THE CONCEPT OF SMART CITY IN THE THEORY AND PRACTICE OF URBAN DEVELOPMENT MANAGEMENT

Article · June 2016

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Abstract

When discussing the issue of development of urban areas, it is not uncommon to highlight a new stage of urbanisation – stage of smart city creation. Increasingly more cities are nowadays labelled as "intelligent" or "smart", even though there is no clear-cut definition which would specify the criteria that cities ought to meet to be considered as such. The existing sets of criteria are relatively ambiguous, they have different priorities depending on the region etc. It is thus extremely important and useful to determine whether or not cities may be considered as smart cities, to what degree and on what grounds. The article's objectives are: firstly, to identify the degree to which the smart city

concept is used for managing cities in general and, secondly, to initially assess whether application of the smart city concept makes it possible to reduce the costs of city functioning.

Key words: smart city, ICT, local management, technology, intelligent city

JEL classification: O18, O31,O33

1. Introduction: Contemporary conditions for urban development

Urbanisation is one of the most important social processes occurring on all continents and characteristic of our age. It is commonly defined as a process of concentration of population in certain points of geographical space, mainly in urban areas. It means the dynamic growth of the urban population and its share in the overall population of a given area, as well as the spatial development of cities and the adoption of urban lifestyle by rural population. A strong concentration of population and various forms of their activities results in increased complexity of life and the countless relationships between the various activities of people, organisations, enterprises, institutions, informal groups with various goals and needs. In modern terms, urbanisation should be perceived more broadly, as a multidimensional system of economic, social, demographic and cultural processes, which results in growing cities and urban populations, concentration of these populations, cities spreading over greater and greater areas, spatial concentration of enterprises and administration, shaping characteristic forms of anthropogenic development and the promotion of urban lifestyle. All over the world, including Poland, urbanisation processes are currently influenced by globalisation, as well as the technical and technological progress. As concentration of population, cities should reflect the social and business needs as much as possible. But these needs are constantly evolving, and time in its social sense, along with quality of life, have become vastly important. The social, economic, cultural and environmental conditions of human dwellings have been changing. The technical and technological progress and innovations create new opportunities to meet the collective needs of urban populations. Improved fulfilment of these needs, reflected by the quality of life, is perceived as equivalent to urban development. Thus, urban development may be defined as a process of positive changes (quantitative growth and qualitative progress) occurring in a given city (urban area), which takes into account the needs, preferences and hierarchy of values characteristic to this area and its community.

Globalisation has numerous indicators, one of them being the fast exchange of information on a global scale. Owing to this exchange, any advantages offered by wealthy cities in highly developed countries to their inhabitants can be quickly observed by cities in less developed

countries. Modern solutions used in a city may be used as a model in a different country, on a different continent. However, implementing such novelties to improve the living standard always entails appropriately high financial cost. Due to this, countries and cities with lower level of social and economic development are usually not able to keep up with the dynamic development of many cities in the world.

Researchers studying cities currently have an extensive knowledge of the classic factors and processes that impact urban development, as well as the barriers and problems limiting it. In the last 40 years, numerous concepts concerning the development mechanisms were created, along with tools that can be used by the authorities to stimulate and control the processes occurring in the city. At this stage, we should point out the phases of urbanisation, from the first one - urbanisation, through suburbanisation and disurbanisation to reurbanisation, related to the spatial development of the city and the changes to local population, and the theory of economic base, which claims that functions fulfilled by the city can be divided into export funtions (material production for supralocal market, processing and distribution of information with a scope larger than the city, often even the country, providing services for population outside the city), and the functions related to services for local population and local market. The latter (or the various activities it encompasses) and scale and scope of influence determine the development of the city. The city-forming role of industry was reflected not only in the dynamics of urbanisation processes, but also significantly influenced the formation of spatial and functional structures (Mierzejewska, 2008). The theory of external effects is one of the theories that explain the formation and the dynamics of development of cities. The creation of external effects is the objective of any activity. Their magnitude, scale and direction depend on the general level of social and economic development. The differences in spatial development result in diversified external effects. Where activities are intensified in a limited area, i.e. in cities, external effects will be doubly powerful. In recent years, the possibilities of urban development were considered in the context of the city's competitiveness, i.e. the creation of the most favourable conditions for enterprises in order to attract new investors. The concept of sustainable development, most widely associated with environmental activity, recognises the need to maintain the natural environment in the most intact state possible. This development may be considered as a whole, or as a combination of different ingredients: environmental, social, economic and spatial. It entails a departure from static and defensive behaviours that concentrate on removing the effects, to preventive actions that allow for not only solving the problem, but also for achieving a higher level of urban development. We should also note the processes of territorialisation of space, which are perceived on one hand as a concentration of activity and, on the other, as a networked connection between various entities and organisations with high levels of human and

social resources (Nowakowska, 2011). We can also cite the process of metropolisation which significantly differs from the processes previously occurring in urban areas and is expressed by new ways of territorial division of labour, capital, knowledge and power. Metropolisation is a process related to the crystallisation of a new type of spatial structure, which gains competitive advantage over other areas on international scale and exhibits different type of relations between the central city and the surrounding region, and which leads to the formation of a large and hugely complex settlement system with diverse internal and external connections, which means the development of urbanised space which leads to expansion, export and creation of model behaviours that are transferred to other areas by the process of benchmarking. Creativity as a factor of regional development (and thus also a factor in urban development) appeared in the works by Swedish urbanist and geographer Gunnar Törnqvist in the 1980s. His works include comments on the relationship between the creative environment and the development of a territory. He focussed on four factors significant for the development:

– large information resources and the opportunities of its transfer inside the area,

– knowledge, its acquisition and accumulation over time by various organisations and institutions,

– competences in various areas and types of activities (Stryjakiewicz, Stachowiak, 2010).

The combination of these elements forms an area, whose main causative force is creativity, i.e. the large-scale ability to create new material and immaterial forms and values. Urban development which stems from the culture and science sectors, as well as the creative capital and economic potential in them which serve as the basis for the formation and development of creative industries, allow us to dub a city a creative one. Four areas imply developmental processes, namely:

– creative capital, co-created by creative professionals, also reflected in social capital and the effectiveness of administration,

– special material and immaterial, technological and information infrastructure,

– urban spaces that are appropriately developed, attractive for people and environments, institutions, creative activities (such as technological parks, cultural and entertainment zones, revitalised post-industrial facilities used for various cultural, scientific, athletic and exhibition purposes),

– creative industries that serve as the basis of economy, an important segment of the city's economic activity.

Richard Florida, who coined the term "creative class" proves, that the cities which gather the most creative and dynamic individuals develop in the most dynamic fashion. In order to maintain

this high dynamism of development, such cities will have to provide their inhabitants with high standard of living, interesting entertainment and freedom to express themselves (Florida, 2010). Concentration of people, capital, production and consumption in cities is also economically justifiable. Concentration determines effectiveness, due to, among others, the benefits of agglomerations. But huge cities (mega cities) also experience numerous social conflicts stemming, above all, from the diversified affluence level of urban communities.

The history of development of every city include times of prosperity, stagnation and depression. The phase that a given city experiences is always influenced by a number of factors, such as the political and economic stabilisation of the country, the nationwide development policies, globalisation, global economic crises, investors' choice of locations, personal decisions of the inhabitants, activities of municipal authorities, entrepreneurship and affluence of the inhabitants. For centuries, regardless of the continent of country, population has been concentrating in cities, reforming their structure, culture, economic power, scope of influence, introducing innovations and new forms of development, impacting public spaces and rules of co-existence, creating modern attitudes, etc., which shows beyond any doubt, that the future will be urban. Therefore it is so important in the process of managing a city (urban structures) to consider the needs and expectations of urban communities, which show mobility, entrepreneurship, creativity, and for whom the standard of living is especially important. The more important, in fact, the more attention is paid to time needed to get from home to work and to access the service sector.

Research into the transformations of spatial and economic structure of cities more and more frequently indicates new factors in urban development, such as advanced technologies that allow us to save time and energy, as well as human and social capital. A modern city means not just its physical structure, but also a vat network of cyber-connections aimed at optimising the consumption of resources and the processes of preventing the negative external effects resulting from the city's sustainable development. After all, concepts aimed at saving resources have been developed in the last decade. One of such concepts is smart growth, which is a method of spatial planning and transport network planning which is meant to avoid the growing costs of the more and more prevalent urban sprawl. More and more often, technologically advanced cities are called smart or intelligent, striving to save all resources (including finances), time or energy.

Cities are the foundation of the civilised world. They are not only the creation of human work, the result of extraordinary cooperation between people (Szymańska, 2007), but also a place where their activities concentrate, an incubator of new ideas and a driving force of economic growth. The process of urbanisation is a characteristic feature of modern civilization, and its course and nature is related to globalisation and technological progress. For decades, the attention of

scientists and policy-makers has been focussed on the question of the source of development in cities and urban areas, and the degree to which the quality of systems for providing goods and services influences the quality of life (Caragliu, Del Bo, Nijkamp, 2011). More and more often, the most important factors that serve as a basis for urban development include social capital, knowledge and advanced technologies that allow for saving time and energy. In the context of development, cities are being analysed from scholars in numerous different sciences. Economists will discuss the cost of city's functioning incurred long-term by both the authorities (meaning the cost of public services), as well as the costs for inhabitants and other users. The costs can be calculated for such areas as municipal transport, public lighting, heating, waste management, maintenance of public facilities or ensuring public safety. From the economic point of view, the relationship between expenses and effects has a special meaning.

2. The general premises of the concept of "smart city"

The concept of "*smart city*" urban development is based in various decision-making areas related to the quality of life on the preference for savings, or obtaining the best long-term expenses-effects ratio, while considering the systemic approach to solving a given problem. *Smart city* is a novel concept aimed at managing cities (urban areas) in a modern way, using the latest technical means offered by advanced technologies (including IT), according to the environmentally-friendly principles and while maintaining the tendency to save resources and achieve the expected results. The development of innovative technologies, especially computer and communication technologies, used in various areas of human activity allows the functionality of contemporary cities to be significantly improved. Intelligence is, in its broad sense, the ability to solve problems, perceive relationships, learn, adapt to the changing external circumstances, seize opportunities, prevent threats, act purposefully, think rationally and cope with problems effectively, process information actively, act logically and foresee the consequences, etc. If we consider the "*smart city*" concept, urban management should be characterised by the above features of intelligence. Innovations and technologies foster "smart" management both in public organisations and the cities, although it is obvious that people (authorities, society, users, policy-makers) are the ones implementing the rules of this concept.

Initially, the model of a smart city applied to information technologies that could be used to plan city development. The first publication on the subject matter is considered to be the book by Ishida and Isbister (Ishida and Isbister, 2000) on methods the information society applied to create the virtual space of the city (Komninos, 2015), using the Internet and IT infrastructure. Subsequent papers evolved towards the city management method (Van der Meer and Van Winden, 2003), the

ability to attract top class specialists (Murray, Minevich, Abdoullaev, 2011) or the ability to develop and absorb innovation (Florida, 2005). The current definitions of a smart city emphasise various aspects of a city's functioning, with special emphasis on the role of the transport and telecommunication infrastructure, ICT, digital media, creative industries and cultural initiatives to improve the socio-economic and political efficiency (Hollands, 2008) and educated society using new channels of communication with the public administration (Lombardi, Giordano, Farouh, Wael, 2012). Komninos (2002) proposes a broad definition, characterising a smart city as a place with a great learning and innovation capacity, creative, having research and development institutions, universities, digital infrastructure, ICT and a high level of management efficiency.

In the discussion on the concept of *smart city* in literature, the role of advanced technologies in the functioning of the city is a characteristic and significant element. The idea is a multi-faceted approach toward urban development, based on competitiveness, sustainable development, intelligence in solving various problems while utilising the opportunities given by computer systems. In the last two decades, national and local politicians in various regions of the world have attempted to define the rules of promoting the use of ICT to stimulate the development of urban areas, but they still suffer from the lack of clear criteria to distinguish smarter and less smart cities (Tranos, Gertner, 2012). The availability and quality of new technologies are thus not the only indicators of "smartness" - some researchers include the relationships between the ICT infrastructure and economic effectiveness in this concept (Roller, Waverman, 2001). Others point out, that the problems of growing agglomerations are usually solved using creative means, cooperation between interested parties, human capital and innovative ideas - in other words, "smart" methods. Therefore, smart cities should concentrate on novel solutions that allow for developing modern cities through qualitative and quantitative improvement of their productivity (Caragliu, Del Bo, Nijcamp, 2011).

The concept of *smart city* combines several ideas of urban development. The European approach to smart cities is based on actions aimed at reducing carbon dioxide emissions, as well as effective use of energy in all areas while improving the quality of its inhabitants' lives. According to the common European vision, smart cities are based on partnerships forged in order to stimulate progress in areas where production, distribution and use of energy, as well as mobility, transport and advanced technologies are tightly connected and offer improved quality of services while reducing energy and resources consumption and decreasing the emission of greenhouse gases. It is assumed, that modern smart urban technologies are an important contribution to the sustainable development of European cities. European cities are precursors of switching to low-emission

economy owing, above all, to the promotion of investment in innovative and integrated technologies.

In the United States, the last three decades saw the development of various concepts related, among others, to the use of innovation and advanced technologies in various areas of cities. The idea of knowledge-based cities primarily focussed on education, development of intellectual capital, permanent learning, creativity and maintaining the high level of innovation. The ICT present in the cities were considered the main factors in developing digital cities. Renewable energy sources and concentrating the activities on environmental protection were the driving force behind the development of eco-cities (Stawasz, Sikora-Fernandez, Turała, 2012).

The problems in determining the elements of *smart cities* are reflected in the challenges in finding a clear definition of the term. But despite the lack of consensus as to the definition of *smart cities*, scientists agree on the number of dimensions that this concept encompasses.

It is generally assumed, that cities can be defined as smart if they have the following elements:

1. Smart economy - cities should have high productivity based on the use and combination of means of production using knowledge, the climate of innovation and flexible labour market; economy should be characterised by the utilisation of innovative solutions and flexible adaptation to changing circumstances. In this sense, the term is also related to "smart" ICT industries, as well as to business and technological zones.

2. Smart mobility - owing to the ICT sector, a city becomes a huge network of connections between all of its resources. Both traditional transport and digital communication should be based on advanced technologies needed for the rational utilisation of existing infrastructure.

3. Smart environment - a smart city optimises its energy consumption by using renewable energy sources and other means, strives to minimise waste emissions and bases its waste management policies on the principles of sustainable development. Environmental activities also require a high level of environmental education.

4. Smart people - a learning society. All changes in the city should be initiated by the inhabitants who, when provided with appropriate technical support, are able to prevent excessive energy consumption and pollution, and try to improve their quality of life.

5. Smart living - friendly environment, especially by the provision of wide access to public services, technical and social infrastructure, high level of security, an expansive cultural and entertainment offer, as well as proper care for the environment and greenery.

6. Smart governance - development in this regard requires the formation of a proper governance system, the development of procedures that require the cooperation of local authorities and other users of the city, and the use of new technologies in running the city.

This also includes smart public administration which is able to create knowledge and use it practice.

Figure 1. Dimensions of smart cities
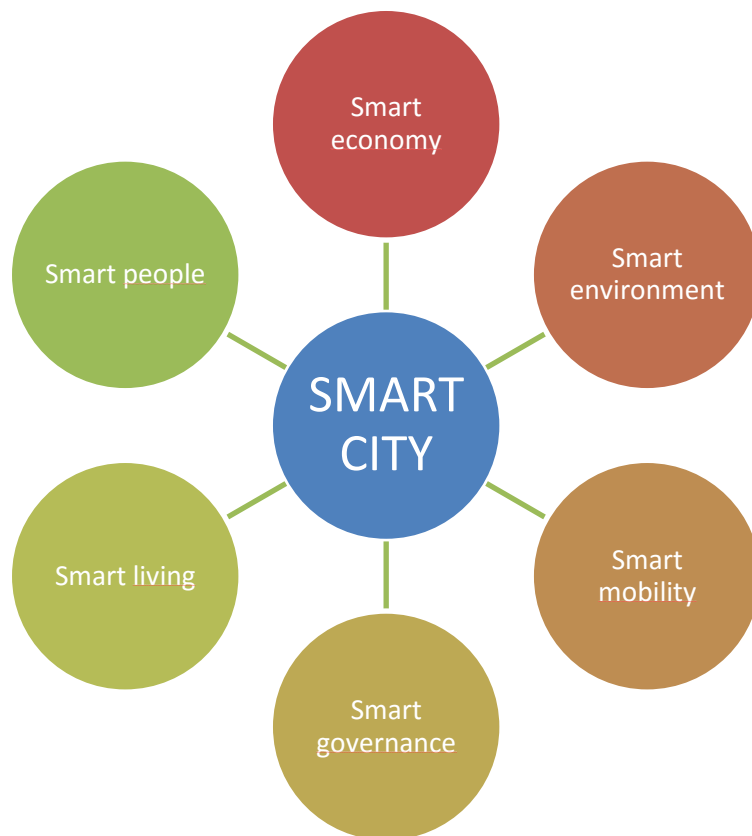
Source: www.smart-cities.eu (accessed on January 15, 2015)

The above six dimensions of *smart cities* are related to the traditional regional and neo-classical theories of urban growth and development. They are based on competitiveness of cities and regions, social capital, governance and new public management, while including the use of advanced technologies among the elements. It should therefore be assumed, that the concept transcends the use of new technologies in order to more effectively use the energy resources and

lower CO_2 emissions by also including other areas of urban life and the functioning of public administration.

When considering which sectors are related to the indicators of "*smart city*" we can list, apart from the above mentioned economy, environment, quality of life, governance, mobility, people that have obvious relation to urban development, the following factors:

- buildings,
- municipal functions,
- public places,
- landscape/ecosystems,
- waste,
- water,
- energy,
- ICT,
- communication, mobility,

in practical circumstances, we can notice feedbacks between these factors. Their interrelations show synergy between urban systems.

In March 2014, the Ministry of Infrastructure and Development presented a document entitled "National Urban Policy". The subjects tackled in the document include: shaping of space, participation, municipal transport and mobility, low-emission and energy effectiveness, revitalisation, investment policies, economic development, environmental protection and adaptation to climate change, demographic challenges, management of urban areas. The national level urban policies are also based on the Leipzig Charter on Sustainable European Cities[1]. The subject matter of this document clearly show how important the principles of sustainable development are, and we can also surmise that the concept of "smart city" is discussed in it.

In attempting to define *smart cities*, some researchers emphasise the differences between *intelligent cities* and *digital cities*, pointing out the role of social and human capital, education, partnership and environmental factors as the main driving forces behind city growth. Regardless of which label we attach to a modern city, all of them represent an image of a city which has a vast number of information processes, mechanisms to free creativity, facilitates the absorption of innovation and has a sustainable approach to its development. Cities are such places. In constructing the notion of "creative class", Florida includes, among others: scientists and engineers, university

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[1] The Leipzig Charter is an EU document which includes common rules for sustainable development of cities, adopted on May 24-25 2007 in Leipzig by the ministers of member states and concerns the development of cities and territorial coherence.

lecturers, poets and writers, artists, entertainers, actors, fashion designers and architects, as well as leaders of "fashionable societies": non-fiction writers, editors and media people, influential pop culture and elite culture figures, consulting teams and any other opinion-forming communities. Apart from that, the creative class includes professionals in new technologies, financial, legal, management and medical services - people whose work involves creative problem-solving and seeking innovative solutions. It is thus the territory of high ability to learn and innovate, creative and equipped with research and development facilities, higher education, digital infrastructure and communication technologies, as well as a high level of management efficiency (Komninos, 2002).

The approach to urban development based on the concept of "*smart cities*" is the result of the need to eliminate or limit detrimental phenomena in urban people's everyday lives expressed by today's societies, as well as the opportunities afforded by the technical and technological development, including IT. Significant problems of contemporary curban settings, also experienced by Polish cities include:

− increasing traffic congestion, generating time losses in transit,
− lack of well-organised public transport,
− the prevalence of cars as the main means of communication (road safety, collisions, accidents, air pollution),
− growing pressure on undeveloped, attractive land,
− the loss of advantages in city centres, hazards originated by the weakening of social bonds and the increasing prevalence of all types of social pathologies (Mierzejewska, 2008).

All of the above problems that occur in cities are solved at the level and speed available with the financial means of these cities. The systemic approach to municipal governance is also important, especially when combined with the ability to foresee the long-term results of undertakings. The formulation of development strategy (directions, goals, tasks) and the selection of priorities are equally important.

The main question that appears when classifying cities as smart concerns the stage of development, at which a city may be considered such. Is a city, in which the actions described above occur in just one area? Or should *smart city* be thought of globally and be considered smart only when it meets the requirements in all six dimensions? What is the state we should aspire to?

In order to describe a city as *smart*, available and new resources, as well as possible investments, have to be optimised. This is achievable through supporting advanced ICT, especially in power engineering, technical infrastructure, public security, waste management and transport (Lazaroiu, Roscia, 2012). It is also important to not invest in implementing advanced technologies

at the expense of other investments that lead to the development of the city and the improvement of well-being. The authorities have to be aware that strong and positive developmental effects do not have to come solely from the utilisation ICT (Anttiroiko, Valkama, Bailey, 2014).

3. The concept of "*smart city*" and the modern approach to managing public affairs

Public management derives from the universally known and used theory of organisation and management, but significantly differs from managing private companies. The differences mainly stem from the nature of both of these sectors. The first and biggest difference is that the public sector organisation - the state or territorial government - is meant to serve the citizens (Markowski, 1999), fulfilling such functions as the provision of goods and public services. Moreover, other differences can be found, such as the scale of activity, the number of employees or its close relation to the political system, which often influences its goals, nature and methods.

The basic premises of public management were born as a criticism of Max Webber's model of ideal bureaucracy, although, as has been stressed in literature, the later managerial model of public management maintains some of its rules (Hausner, 2008). The concept of New Public Management is based on the introduction of professional management in the public sector through clearly defined standards and benchmarks, enhanced control of results, improved financial discipline, savings in all resources and competitiveness. Another theory, participatory management, is characterised by the involvement of all stakeholders in the governance process, transparency of procedures and decisions, as well as responsibility and the strive for sustainable development (Hausner, 2008).

Public management may be construed in two ways: as management of public affairs and as management in the public sector. The difference is only visible in the approach to management itself (subjective in management of public affairs and objective in management in the public sector). In both cases the management is performed by public bodies on the national or territorial level (local government), which perform the tasks they were given by appropriate administrative acts.

The status and functioning of a city is regulated by the municipality government act and the county government act (for city counties), that define their goals and rules, the competences of local government representatives and bring order to the catalogue of tasks required to conduct public affairs. City management is, of course, an area of public management, which involves influencing people in order to make them perform specific tasks, as well as using municipal resources in order to achieve specific goals (Markowski, 1999).

If we consider public management to be the search for effective organisation of the process of performing public programs, we can conclude that management based on the idea of smart cities

has become a requirement for public authorities as far as making decisions concerning the directions of urban development and the rules to be observed in decision-making processes in their functioning are concerned. The choice of appropriate instruments to achieve the previously set goals is an important matter. This means that a set of rules has to be developed, that would define the methods of controlling and conducting urban development and would be used in relationships with all stakeholders. Finally, the issue of the method and scope of utilisation of municipal resources in the strive for improved quality of life is also important.

We should consider it obvious, that efficient city management entails consideration for all aspects of its development. This means, that strategic documents that serve as instruments for the local government's decision-making process, cannot contradict one another. When making any decisions concerning the city, local authorities have to consider its possible ramifications for all areas - social, economic, spatial and environmental. Such behaviour can be considered to be in line with the rules of sustainable development, which provides high environmental, economic, social and spatial standards to all people using this city, as well as to all future generations, according to the rules of intergenerational and intragenerational equity. This concept thus assumes, that the needs of the present generation can be fulfilled without jeopardising the future generations' chances of fulfilling them. This means making decisions in a way that leads to resource savings and the decrease in material and immaterial costs of the city.

Recent years have seen a series of contextual transformations in public administration, mainly involving the division of processes of production and provision of services, as well as the search for creativity and innovativeness in providing public goods. Additionally, the development of information society, knowledge-based economy and the digital technologies have forced the public sector to change how services are provided.

Intelligent solutions in public service provision have been discussed among researchers and politician since the 1990s, when the issue of digitization in public administration emerged (Anttiroiko, Valkama, Bailey, 2014), first as the notion of intelligent community, then of intelligent city and knowledge-based city (Komninos, 2002).

The transformation of the public administration's service provision methods requires that they become codified and formalised using advanced technologies, while digitisation in itself makes the cost of the process lower. Additionally, more and more local services become available globally. If we suppose that the implementation of new, advanced technologies in the system for managing the city and its affairs is meant to improve the living conditions of the inhabitants and lower the overall cost of the city, public authorities have to face the challenge of choosing specific technologies. This may be hindered by the frequent lack of necessary technical skills of public

administration employees, as well as the recipients of such services. This may result in certain solutions failing to become as effective as expected.

Smart city is not a traditional product, it requires some consideration of the direction of municipal policies. City authorities may use the notion to create policies in various sectors, but we should not forget, that marketing slogans have to be followed closely by real actions.

4. The concept of *smart city* in the principles of urban development policies in Poland

The *smart city* concept is still largely unknown in Poland and thus considered mostly in the context of rationalisation of energy management or intelligent transport systems - it may seem that the latter are among the most desirable *smart* systems. When analysing the strategic documents issued by Polish cities, one can notice that they lack the comprehensive perspective of intelligent development in all functional areas of the city. On national level, the Efficient State 2020 strategy developed by the Ministry of Administration and Digitization can be considered partially compatible with the concept. The main goals of the strategy are the effective and efficient public administration open to cooperation with the citizens, as well as effective provision of public services using advanced technologies.

The global developmental trends are closely related to the transition to the era of IT digitization happening in developed societies. The most visible signs of this process in larger scale are:

- the growing significance of science and education in economy,
- direct transformation of knowledge into a production resource,
- diametrical and total transformation of all sectors of human life,
- the creation of new professions with growing significance of the ability to collect, process and use information.

In accordance with this rules, the rules for cities' functioning and development will naturally evolve towards sustainable development and the concept of *smart city*. Beneficial solutions introduced in a given state or city, will be implemented in other urban areas, usually through benchmarking.

Despite the authorities' investment efforts after World War II, Polish cities have still not been sufficiently modernised or provided with modern infrastructure, and in fact it should be noted that they are far behind European cities in this respect. The smart city concept in Poland is starting to be perceived as a method of modernising the infrastructure of cities, which partly contributes to reducing the costs of the city functioning. ICT technologies have been gaining popularity, although

the scope and scale varies depending on the city. This depends on the financial situation of the city, the creativity of its authorities, knowledge, needs reported by the inhabitants and first and foremost on the understanding and inclination of society to accept and be able to use the pioneering solutions. Recent years have seen a number of initiatives implemented in Polish cities to improve the quality of the technical infrastructure and availability of public services for the city dwellers. Measures taken to improve urban transport, relating to power and heat consumption, as well as ITC projects contributing to more efficient operation of offices (e-administration) and communication with stakeholders, are of special interest.

Poznań and Łódź may be cited as good practical examples of cities implementing measures as part of the concept of a smart city. Poznań has the fifth largest population in Poland (540 000). It is a major road and railway hub in Poland with an international airport. Poznań is an important academic centre with highly positioned industry (a well-developed creative industries sector), trade, logistics and tourism. The city authorities undertook an initiative promoting modern solutions facilitating the life of the inhabitants, related to the e-administration tool. Such undertakings fully fit the "smart city" concept. Many transactions can now be done on-line, including car registration, property tax issues and making an appointment in an office to avoid queuing. The city services also make reporting an incident to the municipal police or finding a grave in a cemetery in Poznań easier. Since 2013 there have been posters with QR codes to download audiobooks free of charge on buses and trams.

Using the Internet in urban space has become easier owing to hot spots on trams and buses. A network of mobile hot spots has been implemented under a project entitled "Wireless Poznań" introducing free Internet use in the city centre. The services and mobile applications employed facilitate buying tickets in the moBiLET system or paying for parking in paid parking zones using a mobile phone. The Urban Multimedia Information Guide (Miejski Informator Multimedialny – MIM) is a joint enterprise of Poznań City Hall and the Poznań Supercomputer-Network Centre. It has been developed using materials provided by the departments of the City Hall, institutions and their partner institutions. MIM is the official website of Poznań City Hall. A document can be sent to the Electronic Mailbox of Poznań City Hall and has the same legal status as a paper copy submitted in person. Documents signed with a qualified digital signature can be sent to the Electronic Mailbox as attachments. Poznań is regarded as the leader in electronic administration in Poland.

Łódź is the third largest city in central Poland, only 130 km from Warsaw. A unique Electronic Traffic Control System is being implemented in Poland. The system gives right of way to public transport. It covers a total of 240 crossroads that will be equipped with cameras for

monitoring and recognising registration plates. The images from the cameras will be sent to the new traffic control centre. The bus and tram stops will be provided with 100 electronic passenger information boards displaying the actual bus or tram timetables. GPS units installed in the public transport vehicles will send information about their location to the system. Analysis of the actual travel time will be made automatically. The main aim of the system is to give right of way to trams and buses. They will send signals that will be captured by sensors along the public transport routes and the sensors will communicate with controllers at the crossroads. This will result in switching the traffic lights to give priority to the tram or bus. Additionally, nine boards will be installed in the main streets of Łódź displaying information about traffic problems, traffic jams or recommended alternative routes. The new system will be compatible with the system servicing Łódź regional Tram (the tram line connecting the northern and southern parts of the city and running further on to Pabianice). Public transport (MPK) passengers and drivers will be able to download free smartphone applications with information about the waiting time for a bus or tram and traffic problems. The Traffic Control System was activated in some parts of the city in November 2015 when the modernised East-West route connecting the two largest districts of Łódź, Widzew and Retkinia, was opened[2].

Under the smart city project the city authorities intend to take advantage of innovations to improve the safety and living standard of the population. A modern IT infrastructure will operate in the New Centre of Łódź. Then, intelligent monitoring will be added. This will allow analysing adverse behaviour that can occur in public places. The system will also be useful for traffic analysis. There are plans to install 275 cameras in 92 locations in the Centre. The new IT infrastructure and data compilation in one place will help create different IT applications, some of which will be tailor-made for the city authorities. Smartphone and tablet apps will include a passenger information system (information about traffic jams, collisions and traffic obstacles), a "Street Bump" application (to collect information about road holes, obstacles, unauthorised landfills and snow-covered pavements) and an application providing information on culture and sports events.

It should also be noted, that the main EU priorities concerning cities include the support for integrated municipal policies promoting sustainable development of urban areas in order to improve the role of cities in the new cohesion policy. In the currently ending programming period, it was decided that the role of cities in EU cohesion policies should be increased, mainly considering the role of cities in achieving the goals of the Lisbon Strategy. This strategy is focussed on four areas:

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[2] The investment value amounts to 78 million PLN.

1. Innovation - in the context of knowledge-based economy.

2. Liberalisation of financial, energy, transport and telecommunication markets.

3. Promoting the development of enterprise, mostly through facilitating the foundation and conducting business operations.

4. Strive for social cohesion through shaping a new model of providing social support.

The goal of Europe 2020 strategy is the achievement of intelligent ans sustainable development that will foster social inclusion. Intelligent development is based on achieving positive effects in education, scientific research and innovation, as well as on effective use of ICT. Three main initiatives were identified in this regard:

1. A digital agenda for Europe - a unified digital market based on high speed data connections.

2. Innovation Union - improvement of the process of innovation and the utilisation of research and development activities in eliminating the most important social and economic problems.

3. Youth on the move - enhancement of the attractiveness of European higher education and facilitated access to foreign schools.

In the above strategy, sustainable development is based on the competitiveness of low-emission economy, rational use of resources, intelligent energy and transport networks, as well as the improvement of enterprise development conditions. Support is provided by two main initiatives (Sikora-Fernandez, 2013):

1. Resource efficient Europe - providing energy security, limiting carbon dioxide emissions and rationality in managing resources.

2. An industrial policy for the globalisation era - support for enterprise in reacting to changes brought by globalisation and the economic crisis.

5. Concluding remarks

The development of high technologies which allows for fast, unlimited transfer of data, availability of databases, appearance of effective and easily programmable infrastructure as well as a growing network of sensors and steering modules all result in increasing computerised cities. The major benefit of this general trend is that the quality of services provided to the inhabitants grows while economies in terms of financial resources as well as time and energy which are required for the city's functioning are becoming a possibility. With reference to Polish cities however, a general thesis is that their technological backwardness remains one of major barriers for decision making and rational usage of resources.

Poland still faces the challenge of implementing the governmental Plan of Informatising Poland. Its major objectives include:

- ITC service provision which is well suited for the needs of citizens and business alike;

- Improving the efficiency and effectiveness of public administration through implementation of modern ITC technologies;

- Creating conditions for development of information society.

What is more, local government authorities need to seek out solutions which would enable them to use modern technologies in city management processes, in particular in terms of energy, transport, housing, public safety and e-administration.

Introduction and development of ICT-based services in cities is nowadays an unavoidable trend. Local and regional government authorities seem to recognize this fact – ICT technologies are and increasingly frequently implemented into the everyday routine of urban development.

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