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THE SMART CITY CONCEPT AND ITS IMPORTANCE IN THE DEVELOPMENT OF URBAN SPACE

KONCEPCJA INTELIGENTNYCH MIAST I JEJ ZNACZENIE W ROZWOJU PRZESTRZENI ZURBANIZOWANYCH

Summary: The aim of this paper is to discuss the smart city concept and indicate how its implementation may influence the efficient development of urban space. The paper is a review of the results of research on the smart city concept, smart cities in the European Union and selected aspects of modern urban space development. The author used above all a descriptive method and simple statistical methods. As the paper proves, the implementation of the smart city concept can facilitate and support the development of urban space. The main conclusions concern its impact on awareness in society, civic participation, creative attitudes, entrepreneurial activities and innovative solutions.

Keywords: city, urban space, development, smart city.

Streszczenie: Celem artykułu jest omówienie koncepcji inteligentnych miast oraz wskazanie, w jaki sposób jej wdrażanie może wpływać na sprawny rozwój przestrzeni zurbanizowanych. W opracowaniu zawarto przegląd wyników badań z zakresu: rozwoju tej koncepcji, rozwoju inteligentnych miast w Unii Europejskiej jak również wybranych aspektów rozwoju nowoczesnych przestrzeni zurbanizowanych. Autor użył przede wszystkim metody opisowej oraz prostych metod statystycznych. Jak udowodniono w artykule, wdrażanie koncepcji inteligentnych miast może ułatwiać i wspomagać rozwój przestrzeni zurbanizowanych. Główne wnioski dotyczą wpływu omawianej koncepcji na: świadomość społeczną, partycypację obywatelską, kreatywne postawy, przedsiębiorcze działania oraz innowacyjne rozwiązania.

Słowa kluczowe: miasto, przestrzeń zurbanizowana, rozwój, inteligentne miasto.

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1. Introduction

The smart city concept is a relatively new direction in the theory and practice of urban economics. A special interest in implementing it in the Member States of the European Union falls into the programming period 2014–2020. The cities which develop initiatives in line with the smart city idea can apply and acquire significant means to co-finance such projects from European funds. This paper aims to discuss the concept of a smart city and indicate how its implementation may influence the efficient development of urban space.

2. The smart city concept

In the literature on the urban economics from the turn of the 20th and 21st century the following terms gained in popularity: intelligent city, smart city, knowledge city, digital city, wired city, sustainable city, green city, eco-city, resilient city, creative city and talented city. All of these concepts relate to modern urban structures and systems whose operation and development are carried out through more or less comprehensively planned but deliberate ventures. These structures and systems result from networking relations occurring in cities and their relationships with the environment, and various types of entities being engaged in certain activities, including the urban community (civic participation). Depending on the type of a city, a stronger emphasis is placed on knowledge, digital dimension, sustainability, ecology, resilience, creativity etc. However, for all of the concepts, one emphasizes the importance of information and communication technology (ICT), multi-functionality of the implemented solutions, as well as the synergy effect.

Due to the limited volume of the paper and the nature of the subject, the focus has been on the concept of a smart city and the comparison with the closest term, i.e. that of an intelligent city. N. Komninos (*inter alia*) described an intelligent city as characterized by (see [Komininos 2015, pp. 1–2; Kominionos, Sefertzi 2009, p. 1]):

- innovation combined with a high level of management efficiency,
- creative inhabitants,
- effective development of knowledge,
- accumulation of R&D institutions and universities,
- a wide availability of digital infrastructure, e-services and ICT,
- high learning capacity.

In line with this approach, it can be stated that the concept of an intelligent city is a broader concept than that of a smart city. An approach based on a smart city is supposed to bring a city closer to the vision set out in the concept of an intelligent city, but in practice (it may be due to the fact that cities are in the initial stages of the implementation of the smart city concept) cities are focused primarily on individual

projects consistent with the smart idea. The most common emphasis is laid on the use of ICT and human capital, social capital and civic participation in the smooth implementation of solutions in the field of sustainable development and sometimes, in the narrower sense, eco-development. In some cities it is estimated that these individual projects have a chance to create a comprehensive system in the nearest future, as for others – the road to comprehensive solutions seems to be distant, and the effects are difficult to predict.

In theory, the factors which constitute the smart city concept concern the following areas: smart economy, smart people, smart governance, smart mobility, smart environment and smart living. Whether and to what extent a city may be considered smart often depends on the progress in many fields, such as industry or education, but also advancement in the field of technical infrastructure and the so-called soft factors (e.g. knowledge, innovation, know-how) [*Smart Cities. Ranking...* 2007, p. 10]. In the relevant literary sources on the subject, we can also find the concept of “smart growth” which signifies the development of a city preventing it from dispersal, focused on reducing energy consumption, time or other resources [Stawasz, Sikora-Fernandez, Turala 2012, p. 98]. In practice, at the current stage of development of urban systems and structures, specific “smart” components often occur most selectively. The implementation of the concept is financed primarily with public funds, including those of extra-local character. In the cities of the European Union the projects supporting the concept of a smart city in the 2014–2020 programming perspective are co-financed by the Structural Funds. Strong interest in this concept demonstrated by the central authorities (not only in the European Union countries, but also in the United States, Canada, Mexico, Singapore, South Korea, China and others) leads to suspect that through the implementation of more projects, the ventures become more complex. In order for this to happen, it is important to place greater emphasis on better, more effective planning of the development of smart cities.

The smart city concept is deeply rooted in the American city economics. Representatives of the Massachusetts Institute of Technology under the direction of W.J. Mitchell underline that a smart city draws from combining IT solutions, including the use of numerous sensors and meters with generally occurring local community intelligence. This intelligence is mentioned and discussed in conjunction with other urban systems. Its existence is dependent, apart from intangible components (e.g. social ties, human capital) of an evolved network of technical connections. A smart city is a system composed of multiple subsystems; thanks to their co-ordination, a significant increase in the efficiency of urban structures takes place. One can also reap the benefits related to sustainable development of a city [*Smart Cities: Vision*].

In the European Union within the framework of the smart city concept, it is noteworthy to perceive the importance of such factors as [*European Innovation Partnership...* 2013, p. 4]:

- the saturation of technological innovations (including energy, transport, telecommunications sectors),

- the presence of social innovation (including those related to civic participation),
- better planning,
- cooperation of authorities with businesses, other organizations and the community, all of which contribute to success,
- improved solutions are possible thanks to the synergy of actions.

Initially, while working on the cohesion policy in the period 2014–2020, the EU commissioners focused on the need to support initiatives for innovative partnerships for smart cities, i.e. those which operate more efficiently through the use and combination of different technologies. In subsequent years, this view has evolved and it is now wider with primary emphasis on the role of social innovation and better (more efficient) planning.

The Strategic Implementation Plan defined smart cities as “systems of people interacting with and using flows of energy, materials, services and financing to catalyze sustainable economic development, resilience, and high quality of life” [*European Innovation Partnership...* 2013, p. 5]. A smart city is a city which creates better conditions for meeting the social and economic needs. What is important is that the flows and relationships can be regarded smart due to clear planning and management of urban structures. The tool which enables to achieve these goals is a sufficiently developed information and communication infrastructure [*European Innovation Partnership...* 2013, p. 8].

The problems here are associated with an objective assessment of whether and to what extent a city can be considered a smart city. This assessment depends on a selection of indicators. They should first describe the activities related to environmental protection, energy policy, transport policy, as well as the state of human and social capital, quality of life, advancement in the field of civic participation and the availability of information technology. A detailed selection of indicators and databases on the basis of which they will be calculated, will affect the obtained results, e.g. the position or even the fact of being listed in the ranking.

3. Smart cities in the European Union

The ranking of the so-called smart cities was developed for European cities in 2007. For medium-size cities (selected among the cities with a population of 100,000–500,000 inhabitants), results for large cities were also presented (partly in the form of ranking, taking into account all of the European Union cities with a population equal to or greater than 100,000), in the study which was conducted in 2013.

In the first study *Smart Cities. Ranking of European Medium-sized Cities*, the survey covered 70 select European cities with the population of 100,000–500,000, each of which had at least one university and was not in the influence zone of other big cities – due to the need to obtain comparable data within the Urban Audit [*Smart Cities. Ranking...* 2007, p. 13]. There were 364 cities in Europe with the

target population having at least one institution of higher education. As many as 70 of these cities were ranked according to six characteristics: smart economy, smart people, smart governance, smart mobility, smart environment, smart living, thus we only have the information on how smart a city is compared to others. Being listed in the ranking, especially in low positions, does not mean that a city is distinctively smart. In the top twenty there were four Austrian and Dutch cities, three Danish and Finnish, two Belgian and one city in Luxembourg, France, Slovenia and Sweden [*Smart Cities. Ranking...* 2007, p. 16].

More interesting information is provided by the study entitled *Mapping Smart Cities in the EU*. It examined which of the major European Union cities (with a population equal to or greater than 100,000) have characteristics of a smart city, the extent to which their development is consistent with the concept and a detailed analysis of the situation in the selected leading cities in that respect. According to the survey, out of 468 large cities in the European Union just over ½ (240 cities) had smart city features, out of which 82 cities had only one feature. Smart environment activities were performed in the largest number of cities (it was over 42% of large cities and approx. 83% of large cities recognized as smart cities), the second most popular feature, smart mobility, was valid for a much lower number of cities (approx. 27% of major cities and 50% of smart cities). The least common features are: smart people (respectively 11% and approx. 21%) and smart economy (over 14% and approx. 27%). The absolute values for each of the characteristics are shown in Table 1.

Table 1. Smart cities according to characteristics

Characteristic	Number of cities
Smart environment	199
Smart mobility	125
Smart governance	85
Smart living	71
Smart economy	67
Smart people	52

Source: own elaboration based on: *Mapping Smart Cities...* [2014, p. 36].

Given the location of smart cities by country, in absolute values and in alphabetical order most smart cities (31 and more cities) were identified in Spain, the United Kingdom and Italy; high positions (from 11 to 30 cities) are occupied by France, Netherlands, Germany and Sweden. On the other hand, considering the number of smart cities as a percentage of large cities in a country (also in alphabetical order) over 75% qualified in Austria, Denmark, Estonia, Finland, Italy, Slovenia and Sweden; in the range of more than 50% to 75% the following countries are to be found: Belgium, Netherlands, Portugal, Spain and the United Kingdom [*Mapping Smart Cities...* 2014, p. 39].

A new initiative in the European Union is the European Innovation Partnership on Smart Cities and Communities. The partnership is based on three pillars [*Smart Cities and Communities...*]:

- smart energy,
- smart mobility,
- urban ICT.

This is an initiative of local authorities and the European Commission, in accordance with the principle of subsidiarity, and it plays a coordinating and advisory function.

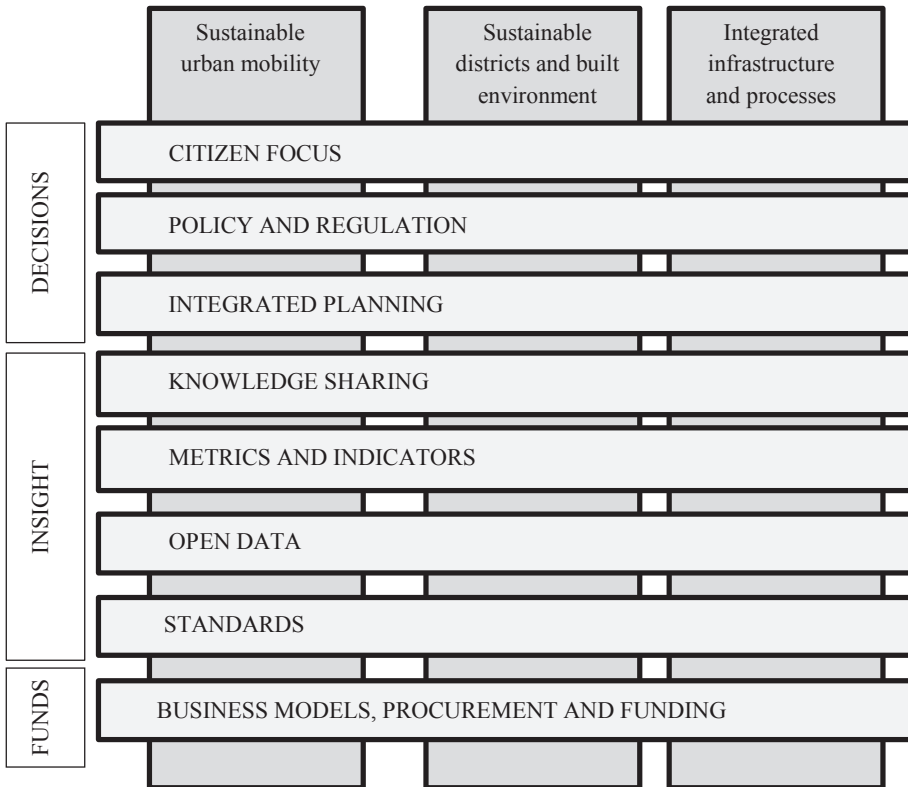


Figure 1. Priority areas in the Strategic Implementation Plan for European Innovation Partnership on Smart Cities and Communities

Source: own elaboration based on: *European Innovation Partnership...* [2013, p. 7].

As shown in Figure 1, joint action plan covers three main areas (horizontal layout) and eight subjects (vertical layout). The partnership will contribute to accelerating the implementation of the smart city concept primarily thanks to a closer cooperation between the cities which are carrying out smart strategies.

4. Selected aspects of urban space development in the context of smart city Initiatives

In the management and development of urban spaces such aspects as environment, participation, heritage and cooperation play a significant role. The implementation of the smart city concept can help to manage a city, with a particular emphasis on those roles. A smart city is dependent on the functioning of many systems which should form one coherent system based on network connections. Developing and strengthening the efficient functioning of such a system requires involvement on the part of various stakeholders, including large social groups. It also requires the continuous implementation of innovative solutions. The concept of a smart city provides such opportunities. Further on, this paper goes on to present examples of activities compatible with the smart city concept, affecting the efficient development of urbanized spaces.

In San Francisco, owing to legal, administrative and social activities which were mainly acting as incentives, the amount of waste deposited in landfills decreased by approx. 80% within 11 years [*The 10 Cities...*]. Innovative solutions are used, such as intelligent garbage bins which crush thrown-in garbage and the energy needed for this comes from the installed solar panels. The implementation of the program requires the cooperation of many entities and civic participation. The impact on the environment and the quality of life is positive.

In Amsterdam, Open Data Program is being implemented. It involves the public sharing of the data generated in public transport in an easy-to-process manner. Thanks to crowdsourcing, new mobile applications are developed for residents. This was made possible thanks to a specially designed online platform. An example of such an application is Shark Park, which facilitates the finding of parking space in the city (filtered by price, form of payment, etc.) [Veracruz, Lam 2015b]. Another example is Bike Like a Local, an application designed for tourists using bicycles (tips on how to go, where to leave bikes, etc.) [Veracruz, Lam 2015a].

An example of a city, to be specific: a district of a city, using its heritage and neighborhood for the development is Poblenou in Barcelona. It is a former industrial district which is being transformed into a smart one. It is to perform industrial functions, using the historical heritage of the place but also attract modern technologies. In addition, residential and cultural functions were introduced there. This should include improving the use of urban space and thus improving the quality of life. One of the important objectives is the enablement of the elderly in society, especially through digital inclusion [22@ *Barcelona Plan...* 2012].

Another example of activities beneficial to the environment and quality of life comes from Mexico City. In this city there is a building of the Manuel Gea González Hospital, which features a smog absorbing facade. It measures 2,500 square meters and it is made of a material which, when in contact with air pollution (under UV

light), splits it into less harmful compounds. It is estimated that the facade is able to neutralize the amount of daytime smog, which at that time was produced by approx. 1,000 cars [Winter 2013].

In the city of Santander in 2010 the implementation the program was begun under the auspices of a team of scientists from the University of Cantabria. They worked on the urban data they had acquired installing meters and sensors in asphalt, buildings, lamp posts, municipal vehicles, etc. These data made it possible to conduct experiments “on the living urban organism” and the results were used to improve the provision of municipal services. Another project from this city is an online platform Brain City, where residents can present their ideas for innovative solutions and evaluate the ideas of others, including solutions proposed by officials [Evers 2013].

Examples abound; however, there are few complex systems. Most popular smart projects (also present in many Polish cities) concern: public access wifi zones, integrated monitoring systems urban, greener urban public transport system, smart waste management systems, savings-oriented electric grid management systems, heating systems, water supply systems as well as sustainable construction. Less common, but also more and more used are mobile applications and online platforms for residents, which allow recommending and evaluating new solutions aiming to facilitate and make life in the city enjoyable such as: integrated intelligent urban transport systems, sustainable building, park and ride zones or multifunctional city cards.

5. Conclusion

Implementation of the smart city concept can facilitate and support the management and development of urban space. Projects that are smart allow for increased awareness in society (including the quality of life, spatial organization) and an increase in civic participation. They create the need for new solutions and facilitate the introduction of multi-functional solutions as well as contribute to synergies. Introducing funds and programs to finance projects attracts new investments. Thanks to these initiatives, the implementation of the concept stimulates the development of creative attitudes, entrepreneurial activities and innovative solutions. These are factors which nowadays impact the resistance to shock and/or socio-economic development. In addition, apart from the benefits behind comprehensive solutions in the medium-long term implementation of projects helps to reduce overall municipal costs, such as lighting, water, waste management, as well as environmental costs.

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