

IMPLEMENTATION OF THE "SMART CITY" CONCEPT – BEST PRACTICES OF POLISH CITIES, E.G. WARSAW AND WROCLAW

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Purpose: The aim of the article is to analyze and evaluate best practices in implementing the “smart city” concept in selected Polish cities, with particular emphasis on Warsaw and Wroclaw, as well as to identify factors contributing to the effective implementation of “smart city” solutions and the challenges associated with it.

Design/methodology/approach: The research methodology includes triangulation of approaches such as analysis of strategic documents of the cities studied (including development strategies, digitalization programs and transport policies), a literature review on the "smart city" concept, including public information queries, and a qualitative case study of the cities of Warsaw and Wroclaw.

Findings: The essence and assumptions of the "smart city" concept were explored. Using Warsaw and Wroclaw as best-practice examples, methods for implementing the researched concept were identified. Based on this, the transformation processes in both cases towards a smart city were assessed. The strengths of both cities' practices were identified and key strategic challenges related to the phenomenon under study were identified.

Research limitations/implications: As "smart city" leaders, Warsaw and Wroclaw can promote good practices at the national level, influencing regulations regarding the digitization of public services, autonomous transport, urban sensors, and infrastructure cybersecurity. The experiences of these cities provide valuable case studies for other metropolises aspiring to become smart and resilient.

Social implications: Identified practices of implementing the "smart city" concept led to an improvement in the quality of life of residents, increased social participation and transparency of city activities, but at the same time carry the risk of deepening digital inequalities.

Originality/value: Deepening and updating knowledge on sustainable urban development based on the assumptions of the "smart city" concept. Popularizing activities related to the studied phenomenon.

Keywords: smart city, digital transformation, best practices, Warsaw, Wroclaw.

Category of paper: A literature review and case study.

1. Introduction

In an era of dynamic development of digital technologies and increasing urbanization, modern cities face the need to implement innovative solutions that enable effective management of urban space, resources, and services for residents (Bibri, Alexandre, Sharifi, 2023; Mazzetto, 2024). The "smart city" concept is becoming one of the key directions in the development of urban planning and management, combining information and communication technologies (ICT) with the concepts of sustainable development and social participation.

In Poland, the implementation of the "smart city" concept is gaining momentum, primarily in large metropolitan areas such as Warsaw and Wrocław, which serve as examples of cities undertaking systemic actions to digitize urban infrastructure, improve the quality of life of residents, and increase the efficiency of public administration (Marchlewska-Patyk, 2023).

This article presents a comprehensive analysis of the implementation of the "smart city" concept, based on the examples of the two largest and most technologically advanced cities in Poland: Warsaw and Wrocław. Unlike many works based primarily on theoretical studies or analyses of international concepts, this study focuses on practical solutions implemented in the Polish socio-economic context, considering local specifics, institutional conditions, and the country's level of digitalization.

The article also provides a comparative assessment of the actions undertaken by two cities with different structures and development strategies, allowing for the identification of both common elements and unique approaches to implementing the smart city concept. This type of analysis rarely appears in literature, which usually describes individual cases or focuses on Western European cities.

The text's originality also lies in the integration of data from various sources—strategic documents, city reports, available digital data, and descriptions of implemented technologies. This approach allows not only for the presentation of the most important "smart city" projects but also for the assessment of their effectiveness, progress, and impact on residents' quality of life.

The article also adds value by presenting practical implications stemming from the experiences of Warsaw and Wrocław, which can serve as a benchmark for other Polish and European cities planning development in line with the "smart city" concept. The publication thus offers an original contribution to literature, combining an academic perspective with a practical approach to urban transformation processes.

The research methodology used in the study includes triangulation of such approaches as: analysis of strategic documents of the studied cities (including development strategies, digitalization programs and transport policies), a review of literature on the "smart city" concept, including public information queries, and a qualitative case study of the cities of Warsaw and Wrocław.

2. Literature review

Based on a review of scientific literature, the essence of the “smart city” concept and the factors justifying its implementation by urban agglomerations were analyzed. These categories were considered key to describing and identifying the practices of the cities studied.

2.1. The concept of a “smart city” – definition, stages of development

Initially, the concept of a "smart city" focused primarily on implementing advanced technical infrastructure, such as intelligent transportation systems and environmental monitoring (Giffinger et al., 2007). Over time, its meaning has evolved from a technological "city of the future" to a holistic model in which public participation, data integration, responsible management, and attention to social and environmental aspects also play a key role (Clark, 2020). This process is confirmed by the overview of selected definitions of the "smart city" concept presented in Table 1, which shows how its understanding has changed over time.

Table 1.
Comparative of Smart City Definitions

Author of the definition	Definition	Key Focus/Dimensions
Giffinger et al. (2007)	„Smart City is a city performing well in six key dimensions: economy, people, governance, mobility, environment, and quality of life”	six-dimension model (economic, human, governance, environmental, mobility, QoL)
Hollands (2008)	„A Smart City relies on ICT but must also critically examine the social impacts of technology and support citizen inclusion”	critical perspective, social justice, citizen empowerment.
Caragliu, Del Bo, Nijkamp (2011)	„A city is smart when it invests in human and social capital, ICT infrastructure, and sustainable development to enhance quality of life and resource management”	human capital + social capital + ICT + sustainability
Nam, Pardo (2011)	„Smart City emerges from the integration of technology, people, and institutions, creating innovative urban services”	three pillars: technology, people, institutions.
Townsend (2013)	„A Smart City uses digital technologies and data to support innovation, collaboration, and improve urban life”	data-driven innovation, civic tech, collaboration
Komninos (2013)	„Smart Cities are innovation territories where knowledge, creativity, and technology interact to produce intelligent solutions”	knowledge-based development, creativity, innovation ecosystems
ISO 37122 (2019)	„Smart Cities systematically use digital technologies to improve performance across key urban domains using standardized indicators”	measurement, performance indicators, digital systems.
Bibri, Krogstie (2020)	„Smart Cities are data-driven urban systems using AI, IoT and Big Data to improve sustainability, efficiency, and quality of life”	AI + IoT + Big Data; sustainability and optimization
OECD (2020)	„Smart City uses digital technologies to design and deliver better public policies while ensuring inclusiveness, transparency, and ethical data use”	governance, inclusiveness, ethics, public value
European Commission (2020)	„Smart City applies innovative technologies and data to improve sustainability, energy efficiency, and public services”	innovation, sustainability, energy efficiency

Source: Prepared based on the sources given on the table.

The comparative overview of “smart city” definitions demonstrates that the concept has evolved from a predominantly technology-centered vision toward a more holistic and citizen-oriented approach. Early frameworks, such as those by Giffinger et al. (2007) and Caragliu & Nijkamp (2011), emphasize the role of ICT, human capital, and sustainable development, while later perspectives increasingly integrate data-driven governance, ethical considerations, and social inclusiveness (OECD, 2020; ISO, 2019; Bibri, Krogstie, 2020). The table highlights that although terminology varies, all definitions converge on the idea that a “smart city” leverages innovation and digital tools to enhance the quality of life and urban performance. At the same time, authors such as Hollands underline the importance of critically assessing technological impacts to ensure cities remain equitable and human centered.

2.2. Factors justifying the need to develop the “smart city” concept

Various factors justify the need to develop the concept of a “smart city”. However, in the opinion of many authors (e.g. Albino, Berardi, Dangelico; 2015; Czupich, Ignasiak-Szulc, Kola-Bezka, 2016; Sharifi et al., 2024) - the biggest factors affecting its implementation are: congestion, environmental pollution, and public safety.

The first of these factors, congestion, relates to the growing population in cities and the associated increase in the number of cars. The importance and essence of this problem from the point of view of smart urban development is explained, among others, by Duranton & Turner (2011), Newman & Kenworthy (2015), Kumar et al. (2020). Growing congestion in large cities is leading to increased demand for more efficient, intelligently managed road infrastructure that can meet user expectations and cope with actual traffic volumes. This solution allows for efficient movement around the city, reduces traffic jams, and improves traffic flow (UN-Habitat, 2020).

The second important factor confirming the need to develop the “smart city” concept is the environmental pollution observed in recent years. The World Health Organization (WHO) emphasizes in numerous reports (2016-2023) that road transport is the main source of pollution in cities. Due to the increasing emissions of exhaust fumes and other harmful substances, fog, smog, heavier rainfall, and even the creation of a unique microclimate with winds blowing from central districts towards the suburbs and temperatures often more than 10 degrees higher than in the surrounding areas have become increasingly common. Poor air quality directly affects the residents of many cities. This fact makes them feel worse and even suffer from serious illnesses, the treatment of which is very costly. Additionally, it is worth noting that the larger the population, the more waste is generated, and improper waste management leads to environmental degradation (Sztangret, Reformat 2020). Growing environmental pollution in cities points to the need to implement modern, smart solutions that will enable more effective monitoring, reduction, and management of emissions, as well as improve the quality of life for residents.

The third important factor supporting the need to develop the “smart city” concept is public safety (Zawartka, 2024). The large number of city dwellers and their diversity have led to an increase in crime in these areas. Initially, people settling in these areas did not establish contact with each other, feeling alienated, and therefore believed that they were anonymous in the local community. Contemporary cities are becoming increasingly complex organisms, bringing together large numbers of residents, critical infrastructure, and diverse social processes. Increased urbanization leads to greater risks associated with crime, accidents, traffic hazards, and emergencies such as fires, floods, and infrastructure failures (Łuczyszyn, 2017). For this reason, cities must implement solutions based on modern technologies that enable rapid detection, analysis, and effective response to threats. Artificial intelligence-based monitoring systems, smart lighting that improves visibility and safety, sensors that detect anomalies, alarm applications, and crisis management centers that integrate data in real time are becoming key elements of a “smart city” (Muntean, 2024). These technologies not only reduce the number of dangerous incidents, but also increase residents' sense of safety, which is one of the foundations of quality of life in the city.

To sum up the above discussion, it should be emphasized that the factors presented above have the greatest impact on the development of the “smart city” concept. At the same time, it should be borne in mind that advances in information technology and changes in the needs of city dwellers related to improving their quality of life are the main determinants of the evolution of this concept.

3. Methods

3.1. Theoretical Foundations

The article focuses on the concept of the “smart city,” which promotes the creation of friendly living conditions for residents of large and medium-sized urban areas. The main research problem is included in the question: *How can the experiences of Warsaw and Wrocław serve as a model for other cities in Poland in the process of digitalization and intelligent management?* To identify the phenomenon under study, qualitative research of a diagnosis nature was carried out. The aim of the study was to analyze and evaluate the implementation of the "smart city" concept in Polish cities, using Warsaw and Wrocław as examples, considering best practices and challenges. The author focused on identifying key areas of the concept, such as mobility, energy, the environment, public e-services, security, and social participation. The adopted goal determined the choice of research methodology, which included the triangulation of such approaches as: analysis of strategic documents of the studied cities (including development strategies, digitalization programs and transport policy), a review of

literature on the concept of a "smart city", including public information queries and a qualitative case study of the cities of Warsaw and Wroclaw. The methods used enabled a multi-aspect assessment of the transformation processes of both cases towards a "smart city". Basic information on the survey conducted is presented in Table 2.

Table 2.

Basic information on the survey conducted

Specification	Characteristic
Research methodology	- the analysis of specialized journals, materials on the studied city, websites, participant observation, case study.
Sample selection	- targeted selection, - criterion: best practices in the field of the phenomenon under study.
Sample size	- best practices in the field of the examined phenomenon selected based on the "Smart City Index 2024/25" Ranking and the "European Cities & Regions of the Future 2025" Ranking, - two cities: Warsaw & Wroclaw.
Geographical scope	- national scale.
Time scope	- 2020-2025.

Source: own elaboration.

3.2. Research Methods

The methods used in the article enabled a multi-aspect assessment of the transformation processes of both cases towards a smart city. They also allowed us to identify actions necessary to increase the efficiency and coherence of "smart city" solutions in the future.

The identification of the studied examples of Polish cities, reflecting the best practices in implementing the "smart city" concept, was based on the analysis of the results of the two latest rankings regarding the studied phenomenon. The first of them was the "Smart City Index" ranking published by the Swiss Business School in Lausanne (IMD) in cooperation with the Singapore University of Technology and Design (IMD, 2025). Cities from this ranking were rated on a scale from A (best grade) to D, and the ranking included two main categories: infrastructure and technologies divided into health and safety, transport, work and science, and city management. It should be added that this ranking was based primarily on the opinions and observations of city residents, but experts also analyzed the way in which technology improves the lives of their citizens. The second source of information was the prestigious European Cities & Regions of the Future 2025 Ranking, prepared by fDi Intelligence - an opinion-forming magazine belonging to the British daily "The Financial Times".

Based on the above-mentioned requirements, rankings identified the two most "smart city" in Poland, which are: Warsaw and Wroclaw¹. These cities implement solutions that not only modernize urban space, but also become an inspiration for other local governments, so they can be considered best practices in the implementation of the "smart city" concept.

¹ It is worth adding that, apart from Warsaw and Wroclaw, the top five smartest cities in Poland also include: Kraków, Poznan and Gdansk.

4. Results

4.1. Practice I – City of Warsaw

According to the “Smart City Index 2025” ranking (IMD, 2025), Warsaw was ranked 28th out of 146 cities in the world. The city received a high score in two dimensions of the ranking: "urban structures" and "digital technologies", which shows the sustainable development of infrastructure and digitalization. The ranging results revealed that significantly influenced by the attitudes of the residents themselves, which reflect a high level of digital social maturity. The city is not only developing infrastructure and services – it also has users who are ready to consciously engage with them. Data collected as part of the study shows that 75.8% of Warsaw residents regularly use cashless payments, demonstrating the widespread adoption of modern transaction methods and openness to digital solutions in everyday life. Additionally, 55.1% of residents believe that easy access to public information increases their trust in the authorities – an important indication that transparency and digitalization of administration translate into positive public perception. It is also worth noting that 51.3% of respondents accept the use of city data for purposes such as reducing traffic congestion, confirming growing understanding of data-driven initiatives and managing the city in an automated yet thoughtful manner. All this together forms a foundation for the continued development of the city as a modern, open, and functional metropolis (IMD, 2025). The strategy for the development of Warsaw as a “smart city” assumes strong digitization of administration and the implementation of innovative urban solutions in several specific areas - see Table 3.

Table 3.

Areas of the strategy for the development of Warsaw as a “smart city” assuming strong digitization of administration and the implementation of innovative urban solutions

“Smart city” development area	The essence, purpose and assumptions of the area
Politics digital transformation	<ul style="list-style-type: none"> - assumes the automation of official processes and digitization of administrative resources, as well as the use of big data for the processing of large data sets for better city management, - indicates, among others, on such values as: transparency, openness, 24/7 access to services, and cloud computing that supports the integration of urban, - the aim is to improve public services, including improving their quality and accessibility for residents, and creating platforms that will centralize data and services (e.g. a specific “Internet of Things” (IoT) platform collecting real-time data from sensors in the city, enabling better management of urban infrastructure), - the city is also planning other platforms: including: a platform for communication with residents, a platform for sharing data, and for providing services, - the main values of the transformation are usefulness, efficiency and inclusiveness.

Cont. table 3.

E-services for residents	<ul style="list-style-type: none"> - one of the key projects is the Municipal Contact Center 19115 (Warsaw 19115) it is a channel through which residents can report issues, communicate with the office, etc., - with the development of the office's digitization, the mojaWARSZAWA platform (mojaWarszawa19115) was launched, which enables handling many matters completely online (e-services), - dozens of e-services are currently available in the system: from administrative matters, through information on garbage collection, to air quality data.
Usage Internet of Things (IoT)	<ul style="list-style-type: none"> - launching an IoT platform collecting data from sensors located in the city (e.g. air quality sensors, number of free parking spaces, location of toilets, etc.), - integration of IoT data with urban open data platforms, which promotes analysis and innovation.
Ethical use of artificial intelligence	<ul style="list-style-type: none"> - the city's adoption of "Directions for the responsible use of generative AI" in public administration, - introduction of the "Warsaw GenAI Code" containing transparency guidelines and ethical principles for the use of AI in the city hall.
Innovations in strategy – "We Generate Innovations Program"	<ul style="list-style-type: none"> - executive program for 2021-2025, its idea fits into the strategic goal "Creative environment", which includes, among others: supporting entrepreneurship, urban startups, - use of new technologies, cooperation between the public and private sectors, - the program diagnosis indicates the need to build Warsaw's innovative potential and increase the share of digital technologies in the city's everyday functions.
Cybersecurity and digital infrastructure	<ul style="list-style-type: none"> - Warsaw is also developing cybersecurity structures, - there is a metropolitan model of digital security, - Information Technology (IT) Office of the Capital City Office Warsaw is responsible for technology coordination, implementation of IT systems, cloud infrastructure management and development of urban IT architecture.

Source: on based (Polityka cyfrowej transformacji...; Strategia #Warszawa2030 ...; Metropolitalny CSO...).

The "smart city" strategy for the development of Warsaw, based on digitalization and innovation, directs the city to build a modern, flexible and resident-friendly ecosystem of public services. The integration of advanced technologies with urban management is intended not only to improve the functioning of administration, but also to improve the quality of life, increase transparency and enable more conscious and participatory co-creation of urban policies. Thanks to this, Warsaw could strengthen its position as an intelligent metropolis, able to quickly respond to the challenges of the future and create sustainable development based on data, cooperation and innovation.

4.2. Practice II – City of Wrocław

Or several years, Wrocław has been consistently developing into a modern, intelligent metropolis that uses digital technologies to improve the quality of life of its residents and improve city management. Its achievements are confirmed by the results of the prestigious European Cities & Regions of the Future 2025 ranking. The data presented in it shows that Wrocław not only took first place in the category of medium-sized European cities but also became a leader in terms of business-friendliness and human capital and the best place to live. It was also awarded second place among the cities with the greatest economic potential (Karpecka, 2025).

The implementation of the "smart city" concept in the case of Wrocław is based on the integration of innovative tools, urban data and cooperation with residents, which allows to create a more effective, sustainable and friendly urban environment (*Wrocław 2030 Strategy...*). Thanks to numerous projects in the areas of mobility, ecology, e-administration and security, Wrocław is becoming an example of a city that actively uses the potential of technology to respond to modern challenges and shape dynamic urban development - see Table 4.

Table 4.

The most important areas in which Wrocław conducts "smart city" activities

Area "smart city" implementations	Applied solutions	Examples implementation
Mobility and intelligent transport	Intelligent ITS Traffic Management	- network of sensors, cameras and signaling controllers, - dynamic traffic light control (green waves, tram priorities), - passenger information boards displaying the arrival time of transport.
	Development of public transport	- electronic boards at bus stops, - applications showing the actual location of vehicles, - introduction of Urban Card as an integrated ticket system and city service card.
	Micromobility	- a rich network of city bikes and scooters, - expansion of bicycle routes and stands, - integration of travel planning (e.g. in multimodal applications).
E-services and digital administration	E- office, electronic inboxes and the ability to register visits to offices	- platform for submitting applications and fees online (including local taxes, registers, ID card applications).
	Open Data of Wrocław	- a portal with publicly available urban data sets (transport, environment, budget), made available to residents and technology companies.
Environment and intelligent infrastructure	Monitoring environmental	- network of air quality sensors, - real-time pollution analysis, - online data publication.
	Energy and lighting management	- modern LED lighting in public spaces, controlled depending on traffic intensity, - intelligent energy management systems in municipal buildings.
	Water management and green infrastructure	- solutions to counteract floods and droughts (retention, urban greenery), - digital monitoring of river and canal levels.
Participation and co-management of the city	Budget Civic	- residents submit projects and decide on part of the city's expenses. - digital voting and consultation platforms.
	Applications reporting	- ability to report faults, failures and needs in public space, - quick reactions of city services thanks to digital information flow.
	Wrocław's Housing Estate Council	- digital cooperation between residents and officials, - online consultations regarding local plans, transport and investments.
Smart governance – data-based management	Big Data and analytics	- analysis of traffic and transport behavior of residents, - urban modeling using spatial data (GIS), - monitoring the effectiveness of city services.

Cont. table 4.

Culture, education and intelligent social services	Using technology in soft areas	<ul style="list-style-type: none"> - digital libraries, e-book rentals, - educational applications and school support tools. - smart solutions in cultural institutions (online reservations, virtual tours) - development of startups and academic projects thanks to cooperation with the Wrocław University of Science and Technology and the University of Warsaw
Wrocław as an innovation center	Initiatives supporting the knowledge-based economy	<ul style="list-style-type: none"> - Wrocław Technology Park, - Entrepreneurship and startup accelerators, - investment zones and cooperation with companies from the IT, R&D and AI industries, - numerous hackathons and open-source projects based on urban data

Source: based on (Strategia rozwoju „Wrocław 2050”...).

The presented analysis shows that Wrocław, as an example of a city implementing the "smart city" concept, strategically uses technologies to make life easier for its residents, improve the quality of public services, increase the transparency of local government activities, develop an economy based on innovation and care for the environment and sustainable development.

5. Discussion

The "smart city" concept assumes the use of technology, data and modern organizational solutions to increase the efficiency of the city, improve the quality of life of residents and sustainable development. It turns out that in practice, the implementation of this idea may look very different, which is confirmed by the analysis of the two best business practices in Poland presented. They depend on local strategies, needs, resources and priorities of city authorities. A comparative analysis of the practices of Warsaw and Wrocław showed how these two large Polish cities implement the "smart city" concept, what areas of development they choose and what challenges they face.

Warsaw adopted the "Policy of digital transformation of the capital city of Warsaw", a strategic document defining the directions of the city's technological development. In the "Smart City" strategy, the key areas are intelligent mobility, city management, human capital, quality of life, environmental protection and sustainable infrastructure (*Warsaw towards Smart City...*). The city is creating a data ecosystem - the Warsaw IoT Platform collects data from city sensors, and the "Open Data in Warsaw" project makes it available to citizens (*Warsaw IoT Platform...*). Research on city resilience often uses the resiliency model² (e.g. Newell, Stults, 2016). In the "smart city" concept, Warsaw adapts the resilience model to

² The resilience model shows how a person or system survives difficulties, adapts to them and emerges stronger from them.

better respond to crises and uncertainty. These observations are consistent with the results of analyzes conducted by Baran, Kłos & Marchlewska-Patyk (2022).

In turn, Wroclaw is implementing the innovative "Smart City Wroclaw" Program, which covers five main areas: seniors and disabled people, intelligent transport, SMEs, education and security and crisis management. The city emphasizes the role of open data through the "Open Data Wroclaw" website, which allows residents and entrepreneurs access to city data sets. The analysis of the "Wroclaw 2050" strategy shows that the city envisages the integration of "smart city" systems: optimization of the energy and transport networks, water and sewage systems, and monitoring of weather threats. The "smart city" strategy covers six equivalent areas: mobility, economy, environmental resources management, human capital, quality of life and city management. The CityLab initiative enables startups and scientists to test innovative solutions in urban space (e.g. technologies related to transport and emissions).

The analysis carried out allowed for a comparison of activities carried out by both cities in specific "smart city" areas - see Table 5.

Table 5.

Comparative analysis of activities implemented by Warsaw and Wroclaw in specific "smart city" areas

"Smart city" area	Warsaw	Wroclaw
Mobility and transport	- development of public transport, integration of city cards, use of IoT and sensors in public transport systems.	- priority on intelligent transport (ITS), mobile applications (e.g. Vozilla), testing solutions in CityLab.
Digital services and e-government	- city platforms (e.g. Moja Warszawa), resident reporting systems (19115 application), city data analytics.	- e-document management, queuing system, applications supporting residents (Mobile Assistant, Virtual Advisor).
Open access to data	- IoT platform and open data that is shared widely, in various formats.	- Open Data Wroclaw website, - the city strives to maximize data democratization.
Environmental and energy management	- investments in energy efficiency, modern urban infrastructure systems, intelligent resource management.	- systems for optimizing energy networks, greenery and resource management through data and predictive technologies.
Residents' involvement	- strong emphasis on participation, transparency and co-decision, - "smart city" strategies are designed considering the needs of citizens.	- city laboratories (CityLab), testing activities, cooperation with entrepreneurs and residents in creating urban innovations.
Financing and partnerships	- data-based management models, city resilience models, city support for innovative projects, administration.	- public-private partnerships, startups, cooperation with global companies (e.g. Nokia), financing of test projects at CityLab.

Source: Own study based on conducted analyses.

The comparative analysis of the activities of both cities allows us to see their strengths and challenges related to the implementation of the "smart city" concept. In the case of Warsaw, the strengths include:

- a) an extensive digital transformation strategy, a coherent vision of "smart city" activities,
- b) strong data infrastructure (IoT, open data), which enables advanced analytics and optimization of urban processes,

- c) high participation of residents, which allows us to adapt services to the real needs of the city,
- d) resilience model, which assumes responding to crises, which increases the city's flexibility.

Referring to the city of Wroclaw, the strengths of implementing the "smart city" concept include:

- a) a wide range of areas (6 equivalent) of "smart city" activities, which ensures even development of the city,
- b) flexibility obtained with the help of CityLab - testing new technologies in urban practice, cooperation with startups,
- c) strong emphasis on open data and transparency of city activities
- d) integration of technology,
- d) with long-term planning (vision Wroclaw 2050).

Summary

The aim of this article, which was to analyze and evaluate the implementation of the "smart city" concept in Polish cities, using Warsaw and Wroclaw as examples, considering best practices and challenges, was to demonstrate that Warsaw and Wroclaw represent two strong, yet somewhat different, models for implementing the "smart city" concept.

Based on the achieved objective of the article, certain theoretical and practical implications of its content can be identified. In terms of theoretical implications, firstly, the article deepens our understanding of what a smart city is, demonstrating that it is not limited solely to ICT technologies but also encompasses governance, resident participation, sustainable development, and mobility. The analysis of Warsaw and Wroclaw demonstrates that the "smart city" concept must be adapted to the regional context rather than thoughtlessly transferred (it depends on the cities' circumstances, budgets, investments, local community openness to innovation, etc.). Thirdly, empirical material illustrating best practices in the development of Polish cities can help build city-specific implementation models at the national level. At the same time, the practices of Warsaw and Wroclaw emphasize the importance of cross-sectoral cooperation (local government, businesses, and residents), open data, and the digitization of public services. Another theoretical implication suggests that "smart city" theories should more closely consider governance and co-management, not just technology.

Regarding practical implications, it should be noted that the discussed case studies of Warsaw and Wroclaw identified practical tools (including Intelligent Transportation Systems, city applications and e-service platforms, air quality monitoring systems, smart lighting, and open data) they use. Other cities can therefore draw on ready-made solutions and

mechanisms for implementing the "smart city" concept. This knowledge can also serve as a guide for decision-makers to prepare "smart city" strategies. Local governments can also use this knowledge to improve administrative efficiency – the cities studied demonstrate how technologies support urban resource management, decision-making (including predictive analytics), and communication with residents. The article provides best practice models that can be compared, adapted, and assessed for effectiveness in other contexts, thus creating the possibility of benchmarking for other cities.

The author is aware of the limitations of the conducted analysis, which was based primarily on publicly available strategies and documents, meaning that lesser-known local or pilot projects were not included. Another limitation is the lack of a more detailed analysis of direct, comparable financial reports for all "smart city" projects in both cities, to assess their cost-effectiveness. However, these limitations open room for further analysis and research on the issues addressed in this article.

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