
Public Perception of the Management of the Implementation of Solutions from the Smart City

Submitted 10/11/24, 1st revision 25/11/24, 2nd revision 01/12/24, accepted 15/12/24

Aleksandra Kuzior¹, Dariusz Krawczyk², Joanna Kubicka³,
Viera Zozulankova⁴, Krystyna Jędralska⁵, Tetyana Nestorenko⁶

Abstract:

Purpose: The aim of the research was to determine residents' attitudes to the consequences of making the Smart City a reality in the practice of social, economic and political life. The specific aim was to identify the specific tasks to be performed by the local administration which, in the opinion of the residents, will create a Smart City.

Design/Methodology/Approach: A literature analysis and critique method and a diagnostic survey method were used to verify the hypotheses posed. The study was conducted on the basis of a questionnaire survey on a research sample of 500 inhabitants of Zabrze, who were selected in a quota and random manner.

Findings: The opinion of Zabrze residents on the management of the implementation of Smart City solutions was identified.

Practical Implications: The application dimension of the research project consisted of using the results to formulate the "Smart City Strategy - Zabrze 2030".

Originality/Value: Specific tasks have been identified to be carried out by the area administration, which residents believe will create a smart urban space.

Keywords: Smart City, smart city, local government, public participation, development strategy

JEL codes: R41, O33, H83, Q55.

Paper Type: Research study.

Acknowledgement: The authors would like to thank all the participants in this study.

¹Associate Professor, PhD., DSc., Silesian University of Technology Faculty of Organization and Management, Poland, ORCID: 0000-0001-9764-5320, aleksandra.kuzior@polsl.pl,

²PhD., the same as in 1, ORCID: 0000-0003-1823-0309, dariusz.krawczyk@polsl.pl;

³PhD, Coventry University, United Kingdom, ORCID: 0000-0002-1795-771X, Ad7618@coventry.ac.uk;

⁴Assistant Professor, Viera Zozulankova, Constantine the Philosopher University in Nitra: Nitra, Slovakia, ORCID 0000-0001-7035-8743, vzozulakova@ukf.sk;

⁵Professor, Institute of Management and Quality Sciences, Humanitas University, Poland, <https://orcid.org/0000-0002-8614-8772>, krystyna.jedralska@ue.katowice.pl;

⁶Associate Professor, Tetyana Nestorenko, Faculty of Social Sciences and Humanities, Academy of Silesia, Poland, ORCID: 0000-0001-8294-6235, tetyana.nestorenko@wst.pl;

1. Introduction

Today's cities face numerous challenges related to mobility, waste management, access to resources, etc. Smart urban centres are using information and communication technologies (ICTs) to develop innovative solutions that can address such challenges and provide a higher quality of life for their residents (Ju *et al.*, 2018; Shin, 2016; Yousef and Dadashpoor, 2020; Simonofski *et al.*, 2021).

Solutions used in cities can include applications such as Big Data platforms for urban analytics (Ju *et al.*, 2018; Shin, 2016), smartphone-based public opinion capture (Moran and Bui, 2019) and 5G wireless networks and services (Frias and Martínez, 2018). Examples include the 'Smarta Kartan' ('smart map') citizen sharing initiative in Gothenburg, Sweden, internet-of-things (IoT) sensors to improve parking services in Seoul, South Korea, and 3D simulations to assist urban planning in Singapore (Hartley, 2023).

Focusing on public sector efficiency and responsiveness in the urban environment, these often disparate technologies have merged into the concept of "smart cities" - defined by Vu and Hartley as "the institutionalised and integrated application of smart technologies with a digital age mindset to the tasks and challenges of urban management" (2018, p. 849).

Cutting-edge technologies and expanded cyber capabilities, combined with the development of artificial intelligence, play a key role in the management of automated infrastructure in smart cities (Machado *et al.*, 2023), and further investment in quantum communications and computing could provide smart cities with a significant competitive advantage (Bashirpour Bonab *et al.*, 2023). The task of the smart city is to solve or reduce the problems caused by rapid urbanisation and a growing population of residents. This includes energy generation, waste management or the reduction of harmful substances with the most efficient use of resources (Hassan *et al.*, 2023).

A smart city can also promote eco-efficiency through the implementation of technological innovations (Yan *et al.*, 2023). The various aspects and dimensions of a smart city identify six essential pillars (SMELTS) ranging from social, managerial, economic, legal through technological to sustainability-based (Sujata *et al.*, 2016). According to the European Commission, a smart city is a place where traditional networks and services are streamlined with digital solutions for the benefit of its residents and businesses.

In the interpretation of the European Commission, however, the definition quoted goes beyond the use of digital technologies to make better use of resources and reduce emissions. A similar narrative is represented by an increasing number of researchers, as regardless of the broad technological view, a sociological perspective is important. Smart cities are supposed to provide citizens not only with access to

innovative tools to help solve problems, but above all to provide the conditions for sustainable development.

Hence, researchers incorporate issues of social inclusion, equity and social capital into the analysis of the Smart City concept as a counterweight to protechnological orientations (Osowska, 2023). They even highlight that although many aspects of smart cities have already been explored, there has been a disproportionate focus on technical and technological elements without addressing social justice and democratic values (Alizadeh and Sharifi, 2023).

In addition, they call for redefining the relationship between local government and the social environment in the context of modern technological systems (McQuire, 2023) or conducting research on financing activities that foster inclusion and social equity towards smart city development (Lin, Chen, and Yan, 2023).

Implementing the smart city concept requires building and developing cooperation between the four determinants of city development: research institutions, city authorities, business and citizens who are the main driving force behind city development (Szołtysek 2015). The evolution of the Smart City approach in local government practice is presented by the authors of the Human Smart City Guide, who, following B. Cohen distinguish three levels of smart city development: a city inspired by available technologies, a city with a decisive role of public administration, and a city based on the creative involvement of citizens (Korneluk *et al.*, 2019).

This concept was then creatively extended to include a fourth level of smart city development defined as a city that gains advantages from the opportunities offered by sustainable development (Makieła *et al.*, 2024).

However, despite numerous studies in this area, the issue of smart cities is still not fully recognised. Given the increase in public and private investment in smart cities and their impact on urban life, the smart city revolution calls for deeper interdisciplinary research on related political and social issues (Kuecker and Hartley, 2020), especially regarding the public perception of the governance of the implementation of solutions from the Smart City sphere.

We also still know too little about how the attachment of local communities to solutions from the Smart City sphere influences the involvement of residents in actual participation in the functioning of smart cities (Lebrument *et al.*, 2021). Therefore, the aim of this study was to determine residents' attitudes towards the consequences of making Smart City ideas a reality in the practice of social, economic and political life.

The presented research results are the result of a completed research project, which had an applied dimension due to the use of the obtained results in the preparation of

a smart city strategy for Zabrze. At the time of preparing this text, the "Smart City Strategy - Zabrze 2030" was being constructed and the conclusions presented in the article were taken into account in this document.

2. Literature review

In the literature, aspects of smart city management have been described in numerous publications (Golubchikov and Thornbush, 2022; Lim *et al.*, 2023; Nastjuk *et al.*, 2022; Reardon *et al.*, 2023). Some focus on the design, delivery and quality of public services enabled by smart city technologies, others on describing smart city technologies (Ben, 2020), transparency in policy-making (Jacobs *et al.*, 2022; Lnenicka *et al.*, 2022), government communication with the general public (Laenens *et al.*, 2018), or equity and justice in smart city development (Kontokosta and Hong, 202; Yigitcanlar *et al.*, 2021).

There is less research on public perceptions of smart cities (Cole and Tran, 2022; Hartley, 2021; Lai and Cole, 2022). Latest results of research show more optimism about the impact of smart cities on quality of life than on governance. Awareness about the smart city concept associates positively with expectations about smart city benefits, but the effect is sensitive to education level and income (Hartley, 2023).

3. Materials and Methods

Due to the implementation nature of the Research Project, the research was conducted among the residents of Zabrze on a quota and random sample of 500 people, using a survey questionnaire. The main objective of the survey, carried out in October 2022, was to establish the residents' perception of the Smart City concept, with particular emphasis on the degree to which individual parameters affecting the quality of life in the city were identified to the Smart City sphere.

An important objective of the research project was also to identify specific Smart City tasks on which residents, i.e., local authority stakeholders, believe funding should be allocated or increased in order to significantly improve the quality of life in the city. Local governments define their smart city policy agenda in a variety of ways (Clement and Crutzen 2021).

For local government units, however, the introduction of systemic Smart City solutions is a process that encompasses all management functions, and therefore first requires a planning stage (Mańka-Szulik, Krawczyk, and Wodarski, 2023) that creates a framework for further implementation and then evaluation activities. Therefore, this article contains the results of surveys of residents and presents analyses made within the framework of a project to create planning assumptions for the implementation of solutions from the Smart City sphere in the functioning of a specific urban organism.

The research field was Zabrze. It is a city with county (powiat) rights, i.e. according to the administrative division, one of the 66 largest urban centres in Poland. Zabrze covers an area of 80.4 km² in southern Poland near two major motorways (the A4 and A1). It neighbours Bytom, Gliwice and Ruda Śląska. Within a radius of approximately 90 km, there are three international airports (Balice in Lesser Poland, Pyrzowice in Silesia and Ostrava in the Czech Republic).

With a population of approximately 170,000 (CSO, 2019) and a population density of approximately 2,100 persons per km², Zabrze is part of the first statutorily separate metropolitan area in Poland: Upper Silesia-Zagłębiowska Metropolis (with a total population of more than 2.2 million in 41 municipalities), established on 1 July 2017 by the Act of 9 March 2017 on the metropolitan association in the Silesian Voivodeship and in operation since 1 January 2018.

In describing the research field, it is worth noting that, at the time of the survey, the city had 4.5 per cent unemployment (against 5.2 per cent in the country and 3.8 per cent in the Silesian Voivodeship). The budget available to the city government was in excess of PLN 1.1 billion, or approximately €266 million (the city's budget for 2023 was PLN 1 billion 129 million on the revenue side and PLN 1 billion 193 million on the expenditure side). Documented coal mining had been carried out in the city since 1790. Zabrze was a centre of heavy industry in the 19th and 20th centuries, with several coal mines and metallurgical plants.

The post-1989 transition period brought 24 per cent unemployment and the liquidation of all state-owned mining companies (one small private mining company remained). The city changed its character from a monoculture of coal and steel to a centre of medicine (with the Silesian Centre for Heart Diseases), science (with faculties of three universities), economy (with a special economic zone) and post-industrial heritage tourism (with the "Guido" Historic Coal Mine complex, which maintains its position as a European leader, and the Key Heritage Adit awarded the European Commission's Grand Prix "Europa Nostra" award in 2019).

The "Development Strategy of the City of Zabrze 2030", adopted on 27 August 2018, formulates four development priorities:

- P1. Active urban society - with the challenge "Actively participate in social development",
- P2. Development and innovation of the economy with the challenge "Strengthen the economic competitiveness of the city",
- P3. Friendliness of the city space with the challenge "Domesticate space in the city", and
- P4. Significant metropolitan position with the challenge "Stand out in the Upper Silesian and Zagłębie Metropolis".

The group of horizontal objectives relating to the set priorities also included an objective from the sphere of smart growth defined as: CH 2. Shaping the conditions for Smart City development (Strategy 2018,).

4. Results

4.1 Citizens' Perception of Smart City Solutions

The first part of the research project involved verifying the formulaic perception of the Smart City concept by representatives of the local community. In an open-ended question, respondents were asked to give an example of a smart solution that they thought was particularly useful for residents. Up to three answers were possible. It is worth noting, however, that as many as 82 per cent of respondents were unable to give a single one.

The survey participants were dominated by those who stated that they would not take up any example without further consideration. This option was chosen by as many as 52.4 per cent of respondents. The next largest group, 29.6 per cent, were residents who explicitly stated that they were not interested in the topic of the smart city. The remainder, i.e., only 18 per cent of the survey sample, chose to respond in this part of the project.

The survey participants were dominated by those who stated that they would not take up any example without further consideration. This option was chosen by as many as 52.4 per cent of respondents. The next largest group, 29.6 per cent, were residents who explicitly stated that they were not interested in the topic of the smart city. The remainder, i.e. only 18 per cent of the survey sample, chose to respond in this part of the project.

Among the respondents individually naming smart solutions, city monitoring (12.4 per cent) clearly dominated, ahead of various types of traffic control support technologies, i.e. intelligent traffic lights and waiting time visualisation (9.9 per cent each), solar lighting of road signs (9 per cent), solar power generation (6.6 per cent), bicycle paths or health paths (4.6 per cent each).

Participants in the research project also mentioned products, activities, services or investments such as the remote reading of meters measuring water, gas, electricity and heat consumption, the installation of interactive information boards at public transport stops, the ability to search for free parking spaces using a city app, the purchase of tickets for cultural, tourist, medical, sports and leisure facilities via a mobile app or its use for renting unicycles.

Other areas mentioned by residents included intelligent city lighting, automatic traffic control for roads, railways, bicycles and pedestrians, and the introduction of a priority for public transport vehicles. Respondents also mentioned the development

of medical centres, the construction of brine graduation towers, the opening of a helipad at Zabrze City Hospital, increasing the availability of city bicycles and the widespread use of electric cars. These examples received between 4.1 per cent and 0.8 per cent of indications from respondents.

4.2 Reception of the Smart City Management Concept

In the second part of the survey - irrespective of their perception of modern or innovative solutions and their identification as a smart sphere - respondents were also given the opportunity to comment on the issue of smart city management. They were asked to identify specific tasks that could significantly improve the city's operating conditions and the quality of life of its inhabitants. In this category, the introduction of traffic control systems gained the most indications from respondents (11.1 per cent), as well as increasing the efficiency of waste management, providing modern tram transport and improving the quality of public transport in the city (9.2 per cent each).

Retrofitting hospitals with high-end medical equipment was mentioned by 8.3 per cent of respondents. On the other hand, noise protection, repair and modernisation of tram tracks 7.4 per cent, universal access to broadband internet - 6.4 per cent or free public transport for residents - 5.5 per cent. Other aspects that received between 4.6 per cent and 0.9 per cent of responses were: improvement of municipal waste collection, effective anti-smog solutions, expansion of cycling infrastructure, reduction of odour from the landfill, smart toilets at playgrounds, renovation of public transport stops and installation of timetable displays or repair of streets and pavements and more care for cleanliness in the city.

Attention was also drawn to the online handling of official matters, the transparency of the municipal website to ensure ease of navigation, the launch of a portal or application providing information on events in the city and allowing participation in the city's offer. As part of smart city management, respondents also emphasised the need for greater availability of catering facilities.

4.3 Understanding Priorities in Creating a Smart City

Taking into account the parameter of time of implementation, respondents were able to indicate actions that should be implemented as soon as possible as part of the realisation of the Smart City strategy. For residents, the priority issue in the Smart City sphere was the expansion of cycling infrastructure (12.5 per cent). Next on the list of the most urgent investments in the area of smart growth was the improvement of urban greenery (7.8 per cent) and easier access for patients to healthcare and especially to specialist doctors (6.4 per cent).

The priority of tramway track renovations was perceived by 5.7 per cent of respondents. In contrast, 5.3 per cent would start with investments in renewable

energy sources in city facilities, and 5 per cent would start with the creation of traffic control systems.

A level of between 4.3 per cent and 0.7 per cent on the list of most urgent actions was reached by, among others, modernising water supply and sewage systems, increasing the efficiency of waste management, improving public safety, digitising municipal services, implementing organisational innovations in economic and social life entities (e.g., modern management models, innovative organisational structures or action strategies, etc.), replacing coal cookers, improving internet quality, monitoring air pollution, reducing local taxes, solving the problem of intoxicated and homeless people in urban spaces, etc.

4.4 Assessment of Factors Influencing Residents' Approval of Living Conditions in the City

In the next part of the research project, respondents were asked to analyse selected parameters influencing the development of the urban area in a sustainable development formula using modern and smart technologies. As the implementation of Smart City solutions is aimed at creating resident-friendly conditions, the areas of activity that influence the level of approval in this regard were analysed.

The parameters determining the perception of the situation in the respondents' immediate surroundings were established by means of an extended question concerning precisely the spheres shaping residents' opinions verifying the quality of life in the city. The basic task was to clarify the catalogue of parameters determining the perception of the existing state of affairs by the participants in the research project in terms of formulating this assessment.

Thirty frameworks were included in the study, which relate to the functioning of the local authority and at the same time influence the public's perception of a liveable city. Among the compartments analysed by the respondents was the sustainable management of natural resources, which was defined as management that allows resources to be renewed or preserved without overexploitation. The availability of green spaces for sports and recreational activities was mentioned. The ecological situation of the city was an aspect to be analysed.

The use of renewable energy sources was linked to this issue, as well as the electricity management formula, the way waste is managed or the state of water and sewage management. The issue of sustainable construction and the development of housing in a variant that benefits both residents and the environment was reviewed by residents.

Respondents had the opportunity to comment on the efficiency of the local administration, the quality of the public transport system, the level of development of the transport system, including infrastructure dedicated to pedestrians and users of

single-track vehicles, and the provision of convenient car parking. In addition, investments in the development of the city were the subject of analysis. The cultural and leisure, sport and recreation offer was examined, as well as the educational offer (in terms of pre-school, primary and secondary education).

Access to retail, service and catering establishments etc. was assessed. The accessibility of city services for people with special needs, including disabilities, was also an important element. Respondents were able to share their opinions on the level of health care (including the availability of health care facilities) and social assistance. Cultural, ethnic and gender equality in access to urban services was also within the scope of the survey.

Respondents were also asked to form a view on the state of public safety, the speed of emergency services or the efficiency of emergency response. Perceptions of the effectiveness of the use of digital technologies were surveyed. Respondents were given the opportunity to comment on the labour market situation with particular reference to the ease of obtaining employment.

The participatory module, in turn, involved gauging opinions on the level of involvement of residents in local community affairs. After ranking the impact of the analysed areas on the level of quality of life, it was found that the survey participants attached the greatest importance to the level of health care, as well as to the availability of health care facilities and the speed of response of emergency services (1,708 points each).

In third place was waste management (1702 points). The next places in terms of the level of approval towards living conditions in the city were taken by green areas for sport and recreation (1692 points), public safety (1690 points), the ecological situation of the city (1680 points), the transport system (1675 points), the accessibility of city services for people with special needs - including disabilities (1669 points), the quality of the public transport system (1643 points), pedestrian infrastructure (1643 points) and investments in city development (1604 points).

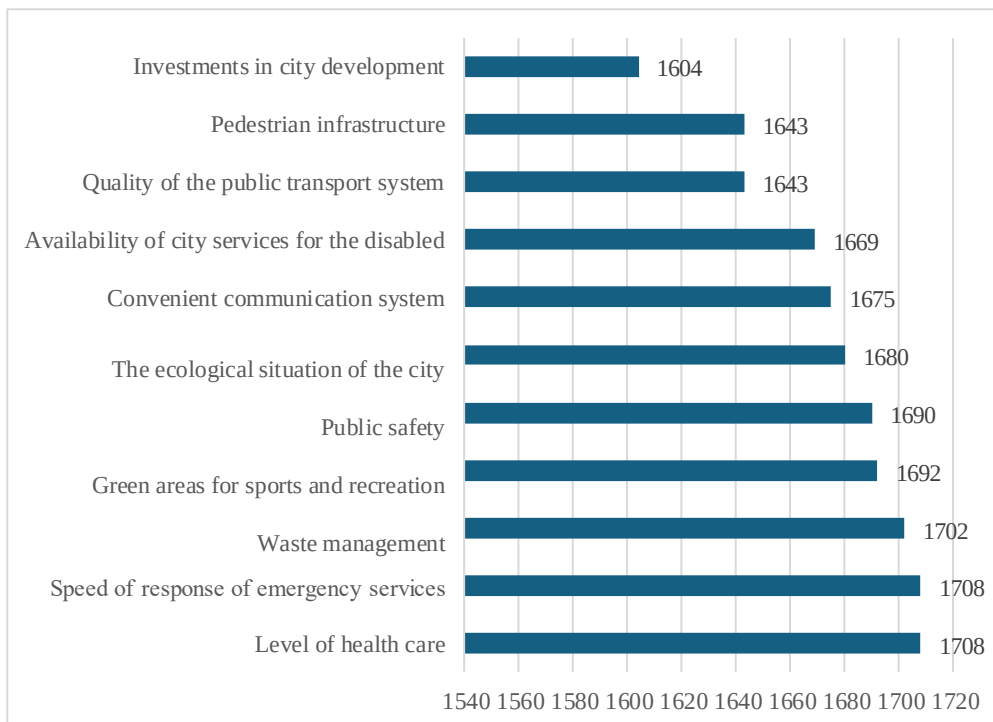
4.5 Creating a Smart City Through an Increase in Funding for Selected Local Authority Tasks

Taking into account the criteria identified in the previous part of the survey that influence the level of satisfaction with the conditions provided by the local authorities, the participants in the research project were able to identify specific actions dedicated to the local government, for the tangible effect of making the socially expected step towards a smart city.

The method was to select individual tasks on which to allocate or increase funding from the municipal budget or external sources (e.g., by applying for EU funds,

environmental funds or ministerial programmes, etc.) in order to significantly improve residents' quality of life.

Figure 1. According to the survey participants, the most important parameters shaping the level of residents' approval of living conditions in the city. Rank results in points.



Source: Own study.

Respondents chose from 43 categories relating to the development of, among other things: public services and urban offerings using the possibilities of cyberspace and artificial intelligence, electromobility, the implementation of innovative technological or organisational solutions, digital education, modern forms of promoting entrepreneurship or the development of a transport system adapted to the movement of single-track vehicles (e.g., traditional bicycles and scooters as well as electric vehicles). As a result of the application of ranked responses, a set of tasks was obtained, the financing of which - according to the inhabitants - will most effectively contribute to the creation of a smart city.

The analysis established that, in the opinion of the respondents, factors relating directly to sustainability and respect for the environment are of the greatest importance for the creation of a Smart City municipal community. The largest share of the number of indications was given to the so-called green urban infrastructure

(671 points), i.e., the planting of trees and shrubs in public spaces, the maintenance and expansion of parks or squares, the establishment of flower meadows, etc.

It is worth noting that these measures do not, however, require the use of innovative techniques as a necessary condition for achieving the intended result. Another area is the elimination of the effects of ecological degradation, i.e. more effective removal of air, water and soil pollution (625 points). In third place was the use of modern technological solutions to improve safety in the city (617 points).

When identifying the next spheres of increased investment needs for building a smart city, participants in the research project indicated the need to increase: the efficiency of waste management (598 points), accessibility of city services for people with special needs, including disabilities (591 points), the quality of city transport provided by public transport (571 points).

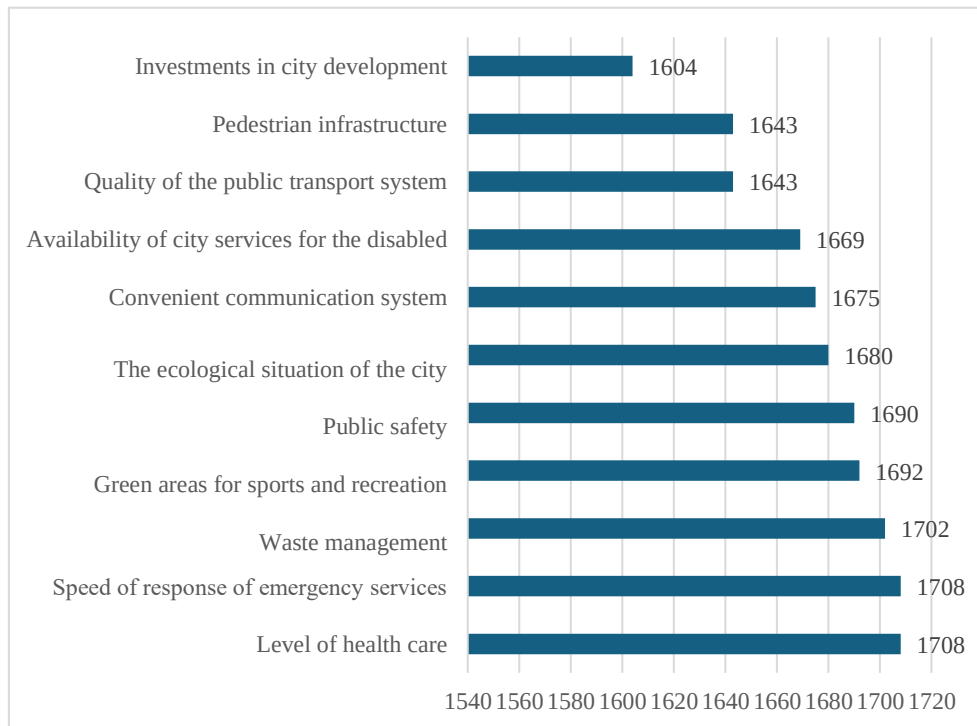
The respondents' perception of the city as smart is also determined by the improvement of water and sewage management (544 points), better management of electricity (503 points), the increase in the share of ecological vehicles such as trams or electric or hydrogen-powered buses in urban transport (500 points). Only further places were taken by typical investment items such as the expansion of: roads and streets (496 points), road lighting systems (485 points), pedestrian infrastructure (481 points), cycling infrastructure (461 points). Likewise, areas based on the application of cyberspace opportunities, including the increase in Internet connection speeds (438 points), the application of smart technologies in crisis prevention (406 points) or the expansion of monitoring of environmental changes (401 points).

5. Discussion and Conclusions

Among the factors shaping residents' level of approval of living conditions in the city, participants in the research project mentioned the level of healthcare above all. In addition to the quality of medical services, they attached great importance to the availability of healthcare facilities and the speed of response of emergency services. Effective waste management, the use of green spaces and the provision of public safety came next.

Moving on from the verification of the parameters ensuring - in the opinion of the respondents - the possibility of creating a smart city to the management sphere, the respondents cited specific undertakings for a smart, yet friendly city. Being able to participate in the local government's financial decisions at the operational level, the respondents would start by allocating funds for investments in the development of so-called green infrastructure (inner-city parks, squares, flower meadows, etc.). They would then address the more effective removal of air, water and soil pollution.

Figure 2. The most important areas in the opinion of respondents that require funding for more effective implementation of the smart city concept. Ranking results in points.



Source: Own study.

The third course of action would be to use modern technological solutions to improve safety in the city. During the survey carried out in Zabrze, most respondents cited the city's video surveillance system consisting of a network of cameras and a surveillance centre (12.4 per cent), as well as technologies supporting traffic control (9.9 per cent) as the best and clearest examples of smart solutions. When asked about examples of smart solutions in city management, introducing traffic control systems (11.1 per cent) was again the most frequently cited, but in parallel also increasing the efficiency of waste management, providing modern tram transport and improving the quality of public transport in the city (9.2 per cent each).

Interestingly, more than half of the respondents were unable to give any example from the Smart City sphere without prompting from the interviewer. The survey was conducted in an important centre of Poland's first statutorily formalised metropolitan structure. Particularly noteworthy, therefore, is the low percentage of residents, reaching only 18 per cent of those surveyed, who were able to identify the concept of a Smart City by exemplifying solutions characteristic of it. This indicates a generally low level of public perception of the smart city concept. In addition to its research value, it also has an applied significance.

Indeed, it confirms the researchers' conclusion that the transformation of cities into Smart Cities must take into account the development of citizens' competences, i.e., focus on people's needs and skills in using ICTs, rather than on the ICTs themselves (Dashkevych and Portnov, 2023). The importance of permanent education in activities from the Smart City sphere should therefore be pointed out.

Lifelong learning is an important factor for increasing competitiveness as well as innovative development (Kuzior *et al.*, 2023). Research confirms that, through information and communication technologies (ICT) primarily through mobile applications, the majority of citizens want a partnership in the creation of smart cities (Fitsilis *et al.*, 2023).

However, it is necessary to create programmes that make it possible to combine the use of modern technologies with the realisation of social participation, taking into account the level of education and the state of digital competence of the citizens themselves. Exclusion due to a lack of knowledge or skills or motivation to acquire them among citizens may rule out the chances of such projects.

It is also worth noting the implications of the collection of huge amounts of data about inhabitants by individual smart city systems and access to these knowledge bases. During natural disasters, accidents or other emergencies, this plays an important role in, among other things, locating victims, facilitating evacuation or improving emergency services. It should be stressed, however, that the lack of precise and constantly updated legal standards, or the failure of local or central authorities to comply with them, can give rise to serious risks associated with the misuse of technology for surveillance.

It should also be borne in mind that the implementation of successive solutions from the Smart City sphere does consolidate the advantage of developed urban centres, but it is not a recipe for counteracting all possible problems, as exemplified by research showing that smart city status did not significantly affect the performance of cities in responding to the COVID-19 pandemic (Pratama *et al.*, 2023). Thus, the local government, when implementing solutions from the Smart City sphere, should follow a strategy that assumes the achievement of objectives in line with the expectations and competences of the inhabitants and the development needs of the city, trying to implement the latest research results in this field in the management process.

References:

- Alizadeh Hadi, Sharifi Ayyoob. 2023. Toward a societal smart city: Clarifying the social justice dimension of smart cities, „Sustainable Cities and Society” Vol. 95, 104612. <https://doi.org/10.1016/j.scs.2023.104612>.

- Bashirpour, B.A., Fedele, M., Formisano, V., Rudko, I. 2023. Urban quantum leap: A comprehensive review and analysis of quantum technologies for smart cities. *Cities*, Vol. 140, 104459. <https://doi.org/10.1016/j.cities.2023.104459>.
- Ben, E.R. 2020. Methodologies for a participatory design of IoT to deliver sustainable public services in “Smart Cities.” In: J.R. Gil-Garcia, T.A. Pardo, M. Gasco-Hernandez (Eds.). 2020. *Beyond smart and connected governments* (pp. 49–68). Springer.
- Cole, A., Lai, C., Stivas, D., Tran, É. 2023. The ‘Smart City’ between urban narrative and empty signifier: The case of Hong Kong. In: A. Cole, A. Healy, C. Morel-Journel (Eds.), *Constructing narratives for city governance: Transnational perspectives on urban narration* (pp. 135-150). Edward Elgar.
- Clement, J., Crutzen, N. 2021. How Local Policy Priorities Set the Smart City Agenda, „Technological Forecasting and Social Change”, Vol. 171, 120985. <https://doi.org/10.1016/j.techfore.2021.120985>.
- Dashkevych, O., Portnov, B.A. 2023. Does city smartness improve urban environment and reduce income disparity? Evidence from an empirical analysis of major cities worldwide. *Sustainable Cities and Society*, Vol. 96, 104711. <https://doi.org/10.1016/j.scs.2023.104711>.
- Fitsilis, P., Tsoutsas, P., Damasiotis, V., Tsivola, R. 2023. How Do Citizens Want to Participate in Smart City Programs? Some Answers from Greece. In: da Silva Portela, C.F. (ed.) *Sustainable, Innovative and Intelligent Societies and Cities*. EAI/Springer Innovations in Communication and Computing. Springer, Cham. https://doi.org/10.1007/978-3-031-30514-6_7.
- Frias, Z., Martínez, J.P. 2018. 5G networks: Will technology and policy collide? *Telecommunications Policy*, 42(8), 612-621.
- Golubchikov, O., Thornbush, M.J. 2022. Smart cities as hybrid spaces of governance: Beyond the hard/soft dichotomy in cyber-urbanization. *Sustainability*, 14(16), 10080.
- Hartley, K. 2021. Public trust and political legitimacy in the Smart City: A reckoning for technocracy. *Science, Technology, and Human Values*, 46(6), 1286-1315.
- Hartley, K. 2023. Public Perceptions About Smart Cities: Governance and Quality-of-Life in Hong Kong, *Social Indicators Research* (2023) 166:731–753 <https://doi.org/10.1007/s11205-023-03087-9>
- Hassan, Q., Sameen Aws, Z., Olapade, O., Alghoul, M., Salman, H.M., Jaszczur, M. 2023. Hydrogen fuel as an important element of the energy storage needs for future smart cities. *International Journal of Hydrogen Energy*. <https://doi.org/10.1016/j.ijhydene.2023.03.413>.
- Jacobs, N., Loveday, F., Markovic, M., Cottrill, C.D., Zullo, R., Edwards, P. 2022. Prototyping an IoT transparency toolkit to support communication, governance and policy in the smart city. *The Design Journal*, 25(3), 459-480.
- Joshi, S., Saxena, S., Godbole, T., Shreya, S. 2016. Developing Smart Cities: An Integrated Framework. *Procedia Computer Science*, Vol. 93. <https://doi.org/10.1016/j.procs.2016.07.258>.
- Ju, J., Liu, L., Feng, Y. 2018. Citizen-centered big data analysis-driven governance intelligence framework for smart cities. *Telecommunications Policy*, 42(10), 881-896.
- Kontokosta, C.E., Hong, B. 2021. Bias in smart city governance: How socio-spatial disparities in 311 complaint behavior impact the fairness of data-driven decisions. *Sustainable Cities and Society*, 64, 102503.

- Korneluk, K., Bielawska, M., Zygałło, S., Dominiak, B., Kruczek, A. 2019. Human Smart City Przewodnik dla Samorządów. Ministerstwo Inwestycji i Rozwoju, Warszawa.
- Kuecker, G.D., Hartley, K. 2020. How smart cities became the urban norm: Power and knowledge in New Songdo City. *Annals of the American Association of Geographers*, 110(2), 516-524.
- Kuzior, A., Krawczyk, D., Onopriienko, K., Petrushenko, Y., Onopriienko, I., Onopriienko, V. 2023. Lifelong Learning as a Factor in the Country's Competitiveness and Innovative Potential within the Framework of Sustainable Development. *Sustainability*, 15(13), 9968. <https://doi.org/10.3390/su15139968>.
- Lai, C.M.T., Cole, A. 2022. Levels of public trust as the driver of citizens' perceptions of smart cities: The case of Hong Kong. *Procedia Computer Science*, 207, 1919-1926.
- Laenens, W., Mariën, I., Broeck, W.V.D. 2018. Channel choice determinants of (digital) government communication: A case study of spatial planning in Flanders. *Media and Communication*, 6(4), 140-152.
- Lebrument, N., Zumbo-Lebrument, C., Rochette, C., Roulet, T.J. 2021. Triggering participation in smart cities: Political efficacy, public administration satisfaction and sense of belonging as drivers of citizens' intention. *Technological Forecasting and Social Change*, Vol. 171, 120938. <https://doi.org/10.1016/j.techfore.2021.120938>.
- Lim, Y., Edelenbos, J., Gianoli, A. 2023. Dynamics in the governance of smart cities: Insights from South Korean smart cities. *International Journal of Urban Sciences*, 27(sup1), 183-205.
- Lin, J., Chen, X., Yan, G. 2023. How Smart City Construction Affects Digital Inclusive Finance in China: From the Perspective of the Relationship between Government and Large Private Capital. *Sustainability*, 15, 9035. <https://doi.org/10.3390/su15119035>.
- Lnenicka, M., Nikiforova, A., Luterek, M., Azeroual, O., Ukpabi, D., Valtenbergs, V., Machova, R. 2022. Transparency of open data ecosystems in smart cities: Definition and assessment of the maturity of transparency in 22 smart cities. *Sustainable Cities and Society*, 82, 103906.
- Machado, A., De, B., Santos, J., Rodrigues, D., Sacavém, A., Sousa, M.J. 2023. Digital Transformation: Management of Smart Cities, Lytras, M.D., Housawi, A.A., Alsaywid, B.S., (ed.), *Smart Cities and Digital Transformation: Empowering Communities, Limitless Innovation, Sustainable Development and the Next Generation*. Emerald Publishing Limited, Bingley, pp. 59-83. <https://doi.org/10.1108/978-1-80455-994-920231004>.
- Makieła, Z., Stuss, M., Mucha-Kuś, K., Kinelski, G., Budziński, M., Michałek, J. 2022. Smart City 4.0: Sustainable Urban Development in the Metropolis GZM. *Sustainability*, vol. 14, nr. 6. DOI:10.3390/su14063516.
- Mańka-Szulik, M., Krawczyk, D., Wodarski, K. 2023. Residents' Perceptions of Challenges Related to Implementation of Smart City Solutions by Local Government. *Sustainability*, 15(11), 8532. <https://doi.org/10.3390/su15118532>.
- McQuire, S. 2023. Beyond the smart city: a communicationsled agenda for twentyfirst century cities. *Online Media and Global Communication*. <https://doi.org/10.1515/omgc-2023-0018>.
- Moran, R.E., Bui, M.N. 2019. Race, ethnicity, and telecommunications policy issues of access and representation: Centering communities of color and their concerns. *Telecommunications Policy*, 43(5), 461-473.

- Nastjuk, I., Trang, S., Papageorgiou, E.I. 2022. Smart cities and smart governance models for future cities: Current research and future directions. *Electronic Markets*, 32, 1917-1924.
- Osowska, M.M. 2023. Smartphone, startup, laboratory - What ambitions and visions do local government officials express by their smart city stories? Case study of Polish cities, *Cities*, Vol. 140, 104438. <https://doi.org/10.1016/j.cities.2023.104438>.
- Pratama, A.B., Amber, H., Shershunovich, Y., Rezende de Castro, A.B. 2023, Do smart cities perform better in governing the COVID-19 crisis? Empirical evidence from Indonesian cities. *Urban Governance*, Vol. 3, Issue 1. <https://doi.org/10.1016/j.ugj.2023.02.003>.
- Reardon, L., Marsden, G., Campbell, M., Gupta, S., Verma, A. 2023. Analysing multilevel governance dynamics in India: Exercising hierarchy through the Smart Cities Mission. *Territory, Politics, Governance*, 1-19. <https://doi.org/10.1080/21622671.2022.2107559>.
- Shin, D.H. 2016. Demystifying big data: Anatomy of big data developmental process. *Telecommunications Policy*, 40(9), 837-854.
- Simonofski, A., Vallé, T., Serral, E., Wautelet, Y. 2021. Investigating context factors in citizen participation strategies: A comparative analysis of Swedish and Belgian smart cities. *International Journal of Information Management*, Vol. 56, 102011. <https://doi.org/10.1016/j.ijinfomgt.2019.09.007>.
- Szołtysek, J. 2015. Uwarunkowania pomysłu smart city. *Gospodarka Materialowa i Logistyka*, nr 2.
- What are smart cities? An official website of the European Union. <https://commission.europa.eu>.
- Yan, Z. , Sun, Z., Shi, R., Zhao, M. 2023. Smart city and green development: Empirical evidence from the perspective of green technological innovation. *Technological Forecasting and Social Change*, Vol. 191, 122507. <https://doi.org/10.1016/j.techfore.2023.122507>.
- Yigitcanlar, T., Mehmood, R., Corchado, J.M. 2021. Green artificial intelligence: Towards an efficient, sustainable and equitable technology for smart cities and futures. *Sustainability*, 13(16), 8952.
- Yousef, Z., Dadashpoor, H. 2020. How do ICTs affect urban spatial structure? A systematic literature review. *Journal of Urban Technology*, 27(1), 47-65.
- Vu, K., Hartley, K. 2018. Promoting smart cities in developing countries: Policy insights from Vietnam. *Telecommunications Policy*, 42(10), 845-859.
- Zabrze 2030 - Strategia Rozwoju Miasta przyjęta w dniu 27 sierpnia 2018 roku jako dokument stanowiący aktualizację Strategii Rozwoju Miasta Zabrze na lata 2008-2020 przyjętej uchwałą nr XXII/284/08 Rady Miejskiej w Zabrzu z dnia 17 marca 2008 roku.