community with the city (e.g. the 'Be a Tourist in Your City' campaign in 2020) (Kraków City Hall, 2020).

In terms of identity and culture, Kraków has already taken strategic action: it has the Cultural Development Strategy until 2030, which, among other things, assumes the use of culture as a tool for building a shared identity among residents, as well as social integration. This document emphasises that culture should connect people, bridge social divides, and create a sense of community. The implementation of this strategy includes, for example, a rich calendar of city events (festivals, city holidays) and support for grassroots initiatives (grants for NGOs for cultural projects in the districts). The city has also had the Participatory Budget in place for years, allowing the residents to submit and select projects – many of which involve improving local spaces, playgrounds, and green spaces, all of which also strengthen the residents' bonds with their surroundings (Kraków City Hall, 2019; Markowski & Stawasz, 2013).

In terms of integrating new residents, Kraków has in recent years become home to a growing number of foreigners (primarily from Ukraine, especially after 2014 and increasingly after 2022) as well as international students and expats in the business services sector. The city has had to rise to the challenge of integrating them into the local community. Multicultural Centres, information points for foreigners, Polish language courses, and more have been established. In 2021, Kraków adopted the Migrant Integration Policy at the city level, which is a sign of strategic thinking about social cohesion in the context of new demographic realities. One can speak here of social intelligence: the awareness that cultural diversity can be valuable, but requires action (intercultural education, support for integration, preventing the ghettoisation of migrants).

Prague's situation is similar in some respects – the historic centre (*Hradčany*, Old Town) attracts millions of tourists annually. Before the COVID-19 pandemic, the city had attracted approximately 8–9 million tourists annually (compared to Kraków's ~3 million foreign visitors and 5 million domestic visitors in the record-breaking year 2019). The scale of tourism in Prague is therefore even greater, which has led to similar problems: crowding, noise, conflicts over short-term rentals, and rising housing prices. The Czech capital faces the threat of losing its authenticity – some argue that Prague could become an 'open-air museum for tourists,' devoid of the authentic life of its

residents. In response, the authorities have begun aggressively regulating Airbnb. As early as 2019, councillors in Prague 1 (the district encompassing the historic centre) petitioned the government to amend the law to allow local governments to control short-term rentals. Pressure from Prague grew in subsequent years, leading to the Czech government drafting an amendment to the law: it plans to introduce the mandatory registration of all tenants and authorise municipalities to limit the number of rental days (Magistrát hl. m. Prahy, 2019).

In May 2025, Prague officially appealed to the parliament to accelerate work on the so-called 'tourism law,' arguing that uncontrolled tourist rentals in residential buildings were 'hollowing out' the community – the city centre was depopulating and infrastructure was suffering. Data was cited: over 8,000 Airbnb listings in Prague translate into an estimated ~80,000 beds, and the residents complain about noise, garbage, and a loss of neighbourhood community (Expats.cz, 2025). Prague argues that it wants to protect local businesses (e.g. legal guesthouses) and the residents from the negative side effects of overtourism. These actions demonstrate a high level of institutional intelligence: the city was able to diagnose the problem and use all available tools (legislative lobbying, coalitions with other European cities experiencing similar problems, media coverage) to try to solve it, despite its formally limited powers. In anticipation of the bill, Prague has also taken some local steps: increased tax and security inspections in rental buildings (pursuing illegal apartment conversions into capsule hostels) and an information campaign for tourists on how to behave in residential areas (at one time, municipal police patrols roamed the streets of Prague with slogans such as "Respect Our Home" in several languages) (Prague City Tourism, 2019).

Regarding nightlife and public nuisance, Prague, like Kraków, is struggling with the problem of pub crawls (organised nighttime 'pub crawls' for tourists, often involving very loud and uncivilised behaviour). Even before the pandemic, the authorities in Prague 1 had limited the opening hours of some beer gardens and introduced a ban on beer bikes (mobile beer bars) in the city centre. The pandemic brought a period of relief (no tourists), and afterward, the city is working to develop a more sustainable tourism model – one focused on quality, not quantity. This reflects adaptive learning: Prague realised that promoting sheer numbers of tourists backfired, so now strategies (e.g. marketing) emphasise attracting visitors interested in culture, outside the peak season, etc. (Prague City Tourism, 2022).

From the perspective of social cohesion, an interesting element is the 'Prague – a Metropolis for All' concept, i.e. the aforementioned policy for integrating foreigners. This document states explicitly in its vision that "Prague maintains social cohesion and is a city that unites people of all generations, nationalities, and groups." It states that for Prague to be "one living community," it is necessary to prevent prejudice on the one hand and the isolation of minorities in their own ghettos on the other. To this end, the city intends to support the development of civil society and the communication of shared values. In practice, Prague creates Czech language learning programmes, employs intercultural assistants in schools for immigrant children, and subsidises intercultural events (e.g. minority festivals). In other words, it ensures that new residents (including the approximately 200,000 foreigners living in Prague, counting in a large Ukrainian, Slovak, and Vietnamese diaspora) become part of the urban community, while also making sure that the native Prague residents accept them. This is an important element of the city's intelligence: understanding the social fabric and consciously managing it (Magistrát hl. m. Prahy, 2022).

Furthermore, in the sphere of culture and identity, Prague invests in the restoration of its historic monuments (which builds the residents' pride in the city) and in projects commemorating local history (e.g. the anniversaries of the Prague Spring and the Velvet Revolution are celebrated as

part of the identity of a democratic and free city). The city also supports neighbourhood initiatives aimed at integration – e.g. local festivals and community gardens – which foster the rebuilding of ties in local communities weakened by urbanisation. In response to the identity/cohesion crisis, Kraków and Prague are addressing quite similar issues (tourism, short-term rentals, and residential integration), although the intensity of their actions and tools differ. Prague appears to be more systematic and strategic in its approach to social integration – it has an articulated vision of a 'metropolis for all,' with specific goals and actions. Kraków is also doing a lot (a multicultural centre, a cultural strategy), but communicates it less as a coherent whole. The difference may be due to scale – Prague – as a capital city of approximately 1.3 million inhabitants, with 15% of the population born abroad – has had to develop an integration policy. Kraków, with a smaller (though growing) percentage of foreigners, operates more *ad hoc*.

In terms of tourism and the local identity, both cities have acknowledged the problem of uncontrolled rentals and tourist events. Prague is aggressively fighting legislatively (a proactive approach – an attempt to systemically change the rules of the game), while Kraków has so far mainly mitigated the effects (nighttime prohibition, appeals to the government – but there has not been, for example, a local resolution limiting the number of tenants, as Polish law would not allow it anyway). In this respect, it can be assessed that Prague is ahead of Kraków in terms of determination and institutional innovation (e.g. the idea to equip streetlights in Prague 1 with noise sensors and automatically call a patrol if the noise level exceeds the norm – a realistically considered solution). Kraków, on the other hand, demonstrated social intelligence in responding to the residents' voices – the nighttime prohibition was introduced unanimously, meaning that the local authorities listened to the community and were able to convince all councillors that the residents' peace was more important than the freedom to sell alcohol. In terms of reactivity versus adaptability, however, many actions in this area are reactive in nature, i.e. they address problems that have already arisen; cities only began to act when crises became apparent (mass renting, resident protests). It is hard to imagine that the scale of Airbnb could have been predicted a decade ago – this phenomenon exploded with the development of the sharing economy. Nevertheless, it is significant that neither Kraków nor Prague ignored the warning signs for too long: interventions were undertaken relatively quickly (within a few years of the problem's intensification). This is a case of *ex post* learning – 'we have experienced the negatives, we are drawing conclusions, and we are changing policies'.

In terms of urban identity in the strict sense (a sense of pride, self-identification with the city), turnout in local elections or participation in public consultations can be a reliable indicator. Data indicates that voter turnout in the 2018 local elections in Kraków was ~55%, while in Prague it was around 43% in 2022 (PKW, 2018; ČSÚ, 2022). This shows that Kraków's residents are more civically engaged at the local level (although the difference may also be due to the political context). Perhaps the high level of mobilisation in Kraków is a result of its residents' stronger ties to the city – a positive sign of social intelligence (a conscious community). In turn, the lower turnout in Prague may be due to the larger number of foreigners without the right to vote or the generally weaker roots of many new residents. This makes Prague's efforts to build this community even more commendable.

Overall, in terms of the challenge of identity and cohesion, both cities show signs of urban intelligence, although in some respects they are still in the 'adolescent' stage. Cultural and social policies often take longer to bear fruit than hard infrastructure investments. However, Kraków and Prague have initiated processes that demonstrate conscious management of social and

cultural capital. For example, Prague openly declares its values of openness and inclusion, which in times of rising populism can be seen as proof of courage and wise leadership. Kraków, in turn, strives to preserve its *genius loci* by protecting historical monuments, reducing tourist nuisances, and strengthening local communities (e.g. grant programmes for district councils to integrate the residents). These actions align with the definition of urban intelligence as one maintaining the 'social glue,' without which even the most modern city will fall into a crisis of trust and conflict (Putnam, 2000; Hausner & Kudłacz, 2017).

The analysis of the cases of Kraków and Prague confirms that the concept of urban intelligence has an explanatory value – where both cities demonstrated higher intelligence (i.e. the ability to act comprehensively and proactively), they achieved better results in coping with challenges. In the area of climate, the effects are clearly visible (improved air quality in Kraków, an ambitious emission reduction strategy in Prague). In the area of social cohesion, the results are more subtle, but it can be observed, for example, that despite tourism, the old towns of both cities have not yet become 'ghost towns' – in Kraków, owing to certain restrictions and cultural policies, local life continues, and in Prague, the number of permanent residents of the Prague 1 district has stabilised (after a significant decline between 1990 and 2010, the current measures are intended to halt further exodus). This kind of reactive-adaptive mix of urban policies is precisely a manifestation of intelligence: the ability to correct the course of a city's development when certain indicators begin to signal undesirable trends (ČSÚ, 2023).

Conclusions

A general summary of results. The comparative analysis of Kraków and Prague yielded several general conclusions confirming the proposed hypothesis. First, the obtained results confirm that a higher level of urban intelligence correlates with greater effectiveness of urban policies in the face of crises – cities that can learn, anticipate threats, and coordinate actions achieve better results. Examples include the improved air quality in Kraków owing to an intelligent (proactive and integrated) anti-smog policy or the ambitious emission reduction plan in Prague. Second, urban intelligence is processual – it can develop over time through institutional learning, strategy updates, and the accumulation of experience. This means that city authorities are able to build intelligence through conscious actions: establishing new institutions, investing in staff competencies, and creating mechanisms for public participation. From the cognitive perspective, this also suggests the need to monitor and measure this process (the indicator database presented in this article is an attempt to operationalise urban intelligence). Third, the results confirm the multidimensionality of urban intelligence – it encompasses technical (technologies, infrastructure), social (social capital, local identity), institutional (governance, coordination), and spatial dimensions. Effectively responding to challenges requires coherent actions across all these spheres; investing in infrastructure alone is not sufficient without the parallel development of social capital and institutions, just as citizen participation will not yield results without institutional capacity to implement agreed-upon solutions. Where greater coordination and balance between these dimensions was observed (e.g. in Prague's climate policy or Kraków's anti-smog campaign, supported by resident education), the results were more pronounced.

Practical implications and recommendations. From the practical perspective, the study translates into specific recommendations for urban policy. Cities aspiring to be smart should strive to create interdisciplinary teams combining technological, social, and planning competencies to

comprehensively approach problem-solving. Investing in organisational learning mechanisms – systematic evaluation of activities, knowledge management, and collaboration with research institutions – is crucial, allowing for faster conclusions and policy adaptation. Maintaining balance between the pursuit of efficiency and public values is equally crucial – protecting the public interest, building trust, and ensuring the authenticity of the local community should go hand in hand with implementing innovation. The findings also point to the need to anticipate problems rather than act reactively, e.g. by implementing impact assessments of planned decisions and consulting with residents early enough to avoid costly mistakes and 'lock-in' effects. A final practical lesson is the cautious implementation of new technologies: cities should ensure that digital technologies actually serve their residents and do not cause unintended harm (e.g. digital exclusion or privacy threats), which requires ongoing evaluation and small-scale pilots before full implementation.

Research limitations. Certain limitations of the study should be emphasised, suggesting caution when interpreting the results. First, the analysis covered only two cities with specific contexts (Kraków and Prague – large cities in Central Europe), which limits the generalisability of the findings. Second, the focus was on two selected thematic areas (climate change and the crisis of identity and social cohesion), while urban intelligence can also manifest itself in other domains; these unaccounted-for aspects were not analysed. Third, the study relied primarily on the existing data (strategies, city documents, available indicators), which carries the risk of incomplete or biased information. No field research (e.g. resident surveys or interviews with decision-makers) was conducted to enrich the conclusions – the lack of these perspectives is a potential limitation. Furthermore, the measurement of urban intelligence proposed in this article (the table of indicators) is experimental in nature; although it proved useful for comparing Kraków and Prague, it requires further validation and possible expansion with qualitative measures (e.g. the assessment of leadership, organisational culture) to increase its universality.

Future research directions. Given the above limitations, further research exploring the topic of urban intelligence is warranted. First, it is worthwhile to expand the analysis to a larger number of cities with diverse characteristics (different countries, sizes, levels of development) to determine the universality of the presented conclusions. Second, future research could encompass other areas of city functioning – e.g. the digitalisation of public services, resilience to other types of crises (pandemics, economic crises), or transport management – to verify whether the concept of urban intelligence retains an explanatory value across a broader spectrum of challenges. Third, the proposed system of metrics requires further development: subsequent research should refine and test it on a broader sample of cities, taking into account both hard data and soft aspects (e.g. the quality of leadership, the level of social trust), which will better capture the multidimensionality of intelligence. Finally, in-depth studies (case studies) are recommended, including interviews with decision-makers and residents, to understand the mechanisms of building urban intelligence 'from the inside' as well as identify factors that facilitate or hinder this process. These lines of research will help translate theoretical conclusions into practical guidance for other cities wishing to increase their ability to learn and adapt.

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