

Analysis and Evaluation of the Implementation Level of the Smart City Concept in Selected Polish Cities

Kamil Roman

Maria Curie-Skłodowska University in Lublin, Poland
Plac Marii Skłodowskiej-Curie 5, 20-400 Lublin, Polonia, Tel.: +48 81 537 51 00
kamilroman61@gmail.com

Abstract

The approach of Smart City is getting more and more important for both academics and policy makers. Despite this, there is still confusion on what a Smart City is and several similar terms are often used interchangeably. This paper aims at clarifying the meaning of the word “smart” in the context of cities development and to identify the main dimensions and elements characterizing a smart city. Furthermore, performance measures of a smart city will be identified. The aim of the article is to analyse and evaluate the degree of implementation of the Smart City concept in selected cities in Poland. The article will also cover the use of information and communication technologies (ICT) to improve selected areas of the city. The article also analyses the main barriers that make it difficult to invest in Smart City. In the following publication, the main research method was a questionnaire, which was sent to the 57 cities-capitals of the Lublin and Mazovian Voivodships. The paper also presents the prospects for the development of Smart City initiative in Poland. The research has shown that the level of implementation of Smart City Initiative is low. The main barrier to such investment is the lack of adequate funds and insufficient human resources and knowledge.

Keywords: Urban development, Smart City, Poland, Cities

1. Introduction

At present, in world literature there is lack of word for systematic and unambiguous definition for the smart city approach. R.G Hollands recognized Smart City as an “urban labelling” phenomenon, and while convincing real smart city to stand up, he emphasises many aspects of them, which are hidden behind self-declaratory attribution of this label (Hollands 2008).

In the opinion of A. Caragliu and P. Nijkamp, a Smart City is where resources are invested in the intellectual capital and innovative infrastructural projects to improve the quality of life and increase their satisfaction and prosperity (Caragliu C., Nijkamp P 2011).

K Kourtit and P. Nijkamp believe that Smart Cities are the result of increased knowledge and creativity in making strategic decisions for improving the socio-economic, environmental, logistical and competitive conditions of cities. Smart cities are based on a combination of human factors, such as qualified staff, infrastructure (modern communication technologies), social capital (interpersonal relationships), and entrepreneurial citizenship (creativity and risk-taking). A city can be considered compatible with the idea of the Smart City if it "systematically uses available data, communication technologies, and resource saving technologies to reduce their consumption and to continuously improve the quality of life of citizens or increase the competitiveness of local economies.¹⁶

Currently, Smart City is a concept that gradually gains the attention of city leaders. More and more agglomerations declare their willingness to become “Smart”. There are many ways of assessing the development of the cities in the world in terms of the degree of implementation of the Smart City concept. Building a comprehensive model for measuring the effectiveness of Smart City initiatives is a difficult task, mainly because Smart City is a multifaceted, multi-technical approach that covers a wide range of cities and requires a number of initiatives (Dameri, 2017).

¹⁶ I. Homeier, Smart City Wien Initiative, Urban Development and Planning Impacts Conference, Vienna, May 2013
źródło: <http://www.impacts.org/euroconference/vienna2013/presentations/Vienna%20impacts%20smart%20city.pdf>

One of these methods of measurement was created by researchers from three research centres: Center of Regional Science at the Vienna University of Technology (Austria), the OTB Research Institute for Housing, the Urban and Mobility Studies Program at Delft University of Technology (Netherlands), and the Department of Geography at the University of Ljubljana (Slovakia). Nearly 70 cities with a population of 100 to 500 thousand inhabitants, with the number of inhabitants living in the higher schools, and the number of inhabitants around the agglomeration exceeding 1500 thousand inhabitants. In this opinion, the method of assessing the activities of cities is the most appropriate in terms of Polish realities (Sobczak 2017).

This method established six factors for assessing the intelligence of the city, which included 31 indicators, based on which one could assess the degree of implementation of the Smart City concept.

Figure 1 shows the following six dimensions of project evaluation for the development of smart cities:

SMART ECONOMY (Competitiveness) ▪ Innovative spirit ▪ Entrepreneurship ▪ Economic image & trademarks ▪ Productivity ▪ Flexibility of labour market ▪ International embeddedness ▪ Ability to transform	SMART PEOPLE (Social and Human Capital) ▪ Level of qualification ▪ Affinity to life long learning ▪ Social and ethnic plurality ▪ Flexibility ▪ Creativity ▪ Cosmopolitanism/Open-mindedness ▪ Participation in public life
SMART GOVERNANCE (Participation) ▪ Participation in decision-making ▪ Public and social services ▪ Transparent governance ▪ Political strategies & perspectives	SMART MOBILITY (Transport and ICT) ▪ Local accessibility ▪ (Inter-)national accessibility ▪ Availability of ICT-infrastructure ▪ Sustainable, innovative and safe transport systems
SMART ENVIRONMENT (Natural resources) ▪ Attractivity of natural conditions ▪ Pollution ▪ Environmental protection ▪ Sustainable resource management	SMART LIVING (Quality of life) ▪ Cultural facilities ▪ Health conditions ▪ Individual safety ▪ Housing quality ▪ Education facilities ▪ Touristic attractivity ▪ Social cohesion

Figure 1. Factors for assessing a smart city

Source: Giffinger R. (2007), *Smart Cities: Ranking of European Medium-Sized Cities*, Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology. <http://www.smart-cities.eu/press-ressources.html>

SMART GOVERNANCE

Intelligent governance is based on the use of available technology to coordinate activities carried out by the city and other local government units. Through synergies, it is possible to work with other stakeholders to meet the needs of the people.

SMART ECONOMY

The economy is considered intelligent if it has the ability to adapt to market needs and has the ability to create innovative and modern solutions tailored to the needs of the market.

SMART MOBILITY

Intelligent mobility is all activities aimed at providing residents with access to efficient, ecological and modern transport networks. To do this, it is necessary to use available technologies to obtain passenger needs data. By using this type of information, it is possible to shape the city's transport policy in line with the demands placed by the residents. Transport policy in the aspect of Smart City Concept is the sustainable development of transport by increasing coordination between its branches and their integration.

SMART ENVIRONMENT

Smart Environment is the use of data from advanced measurement equipment to identify key areas of urban space and spatial planning and to provide city leaders with information that is conducive to achieving their objectives. This policy focuses on the sustainable use of resources while improving the quality of life for citizens.

SMART PEOPLE

Smart people is an approach that involves locating people in the process of undertaking city development initiatives. By attracting and using the human capital available in the city, it is possible to create innovative and modern solutions, where there is a social need.

SMART LIVING

Smart Living can be considered as activities aimed at using information and communication technologies to improve the quality of life of residents attracting creative classes.

In implementing this dimension, education plays a central role in shaping new talents in the city and attracting creative classes.

2. Methodology

To investigate the degree of implementation of the smart city concept in Polish cities, the survey was conducted.

The purpose of this study is to identify and evaluate the actions taken by local authorities that may be considered to implement the smart city concept. In particular, they relate to smart management activities, which include exchanges of information between city dwellers, central and city services, police, fire brigades, and ambulance services.

The study hypothesized that the lack of coordination between the activities of decision makers related to the functioning and the development of the city results in ineffective use of available resources. In the long run, this can contribute to lowering efficiency of the urban structure and have negative impact to the city's competitiveness on other units.

In order to verify the main hypothesis, the author made a detailed analysis of the determinants of city management processes by formulating the following specific hypotheses:

1. The degree of implementation of Smart City initiatives in Poland is significantly higher in large agglomerations.
2. The use of information and communication technologies in the analysed cities is low.
3. Inadequate human resources, knowledge, and lack of adequate funds are the main barriers to the development of the smart city concept in Poland.

A survey questionnaire was sent to 57 Polish cities, which are the seat of the counties in Mazovian and Lublin Voivodships. The study covered most small and medium towns. Up to 100 thousand inhabitants. 17 completed questionnaires were received with the success rate of 21.05%

3. Obtained results

As can be seen from the data presented in the chart 2, the implementation of the Smart City concept in the analysed cities can be considered as low. Only one city out of 17 participating in the survey has fully implemented the Smart City initiative, and two agglomerations are working to implement smart solutions. Of the seventeen analysed entities, they have a general plan for implementing the Smart City concept and most respondents (53%) does not currently have a coherent strategy for becoming Smart City. Representatives from the three centres, who completed the questionnaire, stated that their pilot projects are being implemented in their city to implement such initiatives. When analysing the responses, it can be concluded that the degree of implementation of Smart City policy in the examined cities can be considered insufficient.

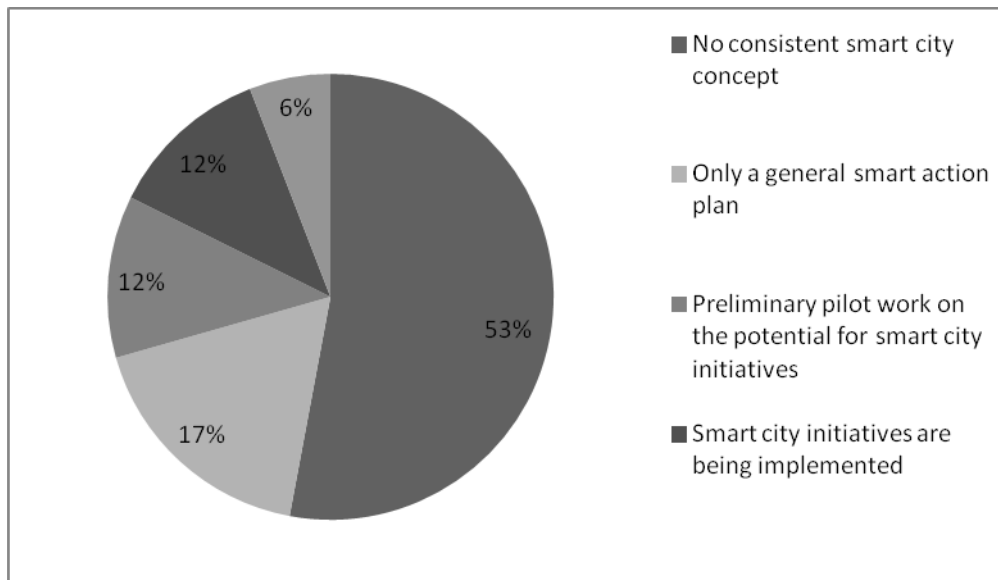


Figure 2. Stage of implementation Smart City concept in the surveyed cities

The second aspect was the use of information and communication technologies in order to improve the efficiency of selected areas in functioning of the cities. Observations were made on elements such as labour market, cooperation with local entrepreneurs, the support for new businesses (start-ups), cooperation with research and development centres, and schools or universities. The surveyed cities could indicate the degree of implementation of the activities carried out in this area by using a five-step scale, where 0 meant no implementation of the element and five was full implementation of the initiative.

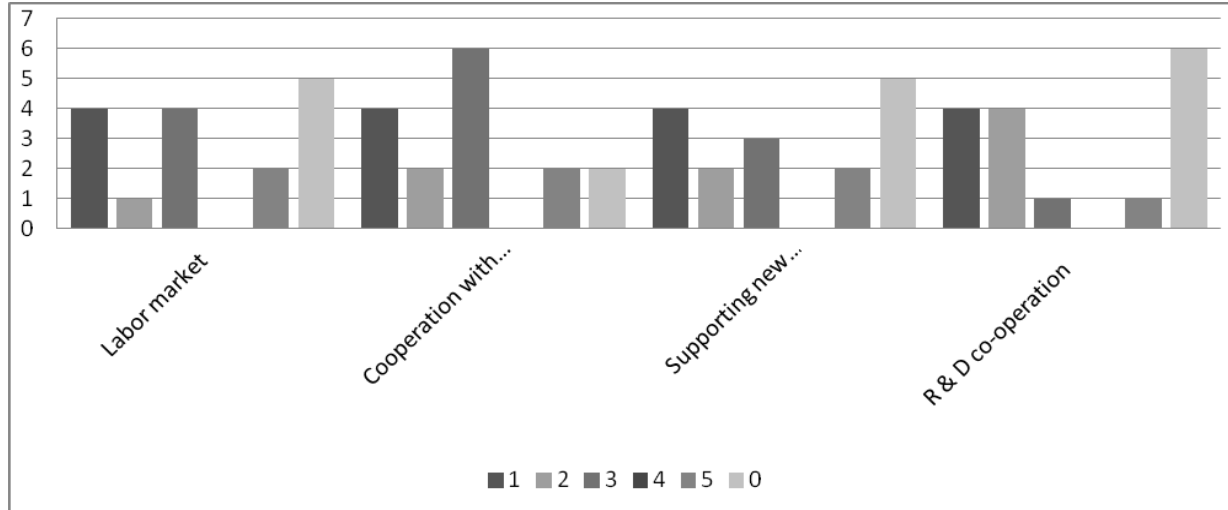


Figure 3. The degree of the use of ICTs to improve efficiency in the following areas

According to data presented in Chart 3, only 2 of the 16 cities that responded to this question fully utilize ICT to improve efficiency in the local labour market. Most respondents (31.25%) do not use this kind of technology to improve the processes in the city, and 4 agglomerations use the available technology on an average level. The results suggest that the degree of exploitation of modern solutions to improve the functioning of the labour market is strongly diversified.

Modern technologies can also be an important support tool that cities can apply to companies operating in their area. In the case of cities participating in the study, only two of them (12.50%) make use of the knowledge and tools available to them in order to create better conditions for local businesses.

The same situation applies to the use of ICT to support new businesses. Only two cities (12.5%) use them in a high level and three in moderate (18.75%).

Another important element from the point of view of the degree of implementation of the Smart City concept is research and development cooperation with universities. In the case of the respondents, only one of the cities defined the level of their cooperation with the local universities as high. In other cities, it is moderate (6.25%), low (25%) or very low (25%), and six of them do not cooperate at all (37.50%). The low level of R & D cooperation may be due to the fact that in each of the analysed cities there are higher education institutions. The analysed research entities are in most cases small cities with up to 50 thousand inhabitants.

The surveyed cities use ICT to streamline activities in the areas listed in Chart 3 through the following actions:

- Using dedicated web sites for specific industries;
- Possessing a program that allows you to send messages with an approximate date of payment for permission to sell alcoholic beverages;
- The labour market is supported by a website, where employers can submit current job offers, and jobseekers are instructed on how to apply effectively;
- In the area of cooperation with local companies, regular e-mails are used to inform about the planned actions of the municipality of importance for entrepreneurs;
- For startups, there is an information on the program "Entrepreneurship Grodzisk", which offers training for people planning to start a business or those that have recently started it;
- The exchange of correspondence, through appropriate bookmarks on the website and mobile applications;
- Building a broadband network that provides free internet access to all organizational units and institutions subordinate to the City;
- Through the use of websites, databases, e-services in the City Hall.

By analysing Figure 3, it can be concluded that the level of ICT use for Smart City policy is low. This type of variation can mainly be the result of differences in the objectives of the city's development strategy, the competence of city officials, and the availability of the funds. Nowadays, urban managers have to make decisions in the wake of turbulent environment changes and the rapid aging of technology. Investments in new technologies are costly and not every city is able to bear the costs associated with them.

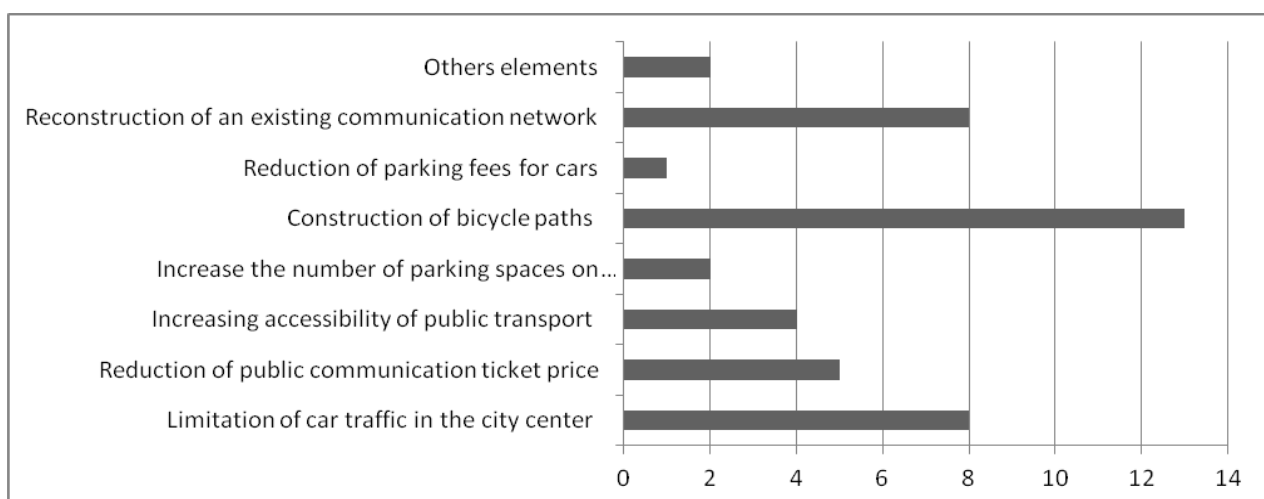


Figure 4. Main elements of transport policy in the city

Sustainable urban transport is a significant area of development. The accumulation of large population centres in a limited area creates the risk of congestion and traffic congestion. In order to reduce congestion, the city uses a number of practices to improve transport.

They mainly concern (Stawasz, Sikora Fernandez, 2015):

- • Applications of computerized traffic control systems;
- • Introduction of intersection monitoring;
- • Terminal equipment for dynamic passenger information;
- • Providing information on current traffic flow to public transport drivers;
- • Effective lighting management depending on traffic conditions;
- • Use of GPS in public transport vehicles;
- • Use of Kiss & Ride, Park & Ride.

Figure 4 shows the main elements of the urban transport development strategy that filled the research questionnaire. Each of the surveyed subjects could identify three main objectives of transport policy.

As indicated by the results, the most frequently indicated action in the area of sustainable transport development was the construction of bicycle paths (13 indications), the reconstruction of existing communication networks (8 indications) and activities aimed at limiting the number of cars in the city centre (8 indications).

The Smart City concept is gradually evolving. According to Boyd Cohen today, we can distinguish three generations of smart cities: Smart Cities 1.0 powered by state-of-the-art technologies, Smart Cities 2.0 with a leading role in public administration, and Smart Cities 3.0, based on creative engagement of residents and stakeholders. (Cohen, 2017).

The city in terms of Smart City 3.0 requires decision-makers to take action for a strong and creative engagement in the development of urban space and the inclusion of residents in the process (Carta, 2017).

The surveyed cities are engaging the residents in the city's decision-making process by:

- Operation of non-governmental organizations (15 indications);
- Organizing social consultations (17 indications);
- Creating participatory budgets (9 indicators);
- Inclusion of inhabitants in the process of developing strategies for the development of selected urban areas (10 indications);
- Support of grassroots initiatives that promote social participation and participation (13 recommendations).

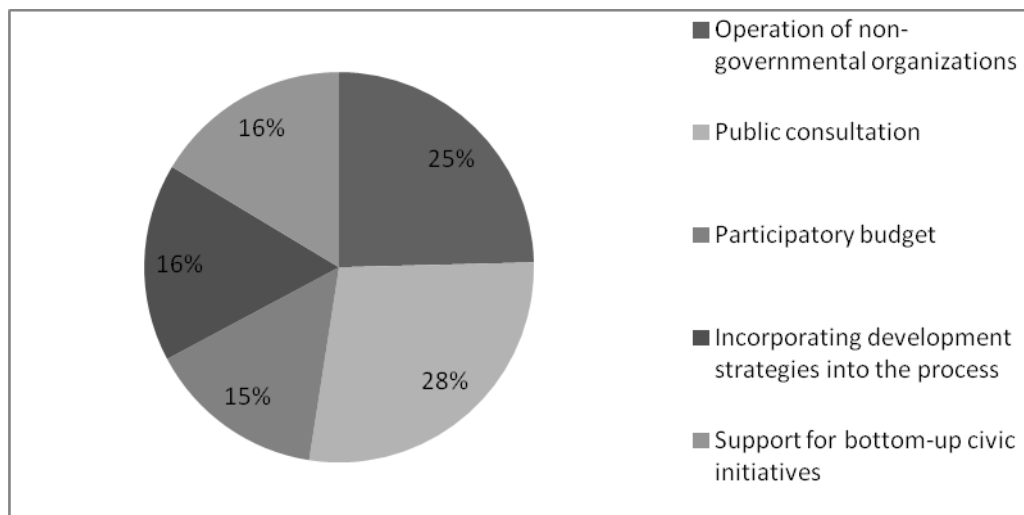


Figure 5. Inclusion of residents in the decision-making process

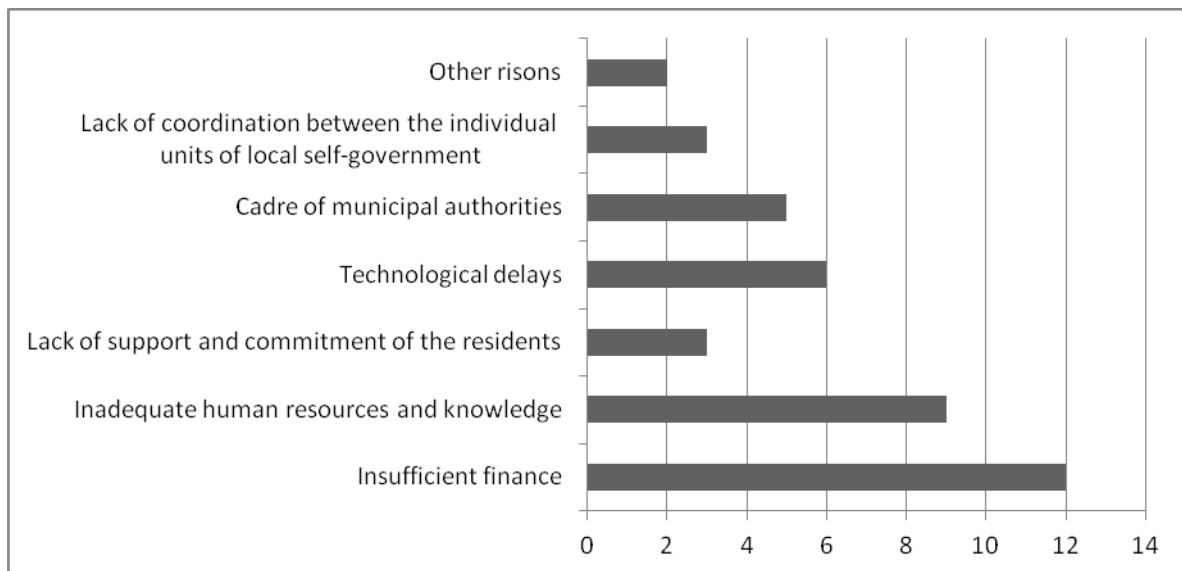


Figure 6. Main barriers in implementing smart city initiatives

The implementation of Smart City operations in Polish cities requires long-term actions and large financial investments. Smart City is a multidimensional concept, with a number of aspects in mind. Representatives of the surveyed cities were asked about the main barriers that hinder implementation of the Smart City concept.

Cities listed the following barriers in the implementation of Smart City initiatives:

- Inadequate finances (12 indications);
- Inadequate human resources and knowledge (9 indications);
- No support and involvement of residents (3 indications);
- Technological delays (6 indications);
- Municipalities' sufficiency (5 indications);
- Lack of coordination between individual units of local government (3 indications).

The responses indicate that insufficient funds and lack of adequate resources are the biggest barriers to implement the Smart City concept in the analysed cities.

4. Conclusions

Preliminary results of the research prove that the level of implementation of the smart city concept is low. Most of the surveyed cities do not currently have an action plan to implement the smart city concept. The use of information and communication technologies in the analysed cities is low.

Research has proved the validity of the hypothesis

1. The degree of implementation of Smart City initiatives in Poland is significantly higher in large agglomerations.
2. The use of information and communication technologies in the analysed cities is low.
3. Inadequate human resources, knowledge and lack of adequate funds are the main barriers to the development of the Smart City Concept in Poland.

Research has shown that the surveyed cities rarely use available ICTs to improve the functioning of the city's processes. The major problems faced by the analysed cities in implementing the Smart City concept are insufficient funds and the lack of adequate human resources and knowledge. It seems necessary to support central funds or to invest in public-private partnerships in order to realize intelligent investments. This will allow for an increase in the dynamics of large capital investment.

The results of our research could be useful for policy makers and city stakeholders to identify smart cities, to plan incentives for their development and, through the identified measures of performance, to monitor the progresses of cities towards getting more smarter cities.

5. Limitations of research

These are the preliminary results of the study. After receiving all the questionnaires, results may change.

My research was limited to small towns in Poland located in Mazovian and Lublin Voivodships. In order to investigate the degree of implementation Smart City Concept in Polish cities, it is also necessary to include bigger cities from other Voivodships and more population.

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Kamil Roman (b. April 4, 1991) received his BSc in Logistics (2014), MSc in Logistics Management (2016). Now he is PhD student of management in Department of Management Information Systems, Faculty of Economics, Maria Curie-Skłodowska university of Lublin, Poland. His current research interests include different aspects of implementation of the Smart City concept, Intelligent Transport systems, Sustainable urban development. He has authored more than 10 papers, and more than 10 conferences participation.