SMART CITIES FROM POLISH PERSPECTIVE

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ABSTRACT

In the consideration of smart cities, there is no systemic understanding of their management, measurement conditions, expected results and potential contextual factors affecting the ingredients and the results as well. A review of the literature indicates that there are various concepts of smart city, smart governance and government, and examples illustrate that both science and art are smart city management. The aim of the article is to present the conditions for building smart cities, taking into account the Polish perspective.

Keywords: smart city, intelligent city management, public transport

INTRODUCTION

The potential of the smart city concept present cities with new strategic challenges (technological, organizational, financial). The starting point should be understanding how to manage modern agglomerations and then build their potential towards smart city. The concept of smart city is often mentioned in scientific studies, in literature reviews and in government studies, but interpreted in various ways.

In the article, the authors tend to adopt the definition of smart city developed by the European Parliament. It draws attention to public issues, partnership and symbiotic fusion of networks, and the use of information and communication technologies (ITC) in a wide range to build competitive advantage and care for a sustainable future (European Parliament, 2014).

Over the past decade, has been made a progress in defining problems, but many cities have implemented only new urban traffic management technologies. This may be the first step on the road to smart city management. However, before the city become "smart", we need to think about a much wider using intelligent technologies, not only engineering, but also organizational in its management. The difficulty is that there are no agreed standards by which we can assess progress of smart cities development. For this reason, the authors show examples in Poland and in the world of interesting solutions in building modern agglomerations in the direction of perhaps not necessarily intelligent, but still well on the way.

At the same time, the authors raise the following hypothesis: The construction of smart cities in Poland will be evolutionary, and the development of information technologies will support this.

Poland is not yet ready to implement revolutionary changes, hence the development of smart cities will take place in many stages. This approach will be particularly initiated by the development of modern telecommunications and information technologies, including IoT (Internet of Things) or AI (Artificial Intelligence). The new, fifth generation of wireless communication systems, 5G, is becoming a very important stimulator in the development of smart cities. At present, the process of standardization and implementation of solutions in Poland in individual cities is underway (Warsaw, Wrocław, Poznań, Katowice, Gdańsk, Łódź, Szczecin). The network enables a more stable, faster Internet connection with higher bandwidth, but above all it means new challenges and opportunities for the rapid development of the Internet of Things (IoT). Construction of a smart city requires the construction of a strategy based on the use of ITC in many areas of city management: economy, environment, mobility, infrastructure, and provision of services for the local community.

The essence of city functioning

The evolution of cities is a fascinating topic, not only historical. We can say that nowadays we are looking at the next stage of this. It is worth to start with indicating of the basic functions of contemporary cities. And these are: administrative, industrial, transport, tourism and leisure, cultural, commercial, scientific, spa and religious functions (Wyczarska, 2016).

Each of these functions can transform into the main one and will be developed and deepened. They affect exogenous and endogenous conditions: historical, landscape, geographical location. The agglomerations of Silesia can serve as a Polish example of cities, which thanks to the presence of natural resources could focus mainly on the extraction and exploitation of coal and they are typical industrial cities. Coal mining increased revenues and profits, gave employment to hundreds of thousands of people. Mines generated the creation of industrial plants working for their needs.

Cities located on major trade routes or having ports by the sea or ocean perform a transport function. Polish cities such as Gdynia, Gdańsk and Szczecin are considered as important transhipment and logistics points. They used to be famous for shipyards and shipbuilding, but there are still many maritime businesses.

Cities with valuable monuments and cultural institutions perform the cultural function. An example is the Italian Florence, which has many museums, palaces, churches and monuments of the Renaissance. Cannes in France also has a cultural function by organizing the annual International Film Festival, which has been taking place since 1946. The ceremony is attended by people associated with the film industry from around the world. The gala awards prizes in various categories, and the organization of this event influenced the perception of the city as a cultural center.

Cities are considered as health resorts when they have medicinal infrastructure, natural values or access to special, healing sources. One of the recognizable resorts in Poland is Ciechocinek, in which there are houses sanatoriums, spa hospitals and many holiday resorts. The spa part is located among rich vegetation, a large amount of flower rugs and picnic areas. There are also famous graduation towers with rehabilitation and calming qualities. Healing waters originating from brine springs are an attraction of the spa for health treatments. Another Polish spa is Kudowa Zdrój in the Lower Silesian Voivodship, where there are natural conditions for the treatment and rehabilitation of people after severe illnesses. On the list of well-known spas, not only in Poland, there are nearly 50 cities that match such well-known centers as Vichy in France, Karlovy Vary in the Czech Republic or Baden-Baden in Germany.

Religious sites such as Assisi, Fatima, Lourdes, Guadalupe, Medjugorje and Nazareth also play an important tourist role in the region in which they are located.

However, most often we have multifunctional urban centers that perform more than one function and combine service, commercial, tourist, cultural and educational functions. They often play an important administrative role - e.g. they are capital cities of voivodeship or countries. Multifunctional centers are usually large agglomerations with a population of over one hundred thousand.

It also happens that because of various reasons cities have to change their functions drastically. This may be due to political changes, natural conditions, e.g. the end of raw materials, the collapse of industry, the lack of labor, the aging of the society, a disaster, etc.

The famous, huge industrial district in the north-eastern United States was based on deposits of coal, iron ore, manganese, zinc and lead with major centers: Philadelphia, New York, Boston, Baltimore, Newark. A region in which the metallurgy, metal, machine tool, shipbuilding and chemical industry were developed. Nowadays, after the necessary modernization, there is a powerful precision, petrochemical, biotechnology industries and many so-called companies not to mention that here are some of the most famous and best universities in the world.

Sheffield, a city in central England famous for "Sheffield steel," had to change its character completely after the fall of the steel industry in the 1980s. They put on education (Quacquarelli Symonds, 2020). They focused on the development of universities and infrastructure to the needs of students. Dorms, cafes, libraries were built, and the University of Sheffield and the University of Hallam expanded their educational offer and opened to foreigners. Universities currently occupy top positions in the rankings and can boast of Nobel Prize winners in the field of chemistry and medicine (The University of Sheffield).

Another interesting case of the city's transformation is the Swedish Kiruna (Kiruna, 2020). The land in the city due to the large exploitation of iron ore and the so-called magnetic anomaly began to crack, which threatened to collapse or landslide residential and public buildings. Therefore, the authorities decided to move the city a few kilometers further so as not to pose a risk to residents. The move has begun in 2007 and meant the demolition of some facilities in the affected area and the construction of new ones at a safe distance from the iron mine. It is known that this involved

huge financial, and also social costs for residents. Green areas and parks (Nowacka-Isaksson, 2005) were created in the area which separated the mine from the new city center, but it required overcoming new difficulties. The whole process is expected to take over 20 years and this is probably the first-ever case on such a large scale (Zuchowicz, 2016).

The examples cited above show that territorial units can change and adapt to the prevailing conditions. The collapse of a sector in the region does not mean the end (although unfortunately this happens), but it can force the authorities to make the necessary changes and find a better alternative. Local authorities should take the residents' good into consideration. All decisions taken must not negatively affect the needs of citizens of the territorial community. To properly manage them, they should distinguish areas important for meeting the needs of residents:

- living conditions, and thus the availability of apartments, spatial planning to take into account appropriate order, land development, greenery architecture and separation of recreational places for families, children, designation of sports facilities and spaces for parking vehicles;
- job opportunities and conditions for employers - providing not only jobs, but development of programs for entrepreneurs, ensuring proper treatment of employees, connecting strategic employment points with the city's infrastructure;
- level of services for residents, i.e. access to administration, education, culture, health care, communication, goods and commercial services;
- environmental protection - paying attention to ecological solutions, improvements that do not adversely affect nature and natural resources;
- security thanks to cooperation with the police, fire brigade and units that can provide protection in the city (Adamowicz, 2003).

It can be said that this is the starting point for building a smart city.

The concept and dimension of smart city

Developing a unified concept of the smart city definition is a challenge and may also result from the fact that this concept is constantly evolving. Sample definitions are presented in Table 1.

Table 1. Smart city definitions / concepts

Definition / concepts	Authors
An intelligent city is one in which investments in human and civic capital as well as customary (transport) and modern (ICT) communication infrastructure require sustainable growth economic and guarantee a high quality of life; it is a city with a reasonable management of natural potentials through shared management.	Caragliu, et al, 2011
A city with educated citizens, using innovative communication channels in the environment at the interface between local administration and citizens.	Lombardi, et al, 2012
The Smart Sustainable City is a city that tries to solve public issues using methods based on information and communication techniques based on the partnership of many municipalities. The existence of a smart city is possible thanks to using technologies to build a competitive advantage and care for a sustainable future through the symbiotic fusion of networks - people, companies, technologies, infrastructure, consumption, energy and space.	European Parliament, 2014,
A city that consolidates the conditions of functioning of critical infrastructure (e.g. bridges, roads, airports, energy networks) so as to improve its potential while increasing the scope of services for residents.	Stawasz & Sikora-Fernandez, 2016,

Source: Adapted from Caragliu et al (2011), Lombarrdi et al (2012), European Parliament (2014) & Stawasz et al (2016)

An intelligent city can provide a specific answer to changing conditions and expectations in the environment. Definitions emphasize various aspects of smart city (Sobolewska, 2018). Such cities invest in human capital, integrate the functioning of critical infrastructure, create conditions for cooperation between the public and private sectors, they

can solve the problem of poverty, exclusion, and improve the comfort of life for all residents. This requires building a platform for cooperation between many municipalities, residents and effective use of modern information technologies.

There are three generations of smart city. In the first generation, advanced technologies play a key role, but the offered solutions are not adapted to the diverse characteristics of cities. Most often the city authorities are not aware of the effects of the implemented technology, the more they do not consult these issues with residents, nor do they examine their expectations. The city authorities play an important role in the second-generation smart city. They are the active part and looking for solutions that will work the best in a given city. The lack of appropriate management arrangements for most cities seems to be the most serious obstacle to their effectiveness and transformation into smart cities (Bolívar, 2016). Modern technologies support the implementation of the strategic plans of the city authorities and contribute to improving the quality of life of the residents. In the third-generation smart city, residents take over the initiative. They propose new solutions. Their ideas expressed in the form of needs and expectations are translated by bidders of modern technologies into implementable projects. The city authorities are here an assistant, observer or support the communication process. Involvement of residents cannot be one-off, they are set up a community of people creating new ideas and solutions. Experts agree that in Polish cities the first generation solutions dominate, the second generation is much less common, and we have to wait for the third generation "Polish smart city".

It is believed that the concept of smart city is quite possible and feasible only by medium and large - sized urban centers. Larger cities are usually a kind of pattern, which may not always be an equally good solution for smaller centers. There are several dimensions of the concept of smart city within its parallel occurring, presented in Table 2.

Table 2. Dimensions of the concept of smart city cities and their definition

The dimension of the concept	Definition
Smart economy	highly efficient and technologically advanced economy, developing new products, services and new business models, conducive to creating local and global connections and international exchange of goods, services and knowledge
Smart mobility	intelligent transport networks: integrated transport and logistics systems using mainly clean energy
Smart environment	high quality social and human capital
Smart living	high quality of life, which means safe and healthy life in a city with a rich cultural and housing offer, providing wide access to ICT infrastructure, enabling the creation of a lifestyle, specific behaviours and consumption
Smart governance	social participation in decision making, transparency of activities, quality and availability of public services play an important role

Source: Adapted from Barns, S. (2016)

The assumptions for the concept of "smart cities"

Creating a smart city involves applying instruments and implementing solutions. But the comprehensive adaptation of the smart city idea and using all its logistical aspects must involve the implementation of multidimensional strategies. The second term of smart city governance or smart city government is often used interchangeably. On the one hand, we look from the point of view of the office as a city unit, while its development concerns a slightly broader context, i.e. not the office itself, but more management.

Table 3. Concepts and definitions

Concepts and definitions	Authors
Smart government - a way of governing the city that consolidates information, communication and technologies to plan, manage and implement action in various areas of the city's activities in order to generate long-term and stable shared value.	Di Maio, 2010
Smart governance - understood such as management, in which all its functions and activities and unifying public, private and civic organizations integrate so that: the city could function efficiently and effectively as a single organism. The main tools to achieve this purpose are information and communication technologies (infrastructure, hardware and software) that enable intelligent processes. This includes public-private and civic partnerships, as well as collaboration with various stakeholders in pursuit of smart goals at city level. Intelligent management, as a crosscutting factor, can also coordinate and integrate some or all of the other intelligent features.	European Parliament, 2014

Source: Adapted from Di Mao (2010) & European Parliament (2014)

The smart city governance solution contributes to better city management by local authorities (Wilhelm & Ruhlandt, 2018). It also leads to reduced infrastructure costs, more efficient using resources, and in some ways makes cities more innovative. Integrated city management (Barba-Sánchez, et al., 2019):

- supports the city's performance of all functions (economic, housing, education, work, leisure) in the least conflicting manner and meeting legally required or desirable standards,
- strives for the best use and protection of human, natural, cultural and economic resources,
- leads to the formation of an integrated city space and good quality public spaces,
- takes into account supra local public goals and city functions in regional and national spatial structures,
- aims to integrate all city users.

Information is the key to integrated city management and the implementation the newest ICT technology (Imsagilova et al., 2019) It is impossible to consciously manage any agglomeration without current and reliable data on the city and phenomena, or activities taking place inside and outside it. (Marek, et al., 2017).

Based on the literature review, it can be indicated that there is no uniform approach to intelligent city management. Research shows significant differences in factors, measurement techniques and defining the concepts of intelligent city management. In addition to the usual identification of problems, the authors face the task of measuring the occurrence or non-occurrence of sets or individual components. The use of basic definitions: "processes" for smart city governance - information exchange, communication, decision making, involvement, participation - cooperation also has a big impact. (Wilhelm & Ruhlandt, 2018). The smart city governance solution contributes to better city management by local authorities (Wilhelm & Ruhlandt, 2018). An integrated approach to building the intelligence of cities is presented in Step 1 (Smart strategies - Governance), Step 2 (Smart projects- Environ-urban, techno-Economic and Socio-Institutional) and Results (Smart Performance – Sustainable Socioeconomic Development) (Camboim, et al., 2018).

The concept of smart city governance includes: components such as stakeholders, organizational structure, roles, technology, legislation, exchange of experience, meters, base components and base assemblies, context parameters, elements of performance and procedural change elements (Odendaal, 2003), (Wilhelm & Ruhlandt, 2018), (Castelnovo, et al., 2016), (Bifulco, et al., 2016), (Fernández-Güell, et al., 2016). The authors emphasize the need for further research in order to better understand what smart city governance consists of, how to measure them and what is their impact on achieving the intended results and designate their areas.

Towards the construction of smart cities

Nowadays, cities are increasingly developing strategic planning processes (Berrone, et al., 2019). As a result, they can take innovation paths and prioritize those aspects that are the future of large smart cities. More than half of the world population lives in cities (Vitunskaite, et al., 2019). This means that urban development must adapt to the needs of the

population and plays an important role in shaping the dimensions of the concept for smart cities cited in Table 2. (Ismagilova, et al., 2019) The current tracking of the ranking of smart cities is helpful in these efforts. The last classification was published on January 25, 2019 under the name IESE Citie in Montion Index 2019. It was the sixth edition of the ranking, developed by two professors Pascual Berrone and Joan Enric Ricart from IESE Business School University of Navara (Berrone, et al. 2019). 174 cities (including 79 state capitals) from 80 countries around the world took part in the study. Table 4 presents the top ten cities with the highest CIMI score and points to two Polish cities that were in the top hundred. The CIMI criterion, which is the basis of the ranking, is a synthetic indicator and a function of partial components. Creating this value is based on a model of weighted aggregation of partial indicators, represented by each of the five dimensions to which they belong. The dimensions taken into account are: smart economy, mobility, natural environment, living conditions and city management

Table 4. Ranking IESE Cities in Montion Index 2019

Ranking	City	CIMI
1	London (United Kingdom)	100,00
2	New York (USA)	94,63
3	Amsterdam (Netherlands)	86,70
4	Paris (France)	86,23
5	Reykjavik (Iceland)	85,35
6	Tokyo (Japan)	84,11
7	Singapore (Singapore)	82,73
8	Copenhagen (Denmark)	81,80
9	Berlin (Germany)	80,88
10	Vienna (Austria)	78,85
	….	
69	Warszawa (Poland)	60,13
	….	
95	Wrocław (Poland)	53,39

Source: Adapted from Berrone & Ricart (2019)

Smart cities are geared towards sustainable development. Infrastructure, innovations and technologies are elements that make smart cities efficient and self-sufficient (Chamoso P., et al., 2020). The aggregate summary shows us the total value of the CIMI coefficient to more accurately analyze how it translates into individual dimensions are presented in Table 5. The thorough analysis of the summary is based on obtaining the lowest values of the component coefficients, which in translation into the resultant CIMI value allows to achieve the highest value - maximum of 100,00.

Table 5. Classification of individual CIMI component dimensions

Ranking	City	Economy	Enviroment	Mobility	Goverance	Living
1	London (United Kingdom)	12	34	3	7	9
2	New York (USA)	1	78	5	26	2
3	Amsterdam (Netherlands)	10	28	11	27	11
4	Paris (France)	8	54	4	37	50
5	Reykjavik (Iceland)	90	1	46	19	108
6	Tokyo (Japan)	3	6	29	71	24
7	Singapore (Singapore)	21	10	67	20	31
8	Copenhagen (Denmark)	25	3	25	12	75

Table 5. Classification of individual CIMI component dimensions

9	Berlin (Germany)	50	47	6	6	40
10	Vienna (Austria)	57	15	7	25	45
…						
69	Warszawa (Poland)	78	96	45	77	20
…						
95	Wrocław (Poland)	92	98	49	112	46

Source: Adapted from Berrone & Ricart (2019)

Looking back over the past several years, smart city seemed like a utopian dream. However, due to the current development of technology, the pace of which is accelerating more and more, it can be concluded that this is a real change (Vitunskaite, et al., 2019). It revolutionizes people's lives, increases economic efficiency and reduces environmental pollution. Such rankings as IESE show Polish cities aspiring to enter the top and be a showcase of cities in this part of Europe, what elements of the city are to be improved and what should be done to become "smart". Focusing only on public transport and the level of life does not give a chance to get closer to the forefront. Criteria such as city's economy, natural environment and city management are equally important. The symbiotic fusion of networks - people, companies, technology, infrastructure, consumption, energy and space - is also important. The hypothesis and analysis carried out according to the adopted classifications show that this requires a large commitment of all interested groups: city officials, residents and specialists from the academic sphere. Entrepreneurs also play a significant role in these processes.

Advantages and disadvantages of implementing the smart city concept

Due to the multiplicity of cities (cities large and small, with high and low development standards, etc.) and the conditions in which they operate (e.g. historical, political, cultural, social and other), as well as the methodology for implementing the smart city idea it is not possible to indicate a catalog of universal benefits from the implementation of this idea in practice. Due to the low level of advancement of smart city projects and intentions, in many cases it is difficult to assess particularly long-term effects of initiating such ventures. Nevertheless, the foundation of numerous patterns can list the expected benefits that will affect the implementation of the smart city idea in cities around the world. These are benefits implemented in various areas of activity, perceived by both residents and other city stakeholders, including local authorities and enterprises (Czupich, et al., 2015, Vitunskaite, et al., 2019).

Below are some of the most important benefits you can get by transforming a city into a smart one:

- improving the comfort of life - easy access in terms of architecture to public administration buildings (direct and indirect),
- improving the quality of life - low- or zero-emission transport, improving air quality in the city,
- benefits for local authorities - simplifying the settlement of matters in offices for residents and entrepreneurs, matching services in accordance with the preferences of the recipients,
- using intelligent public lighting and demonstrating savings in this area,
- optimal using public transport - ongoing satisfaction of users 'needs during transport rush hours,
- implementing a policy of supporting people with disabilities,
- optimization of public service costs,
- increase in the image importance of the city as modern and functional, which in the long-term is conducive to the influx of new residents, investors and tourists (Czupich, et al., 2015).

Examples of changes are spectacular. Curitiba is a very old city, founded in 1654, currently the capital of the state of Parana in Brazil. It has over 2 million inhabitants, and for each inhabitant there is 52 m2 of greenery. It occupies a leading position in terms of innovation, urban development and the level of ecology, it is indicated as a reference city for urban transport solutions. About the mayor of Curitiba (1971–75, 1979–84 and 1989–92), Jaime Lerner is written in management textbooks. Based on his architect's education and passion for environmental protection, he created a number of social programs to facilitate functioning in the city, which raised the quality of life of residents. He focused on building the image of a sustainable city, caring for all residents equally and providing them with a good place to live, work, relax, have no communication problems and be proud of its history (Pluta & Lerner, 2015). Convenience, comfort, mobility and order, he had built his city on these principles, even when there was no discussion about smart city. Initially, he encountered huge opposition and financial difficulties, but he did not give up.

The city authorities analysed the city's needs, access to raw materials and used it to their advantage. They have also created new solutions such as: efficient bus communication system, which is famous all over the world. Currently, buses use only ecological fuel - alcohol from sugar cane. Bus Rapid Transit was created, i.e. fast bus transport, which was to reduce using cars by residents of the city, as well as improve all transport. This was associated with some changes in the urban space, including closing the main street for car traffic and transforming it into a pedestrian street. However, despite objections from drivers, these solutions, although controversial, have brought positive effects for both entrepreneurs (new companies, shops and services within the pedestrian street) and the environment (reduction of CO_2 emissions). Stops are located every 500 m and look like tunnels containing ticket gates. Their structure does not create unnecessary chaos, and in addition it is also adapted for the disabled. The buses come in different colors, and each one reflects a different bus route, e.g. orange vehicles are links between interchange terminals. A sustainable road and transport system modelled on Curitiba has also been introduced in over 80 other cities around the world (Lerner, 2007).

Over 20 years have passed since the initiation of the changes and focus on the ecological trend, and Curitiba is among the greenest cities in the world. It also required long-term changes that required a change in residents' mentality, but also required monitoring. Residents received vegetables or bus tickets for sorting garbage, but an environmental police was also organized and high fines for littering and air pollution.

Wroclaw is a well-known Polish city that has built its new image in a fairly short time. He can aspire to an intelligent city on the border between the first and second generation. Wrocław is the capital of the Lower Silesian Voivodship, it lies on the Oder, has over 600,000 inhabitants, and its area is nearly 300 km^2. Local development became the main pillars of the city's strategy, attracting investors, advertising local education centers and retaining young people in the city, as well as investments in cultural events, as well as emphasis on tourism (Ładysz, 2013).

The city authorities took into account the needs of both residents, tourists and investors. The creation of the program of activities was based on the results of the Wrocław Social Diagnosis in 2014, which showed that satisfaction with the quality of life in Wroclaw is at a very high level and is constantly growing, which did not mean that nothing could be changed (Pricewaterhouse Coopers, 2015). The city authorities implement an open policy, conduct a systematic dialogue with the residents, carefully implement the participatory budget. Created, on the "order" of residents, gyms "under the cloud", bicycle routes, green areas were developed as expected. In order to improve communication in the agglomeration, the Wrocław Spatial Information System was created. It aims to acquire, analyse, process and present data relating to spatial information. Interested persons can find out via the website about all the city's activities, land records, demographic data, the arrangements of the local spatial development plan of Wrocław, etc. In order to solve housing problems, attractive areas for real estate development were designated for about 120,000 people who were to become comprehensively furnished housing estates with the necessary infrastructure.

Sculptures of gnomes were used to promote the city. In different places, those known and less known, figurines of fairy-tale characters have been placed and new ones are constantly appearing. The idea was taken on the initiative of the "Orange Alternative", i.e. a movement fighting the absurdities of communism. In the 1980s, graffiti with elves in orange hats was created in Wrocław. Referring to history, from 2005 sculptures began to appear on the streets of the city. To date, they promote monuments that tourists can visit, following the footsteps of sculptures. Everyone can contribute to putting a new dwarf in the chosen place, because he can submit such an idea (Krasnale.pl, 2019).

In addition to obvious activities for the residents of Wrocław, the city authorities were involved in various actions and events, usually as the hosts of these celebrations. One of the most important was the organization of the EURO 2012 sport event, thanks to which the city attracted football fans from various parts of the world, and could attract visitors with interesting architecture, culture and its history. In Wrocław, promotional campaigns were also carried out under the slogans "Wrocław - meeting city", "Wrocław - your vibes", as well as "WrocLove" (using the word game and the English word "love" meaning love). Thanks to such ideas, the city attracted more tourists, and also "tamed" residents with their place of residence aroused local patriotism. In addition to the information function, such marketing forms increase the attractiveness of the location and allow you to promote the brand. Showing city plans, necessary information on strategic points of the city or placing information in appropriate media means that the city operates transparently and residents can find out what is currently used for their good.

Unfortunately, apart from the positive aspects of the smart city concept, parallel risks go hand in hand that cannot be forgotten, and their presentation can contribute to the full picture of smart cities. This will allow city authorities to make good decisions and development directions for the city.

As already mentioned, there may also be some kind of threat associated with the implementation of the smart city concept. Too much concentration of the smart city idea, especially in the technological dimension, may result in the appearance of negative effects of the development of a modern network infrastructure, as well as ignoring alternative ways of city development. Possible development patterns should also seriously include those that are not based on a business model. The inherent feature of such a model is the mobility of capital, which can flow in as quickly as it can leave the city, especially when another location offers more benefits and therefore profits can be intensified.

An undoubted threat to the development of the city may be the phenomenon of exclusion of certain social groups from the possibility of using the services offered by smart city - e.g. low-paid, elderly, excluded from society due to disability, addiction, etc.

It may also be unfavourable to focus too much on developing a smart city strategy on technology and the so-called "Hard" infrastructure. Sometimes a better way to achieve the goals of a smart city is to use the knowledge and intelligence of residents who are able to independently meet their needs more effectively than local administration can do, even without using technologically advanced tools. As a result, costly infrastructure investments can be avoided by replacing them with social capital, i.e. the energy of cooperation between active citizens.

One cannot underestimate the lack of adequate financial, material and human resources to implement projects related to transformations in cities. This is indicated by many examples of unfinished projects that promised to be very good.

However, it seems that one should try despite the threats, the effects in smart cities are extremely encouraging. You cannot hide behind potential threats and do not make any constructive changes.

Warsaw - towards building an intelligent city

Intensive urbanization, globalization processes and flows of people, property and information cause cities to face pioneering challenges and look for appropriate development strategies. It is becoming crucial to provide innovative methods that meet the needs of citizens and at the same time allow for rational management in accordance with the concept of sustainable development. Warsaw is a "multifunctional" city. This is expressed not only in the fact that it is the capital in which central offices are concentrated. It was here that at the beginning of the transformation at the beginning of the 1990s, many international corporations started their activity. Warsaw is a city with huge traditions, a difficult history with which beautiful monuments are associated. It is a city with the most cultural institutions in Poland - theaters, cinemas, concert halls, museums and churches. There are also a dozen or so sports clubs here, including some with huge traditions and achievements in the form of world champions, Europe and Olympians. Foreigners pay attention to beautiful, well-kept greenery and carefully cared for parks. The capital is the largest academic center with 66 universities. Warsaw is part of trends in many European cities, moving towards sustainable and intelligent development. The capital was appreciated by scientists from the University of French Navarre, who developed the IESE Cities in Motion Index 2019 report (Berrone & Ricart, 2019). Of the 180 cities studied, Warsaw took the 69th place. The city's pursuit of the smart city level allows to improve the residents' satisfaction and savings, which in other cities absorb inefficient and outdated solutions. The possibilities offered by new technologies include the purchase and control of tickets in public transport. It is also a chance to settle personal matters in public administration via the Internet, which results in shortening the time spent in city offices. The availability of free Internet in public buildings and cultural institutions is systematically increasing.

There are many various projects implemented in the capital, which aim to improve the conditions of everyday functioning in the city. These ideas are mainly investments in infrastructure development and the digital layer, which as a result translate into the quality of services provided by the city, including e-services. At the same time, these types of investments are accompanied by many activities focused on building human and civic capital, including involving residents in various projects. By using innovative instruments, these activities increase the quality of life of the inhabitants, and thus bring the capital closer to an intelligently developing metropolis. There are more and more symptoms of intelligent city management, in which the city authorities play a substantive role, setting and uniting the other elements of the smart city (Knight Frank London & Warsaw City Office, 2018). An important role in this area is played by the participation of the public in decisions regarding them directly, the transparency of operations and the high quality and availability of shared services. More and more projects are implemented in cooperation of two sectors: public and private, as well as an integrated city management system that uses innovative technologies. The strategic factors are:

- comprehensive access to municipal, cultural and entertainment services,
- care for the safety of residents,

- public health,
- investments increasing the attractiveness of life in the urban agglomeration.

The city authorities, counting on the main role of residents in determining the needs and expectations, also do not forget about technological solutions that are to improve the quality of life (Knight Frank London & Warsaw City Office, 2018). The use of technology to interact with citizens who can affect such important areas as public transport - replacement for electric and gas rolling stock and installation of public chargers for individual drivers, mobility of residents: city bike system - Veturilo, purchase of electronic tickets, car rental for minutes - Car-sharing; air quality, development and use of green areas, intelligent management of environmental resources. A pilot program is being implemented in cooperation with Dublin in the field of data processing - Big-data - VaVeL system. The platform is designed to integrate and analyse data from public transport and cycling (Veturilo). One of the platform's goals is to create an "intelligent travel planner" for a specific person at a specific place and time, consisting in proposing the optimal route using available communication data. There are many different types of centers and support projects for young entrepreneurs in Warsaw, giving them the opportunity to develop and interact with investors and enterprises - The Heart Warsaw, Reaktor and Academic Incubators of Entrepreneurship.

The capital as an intelligent city is based on new technologies to the maximum extent to achieve civic goals by promoting social coherence and sustainable development. It is assumed that in the long term the smart city initiatives implemented today will enable real-time city management and allow for flexible adaptation to changing requirements in the area of public services.

Building an intelligent city of Warsaw can be seen in the efforts the authorities put into managing public transport, which consists of four types of vehicles. These are: buses, trams, rail (SKM - Szybka Kolej Miejska, KM - Koleje Mazowieckie) and metro. In this respect, the capital stands out from other cities in the country when it comes to the diversity of passenger transport. It shows us the complexity of processes needed to meet the needs of residents. The body supervising this complex organism is ZTM in Warsaw (Public Transport Authority). It is who, on behalf of the city, provides formal, legal and organizational functionality and has full capacity to conclude all kinds of contracts with city carriers as well as with other operators interested in providing transport services in the capital city of Warsaw. In order not to lag behind the future and aspirations for the city of smart city, the authorities are planning to replace the rolling stock in companies providing transport services efficiently and in the long-term. Building a smart city also means adapting the appropriate transport system in areas such as:

- transport and a sustainable environment,
- fast combined transport systems,
- transparency and data analysis in the transport system,
- a diverse, intermodal transport system.

Unfortunately, Warsaw is still a long way from the leaders of the smart city ranking. At the turn of the 1980s, during the political transformation, the city began to be expanded following the model of western metropolises. There was a trend called "uncontrolled suburbanization" (Kulisiewicz, 2018), involving the mass migration of residents to suburban areas with single-family housing and daily travel to work or school in their own cars. Another problem that Warsaw faces is, among others, ownership of urban areas. In 1945, a decree was adopted in post-war Warsaw (Decree of 26 October 1945 on the ownership and use of land in the area of the Capital City of Warsaw, 1945) on the ownership and use of land in the capital city Warsaw, which were transferred to the city. Dematerialization of spatial planning has been progressing for over 20 years. An example of this is the lack of common public space in the city center, this applies to the MDM project from 1950-1952, which is a coherent concept of downtown. For over a decade, it has been operating in public spaces as a paid parking lot. Another example is the surrounding development area around the Palace of Culture and Science, involving the conversion of a car park on Parade Square into a public space dedicated to residents and tourists. The first positive undertaking in the right direction was the liquidation of tin stalls operating for years. Currently, the city authorities are focusing on supplementing or compacting urban areas, as well as modernizing transport routes, and not on building new districts in empty areas that are not urbanized.

CONCLUSION

Achieving sustainable city management goals is taking place today using the concept of development known as smart city. New organizational structures, composed of properly trained employees, are created for the smooth functioning

of systems. Economic issues are also important. City authorities think that the increased costs end of the implementation stage, and the costs of maintaining the systems are assigned to their successors. This way you don't create an intelligent city. Pursuant to the assumptions, the implementation of the smart city concept is focused on the needs of urban residents. As a result, residents are supposed to feel the improvement in the quality of life, implemented solutions will facilitate or even overcome them in overcoming daily hardships.

The development of new technologies and the accompanying easier access to information will make future city management possible in real time. Smart cities use the growing potential of information and communication technologies (ICT) to achieve goals that enable authorities to access relevant solutions. Smart cities are striving to improve through ICT and the ability to analyse data: social coherence, sustainable development, effectiveness.

Achieving these goals is possible only through close cooperation between the city authorities and its residents and a detailed analysis and assessment of data obtained from probes installed in the urban infrastructure, e.g. from traffic lights, at bus stops or on the basis of signals from smartphones. Intelligent systems must be constantly monitored and the acquired data processed and made available and should constitute the stage of initiating new processes.

Innovative projects build social capital by supporting interpersonal relationships and building civil society. At the same time, they strengthen the economic potential of the region in which they operate and thus contribute to building an intelligent city. The socioeconomic significance of the concept described in the urban structure is key from the point of view of improving the quality of residents' functioning. Thanks to innovative solutions, they affect the quality of people's lives, including to save human health and life, improve the environment, increase comfort of living, open new communication channels, expand access to various forms of entertainment, and allow for time and financial savings.

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