
TRANSFORMING BUCHAREST INTO A SMART CITY

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Abstract

The increase of urban population raises high challenges to city management policies because of agglomeration, pollution, heritage endangerment and overall welfare of inhabitants. In the same time, urban population is more educated and more prone to using and responding to new technologies; hence Smart solutions may be prove to be efficient means of addressing negative issues of urban living. The paper presents the challenges of adopting Smart technologies, with special focus on Bucharest – one of the most crowded and polluted capitals in Europe. A thorough analysis of Smart projects developed in this capital reveals that some steps in the right direction for a Smart city have been taken. Recommendations for future Smart city development are made after a thorough analyse of the already implemented Smart solutions and their overall effect on the population.

Keywords

Smart City, Smart Technologies, Internet of Things, urban policies, environment, citizens welfare

JEL Classification

R10, O18

Introduction

The rapid growth of urban population forces authorities to find efficient solutions for answering the needs of more and more people, within the boundaries of a limited infrastructure. The crowding within cities threatens all sustainability pillars; orienting local policies towards sustainability and not confusing and disrupting the habits of local population is the highest challenge maybe. In the last decade it can be noticed a growing interest of researchers, business environment and decision making cities authorities for the concept of Smart Cities. According to Anthopoulos et al. (2016), there are eight components that define a Smart City: Smart utilities (energy, water, IoT etc), services (health, education etc), government, planning, management, architecture, data and inhabitants. Other researchers see the concept of Smart City as a continuously evolving one, depending on the interests of large business corporations (Allam and Newman, 2018). Nam and Pardo (2011) consider that an intelligent city has the following essential components: *technology*, *citizens* - here referring to creativity, diversity and education, and *institutions* (government and policies). Connections must exist between all these, a truly Smart City being when investments in human and social capital, as well as ICT infrastructure lead to durable development and life quality enhancement. Other research point out the fact that four components must build a Smart City: 1) a large range of electronic and digital technologies

for creating the cybernetic urbis, knowledge based; 2) using ICT for transforming work and living; 3) integrating ICT in city infrastructure; 4) adjoining human and ICT to enhance innovation, learning and knowledge (Komninos, 2011; Albino et al., 2015).

In the same time, Batty et al. (2012) consider that the spread of ICT in city management must improve each of the areas that contribute to increasing the quality of life. Taking into consideration the various approaches of a Smart City, we can conclude that information, communication and technology must work together for enhancing the various areas related to living, leisure activities and working of city inhabitants. The way a city evolves into a Smart City depends mainly on human involvement, vision and decisional models adopted by business environment and authorities. The many successful models of the already acknowledged Smart Cities (i.e. Vienna, Hong Kong, Barcelona) differ in their approach of making citizens life a better one. Despite the crucial role of technology in Smart development, the particularities of the very city will determine the policies of Smart transformation: the climate, the culture, resources, already built infrastructure with its limitations, the main touristic attractions within city etc. Thus, in the overall Smart city development, various needs must be prioritized. For example, the preoccupation for air quality of a city surrounded by forests and with large green areas inside its boundaries may be less important than it should be for another city situated in an industrial area, lacking vegetation inside and overcrowded with traffic.

Internet of Things and Smart Cities

Internet of Things (IoT) is more and more used to minimize the waste of resources (energy, time, materials, etc) in various sectors such as transportation, air quality, energy consumption, services delivery; however, its success depends on both citizens and various other actors (authorities, academia and business environment) involvement. According to Jiong et al. (2014), if the current trend is maintained, by the year 2050, 70% of global population will live in cities and suburban areas. Billions of devices will communicate one with another generating huge amount of real time data. The analysis of these, based on population needs and choices, will lead to developing ever more intelligent cities. Thus, IoT will emerge from its nowadays incipient status and will transform the traditional network infrastructure in a totally Internet dependent future (Rathore et al., 2016).

There are six main key points to be taken into account when building smart infrastructure (The Royal Academy of Engineering, 2012):

- Smart government – vital for creating the framework for investments in smart infrastructure
- Data quality and its management about infrastructure
- Privacy – restrictions due to security and privacy of data may prevent data usage
- Investments
- Vulnerability – is inevitably linked to ICT systems, hence with any Smart system design
- Lifetime of the designed infrastructure and its components

There is already noticeable impact of IoT upon Smart city management, many mobile applications providing citizens with real time information about public transportation, shared transportation, air quality, parking available, entertainment, neighbouring shops, restaurants, attractions etc. Many of these applications rely on user involvement in order to provide real time data and feedback (i.e. Waze, Google Maps showing congestion in traffic and suggesting alternatives when driving; Moovit for public transportation with suggesting public transportation routes, while indicating the expected arrival time in various stations).

An analysis of Bucharest Smart City projects

A study regarding the status of cities in terms of their preoccupations for becoming smart, shows that, although Bucharest is the capital of Romania, it is the 4th among other Romanian cities aiming to become Smart (table no.1)

Table no 1. Romanian Smart cities ranking according to implemented/ under development projects

Position	City	Number of projects for Smart city
1	Alba Iulia	72
2	Oradea	20
3	Cluj-Napoca	18
4	Bucharest	13
5	Piatra-Neamț	12
6	Brașov	11
7	Arad	11
8	Sibiu	11
9	Constanța	10
10	Iași	8

Source: Good News, 2018

It can be noticed that there is a very large gap between Bucharest and Alba Iulia in terms of implemented projects, a future benchmarking study being useful in terms of understanding the positive aspects brought by Alba Iulia projects within the socio - economical and political context of our country. Since 2018, Bucharest authorities have officially announced the partnership with business environment in what concerns the creation of a Strategy for the development of Bucharest as Smart City. Areas, such as traffic management, parking, lighting, infrastructure, local governance, public safety, energy, telecommunications, environment and tourism are subject to smart development within this strategy (Good News, 2018).

An analysis of projects already implemented in Bucharest, show that they address important issues for the welfare of the population, such as pollution, public transportation, parking places, energy consumption.

Bucharest is one of the most polluted cities in Europe, according to Pollution Index 2018 Mid-Year, ranking 6th among the 76 cities included in the index (table no.2). Pollution Index is an estimation of the overall pollution in the city. Air pollution weights highest in the calculus of the pollution Index, followed by water pollution and then other types of pollution (NUMBEO, 2019)

Table no. 2. Evolution of pollution index in Bucharest and its ranking among the most polluted European cities

Year	Polution index	Ranking
2012	140.71	2
2013	91.85	3
2014	92.66	1
2015	76.06	11
2016	72.39	7

2017	71.28	9
2018	72.08	6
2019	73.87	7

Source: NUMBEO, 2019

Another report issued by the European Environment Agency (EEA) found that there were over 27,000 premature deaths because of air pollution in Romania in 2015 (Ro Insider, 2018).

Bucharest tackled this negative issue, by using since 2018 the first independent air quality monitoring network in Romania, which checks the air quality in Bucharest and in the nearby city of Ploiești. A total of 15 sensors record the level of polluting substances in the air, the data being available at Airly.eu/map/en/ or in the Airly mobile app. The sensors also register the temperature, air humidity and atmospheric pressure. This integrated data is used to predict the areas and the hours with the lowest pollution, information essential for people aiming to engage into outdoor activities (walking, cycling, running etc).

Use of fossil fuel means of transportation – both for public and personal transport within city is directly linked to the quality of air. Hence, another project under development refers to providing 300 points for charging electric cars in Bucharest. Users of electric vehicles may charge these and pay charging costs through Polyfazer mobile application. In the same time, authorities have an ongoing project for electric trams and busses procurement – project also design to contributing to the environmental component of a Smart city.

Another Smart project implemented in a pilot area in Bucharest refers to smart street illumination, aiming to reduce the use of electric energy by 70%. The technology involves movement, pollution, temperature and noise sensors incorporated in the lighting poles of the streets.

Managing diligently the public transportation sector is vital for a crowded and polluted city. Another project is design to making public transportation services transparent in terms of busses and trams schedule and their real time availability, providing passengers comfort, while travelling in green means of transportation. Thus, Bucharest authorities launched in 2019 a new mobile application, available for iOS and Android, named InfoSTB (fig. no. 1).

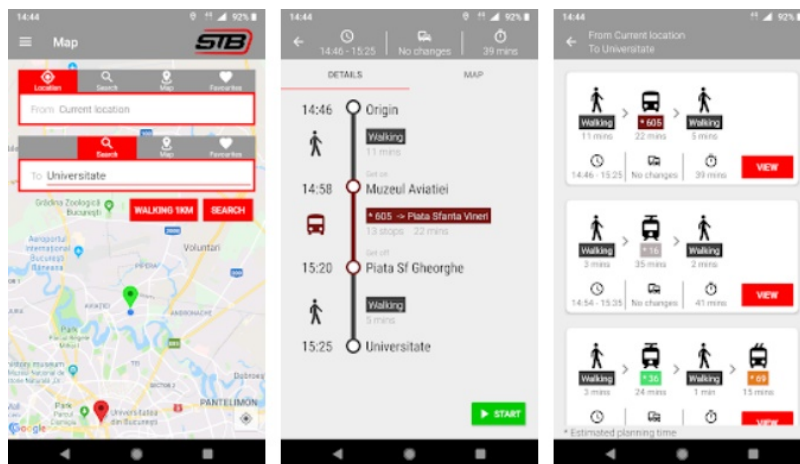


Fig. no. 1. Interface of the InfoSTB application launched by Bucharest authorities in 2019 for smart public transport

Source: Google Play, 2019. <https://play.google.com/store/apps/details?id=ro.stbsa>

Real time information from traffic about estimated times until arriving to a certain station and intelligent parking are important for traffic decongestion. Indeed, by having an always

updated, real time map of transportation means, Bucharest travellers could see that the public transport alternatives may be just as fast as their travelling with personal cars and, in the same time, much cheaper. Less travelling with personal cars inside Bucharest will determine in time a decrease of daytime parking places need and will diminish chaotic parking that narrow traffic lanes and produce traffic congestion. To support faster communication between citizens and authorities, another application called Traffic Alert (see fig. no. 2) gathers data from users who give real time feedback about various traffic issues (i.e. broken traffic lights, street lanes blocked by cars parked in forbidden areas etc).

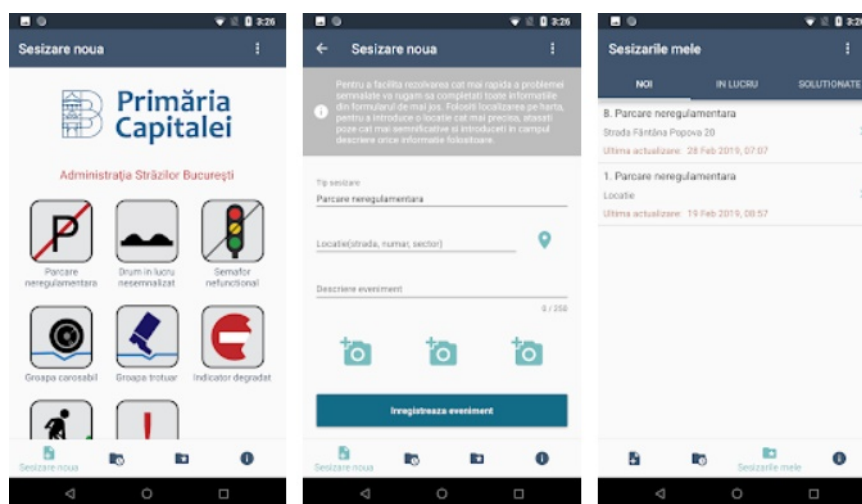


Fig. no. 2. Interface of the application launched by Bucharest authorities in 2019 for communicating with citizens

Source: Google Play, 2019. <https://play.google.com/store/apps/details?id=ro.cmtib.parcare>

Parking places are always a problem in agglomerated traffic areas of Bucharest. Both temporary parking spaces, during day time, and residential parking places during night time or in weekends are issues consuming time, fuel and annoying citizens.

In respect to residential parking places, District 4 of Bucharest provides a Smart application for online residential parking reservation. By mapping and inventorying available parking places and transferring these through Geographical Information System (GIS), citizens can see, reserve and pay parking places for their cars (Primaria Sectorului 4, 2018).

In term of parking areas to be used during day time, a new mobile application, Parking Bucharest, launched in 2019 guides drivers towards real time available parking places, provides information about parking costs and offers various alternatives of payment. As

Proposals for future Smart development of Bucharest City

Gathering citizens' ideas

It is important that people living day by day in a city should be consulted in respect to their annoyances and complaints before starting a long term Smart development strategy. Developing smart city solutions is a complex task, requiring the involvement of citizens to propose solutions for the various needs and problems they face on daily bases. One simple solution is to create an open online platform where people are encouraged to bring in discussion issues they consider important for the quality of their living and working in the city. Of course, a thorough analysis of pertinent opinions is required in order to identify the critical clusters to be translated further on in future development policies. A barrier to implementing this simple solution is finding the right motivation to encourage citizens to be

honest, open minded and creative when providing potential solutions. There is also a risk when documenting development strategies only throughout this kind of platforms, due to the fact that only the opinions of platform users are taken into consideration.

Organizing Hackathons

These events that bring together programmers, hardware specialists and other experts in areas vital to smart city development (i.e. environment, architecture, transportation, chemistry, etc) translate the voice and the needs of population into concrete projects. They are the practical start point in transforming ideas for a smarter city in ICT solutions.

Integrating various smart applications into a single platform

Using too many apps might prove to be uncomfortable for the citizens, especially for those who are not very accustomed with technology (i.e. older people). Hence, a simplified platform integrating in a single map layers of real time information about air quality, traffic conditions, public transport, parking, points of interest would lead to simplified usability.

Testing various applications for Smart city

Some people are more accustomed than others in using technology and mobile applications. The developers should keep in mind that young and skillful people in using mobile applications are citizens with the same rights as older and not so skillful ones. A smart city should be smart enough to provide comfort for all its inhabitants.

Conclusions

Although there is no consensus to what exactly a Smart city is, common elements may be noticed in all scientific theories. ICT is the foundation that facilitates Smart development taking into consideration sustainability pillars, governance and present welfare of citizens. An analysis of Bucharest Smart projects revealed that they try to address some of the negative attributes of living in this city, like air pollution, very agglomerated traffic, lack of infrastructure etc. The various mobile applications provide useful information to citizens and are good premises for increasing the number of persons that use public transportation, instead of own transportation means. These applications, however, are subject to improvement in terms of usability and features available. A Smart city development should encompass the needs of all citizens and it should take into consideration the need for educating people in becoming Smart citizens.

References

- Albino, V., Berardi, U. and Dangelico, R. M., 2015. Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, 22(1), pp. 3-21.
- Allam, Z. and Newman, P., 2018. Redefining the smart city: Culture, metabolism and governance. *Smart Cities*, 1(1), pp. 4-25.
- Batty, M., Axhausen, K.W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Ouzounis, G. and Portugali, Y., 2012. Smart Cities of the Future. *The European Physical Journal*, 214, pp. 481–518.
- Good News, 2018. *Orașe din Romania care aspiră la statutul de smart city*. [online] Available at: <<https://goodnews.info.ro/orase-din-romania-care-aspira-la-statutul-de-smart-city/>> [Accessed 19 February 2019]
- Google Play, 2019a. *InfoSTB. Ajungem împreună la destinație*. [online] Available at: <<https://play.google.com/store/apps/details?id=ro.stbsa>> [Accessed 1 April 2019]

- Google Play, 2019b. *Trafic Alert București*. [online] Available at: <<https://play.google.com/store/apps/details?id=ro.cmtib.parcare>> [Accessed 1 April 2019]
- Jiong, J., Gubbi, J., Marusic, S. and Palaniswami, M., 2014. An information framework for creating a smart city through Internet of things. *Internet of Things Journal*, IEEE 1(2), pp. 112-121.
- Komninos, N., 2011. Intelligent Cities: Variable Geometries of Spatial Intelligence. *Intelligent Buildings International*, 3(3), pp.172–188.
- NUMBEO, 2019. *Europe: Pollution Index 2019*. [online] Available at: <https://www.numbeo.com/pollution/region_rankings.jsp?title=2019®ion=150> [Accessed 22 January 2019]
- Primaria Sectorului 4, 2018. *Platforma online a locurilor de parcare din sectorul 4*. [online] Available at: <<https://ps4.ro/comunicate-de-presa/platforma-line-locurilor-de-parcare-din-sectorul-4/>> [Accessed 12 February 2019]
- Rathore, M. M., Ahmad, A., Paul, A. and Rho, S., 2016. Urban planning and building smart cities based on the internet of things using big data analytics. *Computer Networks*, 101, pp. 63-80.
- Ro Insider, 2018. *Bucharest, among Europe's most polluted cities*. [online] Available at <<https://www.romania-insider.com/bucharest-numbeo-pollution-mid-2018/>> [Accessed 22 January 2019]
- The Royal Academy of Engineering, 2012. *Smart infrastructure: the future*. [online] The Royal Academy of Engineering. Available at: <<https://www.raeng.org.uk/publications/reports/smart-infrastructure-the-future>> [Accessed 23 March 2019]