

THE IMAGE OF A SMART CITY IN THE CONTEXT OF ITS IMPACT ON THE RESIDENTS

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Abstract: The aim of the article is to present selected assumptions related to the concept of a smart city in the context of its role and impact on the residents. Satisfaction of the residents resulting from the improvements in their quality of life is a basic measure evaluating the activity of local authorities. Their positive attitude to the innovations is an important factor in the socio-economic changes taking place in the city.

Rzeszów was chosen as an example for empirical verification. This city is a model example of implementing innovative solutions within the city. The selected areas for implementing innovative solutions in Rzeszów and the opinions of the residents on the development of a smart city are presented against the background of theoretical assumptions concerning the concept of a smart city.

Under the promotional slogan “Rzeszów – Capital of Innovation”, intense activities occurred in the field of implementing smart solutions, which were appreciated both in the external environment and among the internal stakeholders, especially the residents. The residents' opinions on the innovative solutions implemented in Rzeszów are demonstrated on the basis of the results of surveys carried out in 2018 with a sample size of $n = 300$. The study showed that the residents have a definitely positive attitude towards implementing innovative solutions in the city. The study also indicated that there is a statistical relationship between education and the assessment of the city's activity in this area. It was observed that the higher the level of education, the more positive the attitude to the implemented innovations.

Keywords: smart city, residents, image of a territorial unit.

1. Introduction

The concept of a smart city, one which is reflected in modern, innovative solutions in various spheres of public life, seeks to create the best living conditions and efficient operation for all recipients of what the city has to offer. The development of a smart city is primarily associated with implementing advanced technologies that focus on improving the quality of the urban infrastructure. The facilities introduced increase the attractiveness of individual

subproducts of the city for the internal and external stakeholders, in particular the residents. Therefore, their needs, expectations and desires become the main determinant of the implementation of innovative solutions. It should be emphasised that the inhabitants have a dual role, i.e. they are the clients of what the city offers, as well as its creators, who increasingly often participate in the process of planning and implementing smart solutions etc. This includes proposing creative, useful directions for activities that enhance the development of the city. This forms part of the basic assumptions of the smart city idea, based on the use of the latest technologies to involve the local community in the process of participating in the development of the city.

The aim of the study is to present selected assumptions related to the concept of the smart city in the context of its role and impact on the residents. To form a background to the theoretical considerations, the city of Rzeszów was selected as the study unit, as it is one of the leaders in Poland in the field of implementing innovative, smart solutions, the determinant of which is the promotional slogan: “Rzeszów – Capital of Innovation”.

In addition to a critical analysis of the literature on the subject and a case study based on the city of Rzeszów, the article presents the results of the surveys carried out in 2018 with a sample size of $n = 300$. The respondents were the residents of Rzeszów, and a non-random quota selection was used that took into account the gender and age of the respondents. The structure of the sample was as follows (gender: women – 51%, men – 49%, age: 19-24 – 13.7%, 25-44 – 38.3%, 45-64 – 32%, 65 and over – 16%). To evaluate the effect of the level of education of the respondents, the sample included 26.3% of inhabitants with basic or vocational education, 31.7% with secondary education and 42% with higher education. In addition to the basic measures of descriptive statistics, the Pearson's Chi-squared test was performed at significance levels of $\alpha_1 = 0.05$ and $\alpha_2 = 0.1$. The analysis also determined whether there was a statistically significant relationship between the characteristics of the respondents (age, education and gender) and the opinions of Rzeszów inhabitants related to implementing innovative solutions in the city.

2. The development of smart cities and the expectations and commitment of their residents

The source literature provides many definitions of a smart city, which emphasise the process of implementing modern technologies in the area of public services. Smart cities are characterised by their use of information systems to coordinate the development of urban infrastructure, which contributes to improving its functionality and efficiency for the residents. According to Komninos (2008), a smart city is a space with high educational and innovation capacity, creativity, development and research organisations, higher education, ITC, digital

infrastructure and a high level of management skills. In turn, in a strictly technical dimension, emphasising the role of IT technologies, a smart city is defined as one that uses information and communication technologies to increase the interactivity and efficiency of the urban infrastructure and its components, as well as to raise the awareness of the residents (Azkuna, 2012). Smart cities can also be described as creative territories with high learning and innovation skills, in which there are research and development units, digital infrastructure, communication technologies or a high level of management efficiency (Sobczak, 2015). In studies on the development of smart cities, there is usually agreement regarding the pursuit, through appropriate decisions and actions, of sustainable economic growth and improvement in the quality of life within the city, where the reduction of negative impacts on the environment becomes an important element. This problem is emphasised by the European Smart Cities, indicating the need for the city to strive to improve the quality of life by developing smart solutions while ensuring a friendly environment for its residents.

It should be emphasized that the concept of building smart cities manifests not only in the implementation of investment and organizational solutions in urban spaces to facilitate functioning within it, but seeks to activate the city authorities, residents and other groups of stakeholders associated with the city to take creative actions (Stawasz, 2015). Among the groups mentioned above, the residents themselves, their attitudes, knowledge, commitment and creativity, all of which contribute to the development of the individual, have an increasingly important role in the development of a smart city. This is emphasized in the source literature, which indicates that the nature of urban intelligence comes down to the use of the knowledge and intelligence of the residents (Szturoet al., 2015), which allows the use of the effects of cooperation of active people associated with a given unit. This is a part of the concept of New Public Governance, according to which residents become more active, are treated as stakeholders, partners who are not ordinary customers but who are a part of society's life, participating in solving collective problems as well as in creating services (Osborne, 2010). Therefore, they have a dual role, i.e. the client and co-creator of the value of a given territory (Kuźniaret al., 2016). Increasingly, the residents can become a source of ideas and inspiration for innovative solutions, which is reflected in the concept of User Driven Innovation, based on the use of consumer knowledge, ideas and suggestions to implement innovative solutions (user co-created innovations) (Wise and Høgenhaven, 2008).

In implementing the idea of smart cities, involving citizens in co-creating the city, according to J. Fazlagić (2016), the following issues should be considered:

- 1) a new approach to understanding urban problems,
- 2) IT system integration,
- 3) the use of data from various sources,
- 4) creating new technologies enabling communication and popularisation of information among residents, as well as more effective interactions between people and machines (Human Computer Interaction – HCI),

- 5) new forms of management and decision making in public matters,
- 6) energy management,
- 7) risk and crisis management.

In the light of the presented assumptions, it should be stated that a city can be considered smart when it invests in technologies, human capital and communication infrastructure, while maintaining the principles of sustainable development, which results in improving the qualities of life and functioning of the people associated with it, especially the residents. These conditions are fulfilled by the city of Rzeszów, used as the subject of the empirical considerations in this study.

3. Directions of the development of a smart city based on the example of Rzeszów

Rzeszów is the largest city in the Podkarpackie region, and since 1999 has been the capital of the Podkarpackie Voivodeship. It is located in the south-eastern part of Poland, between the Carpathian Foothills and the Sandomierz Basin. Rzeszów covers an area of 126,6 sq. km and has a population of 194,300 (as of 10 May 2019).

The largest percentage of people are employed in services (over 72%, of which 5.5% are individuals dealing with finance, insurance and the real estate market), nearly one in four people work in industry, and only 3.5% in agriculture. The unemployment rate in Rzeszów (as of 30 June 2019) is 4.9%.

The city of Rzeszów is the economic, cultural, academic and recreational centre of South-Eastern Poland. It plays an important role as the aviation, IT, chemical, commercial, construction and service industries centre. It is a dynamically developing city of young and enterprising people. Nearly 25,500 enterprises, served by over 800 financial and business-related institutions, are registered in the city. The leading Rzeszów company is PRATT & WHITNEY RZESZÓW S.A. – a manufacturer of aircraft engines. In order to create favourable conditions for doing business in Rzeszów, the Rzeszów-Dworzysko Special Economic Zone was created. Significant advantages of the city are the Podkarpackie Science and Technology Park and the Rzeszów-Jasionka International Airport.

The direction of city development is based on the assumptions of a smart city, which is the basic determinant for all activities undertaken in the area of the unit. The document indicating the developmental directions is the Rzeszów City Development Strategy until 2025 (Biuletyn Informacji Publicznej Miasta Rzeszowa, 2016) and the Rzeszów Brand Strategy Update as well as the City of Rzeszów Promotion Programme for 2014-2020 (Serwis Informacyjny Urząd Miasta Rzeszowa, 2014).

A significant role in the development of the city of Rzeszów is played by the city brand and the promotional slogan: “Rzeszów – Capital of Innovation”, which form a challenge to achieve high rates innovation activities. As a result, Rzeszów has numerous companies from the sectors of innovation, technology transfer and advanced business models, a general increase in the “quality” of human capital has been observed as well.

Along with the implementation of innovative solutions, the city intensively strengthens its position as a smart city through such features as the use of modern technologies in the areas of smart transport, urban water supply system, waste management, sewage treatment and broadband Internet access. Some of the major improvements for the city's community include:

- Rzeszów Smart Public Transport System, which is a platform for data exchange between the traffic light control system (District Traffic Control System), information at bus stops, electronic ticket and the control of street signs with variable content, ticket machines and weather information,
- implementation of ecological solutions related to the functioning of urban infrastructure (e.g. buses with CNG drives and electric motors, street lighting with the use of LED lamps),
- improvement of parking policy based on modern technological solutions (boards informing about the number of free parking spaces),
- use of advanced technologies to improve the quality of public services, including customer service in public administration units (e-Taxes, e-Education),
- organisation of events related to innovation, such as the Innovation Forum, InternetBeta, congress of IT specialists, Aviation Valley EXPO Day, SMART Project Congress, Building & City,
- guaranteeing access to unpaid broadband Internet in the city as a part of the Municipal Data Communication Network programme implemented since 2003,
- supporting the development of the Podkarpackie Renewable Energy Cluster, related to the Inteligentne Eko Osiedle 2020 investment,
- efficient use of ecological energy sources, with a special emphasis on solar energy to supply, i.e., traffic lights or public utilities.

In the near future, further innovative solutions are planned, aimed at improving the quality of life in the city, such as an electric taxi service or the construction of a monorail.

A number of prestigious awards received in recent years, including the Smart City statuette on several occasions, are confirmation of Rzeszów's high innovative activity in the implementation of smart solutions. The Smart City contest aims to popularise personalities and ventures that significantly contribute to the promotion of solutions for the construction of smart cities in Poland and cities that implement this idea. The year 2018 was the third time the city of Rzeszów was awarded the statuette for the first place in the Smart City contest in the category of “Smart City 100,000-500,000 residents” (Serwis informacyjny Urząd Miasta Rzeszowa,

2018). The city has been recognised for implementing the Smart City idea, including: a modern IT and administrative system, the implementation of projects: e-Taxes, e-Education, e-Communication, e-Citizenship Budget and many other services, as well as for the production of green energy. It is also worth noting that in the European Financial Times “Cities of the Future 2019/2020” contest Rzeszów won in two categories: Creating Friendly Conditions for Business Development, and Human Capital and Lifestyle. These categories fit the basic pillars of smart city development, bringing in new and attractive investors. These trends were confirmed by the latest (June 2019) Ranking of Attractive Business Cities, prepared by the FORBES monthly, in which in the category of cities with populations of 150,000 to 299,000, Rzeszów once again took first place. These rankings verify the investment activity of regional units and allow the statement that Rzeszów is the country's leading centre for implementing innovative solutions.

4. Opinions of the residents about the innovative activity of the city

The basic measure of assessment of the activity of local authorities in the field of implementing smart solutions is the improvement in the quality of life of the main stakeholders, i.e. the residents, which results in their satisfaction with belonging to a given city. This is reflected in the assessments of the city authorities in terms of investment activities undertaken, especially the implementation of innovative solutions enhancing better functioning of the city (Table 1).

Table 1.

Attitude of the residents to the implementation of innovative solutions in the city of Rzeszów (in %)

Task	Total	Gender		Age				Education		
		female	male	19-24	25-44	45-64	65 or over	vocational	secondary	higher
Definitely negative	-	-	-	-	-	-	-	-	-	-
Rather negative	1.0	0.7	1.4	2.4	-	2.1	-	1.3	2.1	-
Rather positive	44.7	43.1	46.2	43.9	40.0	49.0	47.9	55.7	41.1	40.5
Definitely positive	54.3	56.2	52.4	53.7	60.0	48.9	52.1	43.0	56.8	59.5

Source: own calculations based on surveys.

The data presented in Table 1 show that almost all residents of Rzeszów presented a positive attitude to the implementation of innovation in the city (99%). The positive attitude of internal stakeholders to the introduced innovations deserves special attention, as it is an important factor verifying the changes that have been taking place in Rzeszów in recent years. The support of such a decisive group of respondents regarding the innovations introduced may be caused by

the fact that innovative solutions directly influenced the improvement in the quality of life of the residents and facilitated the functioning of the city. It is worth emphasising that no one indicated a definitely negative attitude to innovation. Both men and women have a positive attitude to innovations. A small number of respondents expressed a rather negative opinion. The study also showed the relationship between education and the overall assessment of smart innovation solutions implemented in the city. The higher the level of education, the more positive the attitude to the innovations implemented in the city of Rzeszów. All the respondents with higher education evaluated the implemented solutions positively (100%).

In order to examine the occurrence of statistically significant relationships between the respondents' characteristics and attitudes towards the implementation of innovative solutions in the city, Pearson's Chi-squared test was performed, at significance levels $\alpha_1 = 0.05$ and $\alpha_2 = 0.1$.

At a significance level of $\alpha_1 = 0.05$, on the basis of a statistical value ($\chi^2 = 7.404$, $p = 0.691$), no statistically significant relationship between the variables was found. In turn, at the level of $\alpha_2 = 0.1$ ($\chi^2 = 5.919$, $p = 0.432$), a relationship between education and attitudes towards the implementation of innovative solutions was demonstrated. In relation to the gender and age of respondents, no statistical relationship was found in the assessment of the implementation of innovative solutions in the city.

Respondents, in expressing an opinion on the development of the city of Rzeszów assessed the selected statements, related to the city using a 7-point Likert scale (Table 2).

Table 2.

Opinions of residents on the development of the city towards a smart city

Task	Total	Gender		Age				Education		
		female	male	19-24	25-44	45-64	65 or over	vocational	secondary	higher
Rzeszów has intensified its investment activities	6.35	6.44	6.25	6.27	6.23	6.48	6.44	6.25	6.28	6.46
The city's asset is the implementation of smart solutions improving the quality of life of the residents	5.58	5.62	5.54	5.44	5.51	5.76	5.50	5.48	5.59	5.63
Innovative activities affect the city's recognisability outside the city	5.46	5.53	5.39	5.49	5.25	5.61	5.65	5.67	5.39	5.39
The city is very active in obtaining EU funds	6.06	6.19	5.93	6.10	6.05	6.05	6.08	6.01	5.98	6.16
The city is very active in promoting its assets	5.75	5.73	5.78	5.44	5.63	6.04	5.73	5.73	5.73	5.78

Source: own calculations based on surveys. Note. Average based on a scale of 1-7, where 1 is the lowest agreement with the statement, 7 the highest agreement with the statement

In analysing the data contained in Table 2, it can be seen that respondents highly appreciated the development of the city, with all the statements rated above 5 on the 7-point scale. The statement that Rzeszów shows increased intensity in terms of investments and obtaining

EU funds had the highest average rating. Both men and women agree with the statements regarding the development of the city. It is worth emphasising that respondents, regardless of age and education, also fully agreed with the statement that Rzeszów has clearly intensified its investment activities. Recognition of the city outside through the implemented innovative activities was the least-rated statement, which indicated the need for professional promotion of the city's values, using various means and forms of communication, especially to reach external stakeholder groups.

Among the numerous factors determining the development of the smart city idea, it is first and foremost necessary for the city authorities to take a new approach to understanding the problems of the units they manage and the expectations of the stakeholders, among which the residents play a special role. The residents' satisfaction resulting from the improvement in the quality of life is a basic measure evaluating the activity of local authorities in the field of implementing smart solutions. However, it should be emphasised that the process of implementing smart solutions would not be possible without the participation of residents who actively support its development. This can be reflected in sharing knowledge, ideas or suggestions regarding local development, creating and implementing innovative solutions, all of which form an important source of the socio-economic changes taking place.

5. Summary

The city of Rzeszów is an example of high activity in implementing smart solutions, using the knowledge and ideas of its residents. Local authorities that are facing the challenges under the promotional slogan of “Rzeszów - Capital of Innovation”, are conducting intense activities manifested in a modern approach to its development, also in the field of smart solutions. The implementation of the assumptions contained in the city's strategic documents is reflected in the consistent development of solutions in the field of the smart city, which is recognised both by the residents of Podkarpacie capital, as well as in numerous domestic and foreign competitions. The conducted research showed that the inhabitants of the city, regardless of gender or age, gave a very high assessment of the innovative activity of the city.

To sum up, Rzeszów can be considered an example of how, within a few years, thanks to consistent and effective actions by the local authorities, a city's image may be changed from one with a poor development perspective located in the so-called Eastern Wall area to a dynamically developing, innovative city that is the centre of modern technologies and attracts young, entrepreneurial and creative stakeholders, especially investors and new residents.

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