

Social Media as a People Sensing for the City Government in Smart Cities Context

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Abstract – Social media have a huge impact on different areas of modern life. In smart city context, they can be used as a tool for enhancing dialogue between citizens and municipalities. Based on present research, empirical evidence is provided on insufficient use of social media capabilities. Relationship between smart cities and social media power is examined through study on the example of Varna municipality. An analysis of city government presence in social media was conducted. Through online questionnaire the citizens' attitude towards smart city concept was studied. Suggestions for improving the communication between citizens and municipal administration of Varna are given.

Keywords – social media, social networks, smart city, people sensing, relation municipality – citizens.

1. Introduction

In recent years, there has been a steady upward trend in urban population, i.e. the process of urbanization, accompanied by increase of use of information and communication technology (ICT) and diffusion of sustainability [1]. According to UN statistics, by 2050 about 60% of the world's population will inhabit urban metropolitan areas [2]. This is a prerequisite for the exacerbation of existing problems regarding the functioning of major cities, as well as the emergence of new problems and challenges [3].

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Some of them are: budget-related problems, overpopulation, increased usage of resources, traffic and mobility-related problems, inconsistent infrastructure, air pollution, inability to provide adequate education and healthcare, increased number of crimes, the need to create new jobs, and others. In order to counteract the deepening of these problems, it is necessary to take steps towards urban transformation [4]. Traditional expansion of cities is no longer able to solve the problems and challenges posed.

According to Clerici and Mironowicz (2009) cities are currently at the stage of the fourth urban transformation that is considered incomplete [5]. One of the opportunities for urban transformation is through the implementation of the concept of “smart city” [6].

At the same time, several major trends emerge in the ICT field in the second decade of the 21st century: mobile devices, social media, cloud technology, smart devices and smart connectivity, big data and the “Internet of Things” concept.

The latter trend, in our view, will play a key role in improving urban ecosystems and transforming their diverse processes. The concept of “Internet of Things” is being implemented in different directions and one of them are the so-called “smart cities” – a concept that relates to the need for urban transformation in the context of improving the quality of life in urban agglomerations, improving the decision-making process and placing citizens at the center of the urban ecosystem.

Social media have an impact on different areas of modern life, changing the way people express, communicate, and share content [7]. In addition to the many areas of their application, they can also be used to enhance the dialogue between citizens and the municipal administration. On the other hand, they can be used as a data source in the context of the smart city conception. The development of the infrastructure needed to implement the smart city concept is strongly linked to enhancing the role and importance of social media [8].

As a result of interconnectivity and the development of ideas for smart cities and social media, new concepts and opportunities are emerging to share the latest ICT developments in order to

fulfill various tasks for better and more efficient urban governance.

This article aims at examining the relationship between smart cities and the power of social media. The study seeks to analyze the interaction on one side based on studies of other researchers in this field, as well as through empirical study of the specific forms of this interaction on the example of Varna municipality – the third largest city in Bulgaria. The survey examines the presence of Varna Municipality on social media and the extent to which they are used as a channel for communication with citizens. In addition, the purpose of this study is to assess the attitude of city residents to smart city initiatives based on an online questionnaire. The article also seeks to provide recommendations for improving the communication between citizens and municipal government of Varna. Ideas for future research are identified as well.

2. Literature Review

Social media influence positively on the expansion and better functioning of smart cities. The relationship between the social media phenomenon and the concept of smart cities has been explored by a number of authors in various aspects.

One aspect of smart cities is to increase citizen participation in urban decision-making and the role of citizens in general. On the one hand, the concept of smart city can be linked to the application of ICT in the urban environment. On the other hand, however, the concept is even broader in nature, also linked to the positioning of citizens in the center of the urban ecosystem.

Collected data from different sources (e.g. sensors, IoT devices, closed-circuit television (CCTV), etc.) play a key role in smart cities and are then processed and analyzed to transform information, knowledge and wisdom [9]. In order to extract the dependencies of the data, various methods and techniques may be used, such as data mining [10] and machine learning [11]. Social networks can also be a source of data, as a place for civil society to express an opinion [12], [13] and enhancing the role and activity of citizens [14]. It should be emphasized that the data collected through social networks are mostly unstructured and therefore more difficult to analyze [15]. Some authors [16] report gaps in the use of this opportunity by various city administrations. Not all administrations regard social media as a possible source of information, which is why strategies or plans are not available in this direction. We see an untapped potential of developing the smart city concept in the context of using real-time data generated by social media.

Another aspect of the social media-smart cities relationship is the role of users as live sensors, the related term crowdsensing and their impact on effective urban governance. Given the tremendous growth of both mobile and social media users, some authors [8] are considering a new kind of services in the context of location-based social networks (LBSNs). The term crowdsensing is highlighted. It concerns data aggregated through sensing people in order to measure phenomena that affect many people. With the help of crowd-sourced location data within the smart city, the authors emphasize that for the first time it became possible to explore the movement of people in an urban environment. They perceive the following possibilities: monitoring crowds, locations and movements to support decision making in the areas of education, emergency training, town planning, traffic management and other smart city activities. Some authors also address the issue of crowdsensing – via chat bots and mobile agent-based crowdsensing [17]. Bosse and Engel take a view that people can be seen as sensors. They propose a framework, which integrates agent-based simulation with crowd sensing performed by mobile agents. Chat bots are used as a tool for crowd sensing and a link between virtual and physical worlds. In this way, using agent-based approaches, the smart city government can be assisted, including manage and synchronize major and complicated socio-technical systems (like traffic control) of the cities. In other works, authors also perceive users as smart social sensors [18]. Findings of other authors [19] about remote sensing based on shared traffic related are made. It is revealed that geosocial media data can be used by drivers to adapt themselves according to the traffic conditions. The research contributes with a focus on new opportunities for traffic condition monitoring in the smart cities.

In addition, some authors [20] consider the contribution of application programming interfaces (APIs) to combining different types of data sources regarding the optimal functioning of smart cities. Using APIs, it is possible for city government to benefit from a variety of static and dynamic data sources, as well as assessing their role as an important element in the governance of urban information infrastructures. The authors also explain the concept of City APIs from different perspectives.

Other authors [21] explored the possibilities of using social media to help address some of the social problems and challenges associated with the development of small and medium-sized cities and settlements. In smart cities, by using a practical smart solution and real-time data, it is possible to help solve such serious problems as poverty – one can get a specific idea of the needs of vulnerable and

marginalized people with the help of the foodbank platform.

This study reveals the need for empirical studies investigating the presence of different city administrations on social media and the extent to which they are best used as a source of data in the decision-making and management of cities.

3. People’s Social Media Participation – Worldwide and in Bulgaria

Before considering the specific effects of social media on smart cities and the studied city, the power of social media and their expanding presence in the lives of individuals, communities and society as a whole is justified. A clear distinction between social media and social networks is needed. According to J. Manning, the two main features of social media are: 1) they allow the users the opportunity to participate and express themselves and 2) they include different elements of interaction [22]. Social media (e.g. various blogs, YouTube, Wikipedia, etc.) is a more general term and it is characterized by the creation of copyrighted content. In contrast, social networks (social networking sites – SNS) are mainly used for communication between users and content sharing, including text, images, hyperlinks, etc. (e.g. Facebook, Twitter, LinkedIn, etc.) [23].

According to the statistics portal Statista, for the last ten years social media users have increased nearly three times, reaching almost 3 billion worldwide by the end of 2019 (fig. 1) [24].

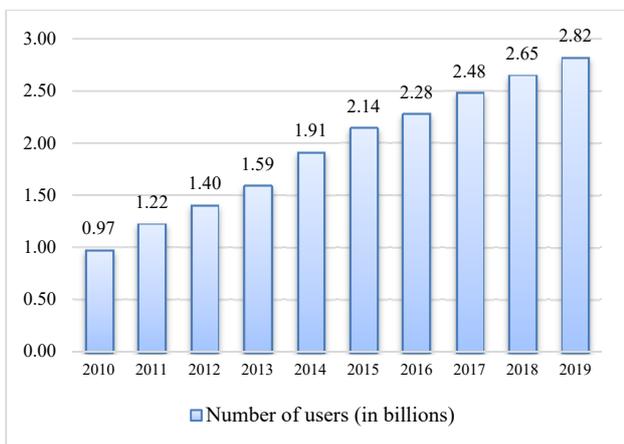


Figure 1. Number of social media users worldwide for the period 2010 – 2019 (in billions)

The increase in the number of social media users leads us to believe that they could play a significant role in expressing the opinion of civil society. On the other hand, municipal administrations and state structures should also be active in social networks in order to use the opportunities provided for effective communication with all stakeholders.

Figures show that the most popular social media are Facebook, YouTube, WhatsApp, Facebook Messenger, WeChat, Instagram, etc. (see fig. 2) [25]. After the media shown in the diagram, the ranking also includes: QQ, QZone, Tik Tok, Sina Weibo, Reddit, Twitter, Douban, LinkedIn, Snapchat, Pinterest, Viber, Discord, etc., whose users range from 823 million to 250 million people.

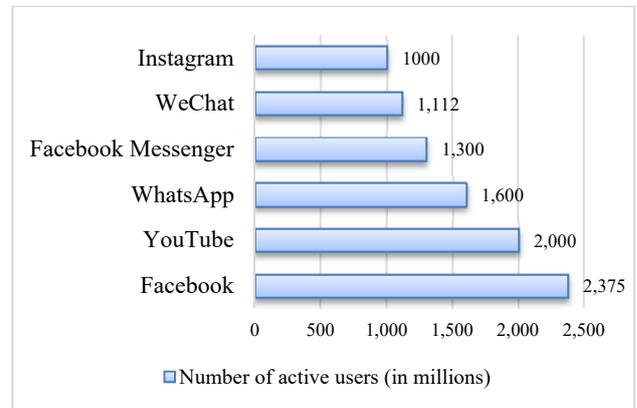


Figure 2. Most popular social media platforms worldwide as of October 2019 (in millions)

Data from the official statistical organization from the European Union Eurostat for 2018 show that 51% of people in Bulgaria aged 16-74 participate in social networks [26]. The percentage is much higher within the group of young people aged 16-24 – 86%. Recent data about adoption of different social networks in Bulgaria are given by the largest non-governmental trade union in Bulgaria – KNSB¹ [27]. According to them, Bulgarian Facebook users are 3.6 million people.

Our research interests center namely around the opportunity to improve the dialogue between citizens and the municipal administration through better positioning in the six most popular social media.

4. Survey of Varna Municipality's Presence on Social Media and Related Projects

As already noted, the object of study in the present work is Varna Municipality. According to the official Bulgarian Statistical Office (National Statistical Institute), at the end of 2018 Varna has a population of 345 369 [28]. By its size, it ranks third in Bulgaria. For the period from 1956 to 2018 the city increased its population almost three times (see fig. 3). Varna is the largest city on the Bulgarian Black Sea coast and one of the most important tourist destinations in Bulgaria.

It should also be borne in mind that due to intra-economic migration and the specifics of the city

¹ KNSB – Confederation of Independent Trade Unions in Bulgaria

(trade, transport, tourist and university center), it also houses a category of persons not included in the official statistics – seasonal workers, students, tourists.

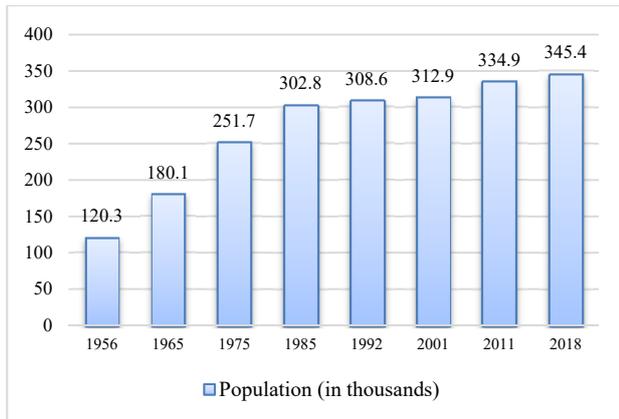


Figure 3. Population of city of Varna for the period 1956 – 2018 (in thousands)

The growing population of Varna poses a number of problems and challenges related to its effective and sustainable management. As mentioned above, one of the possibilities for such an urban transformation is to take steps to implement the smart city concept.

Varna is the first city in Bulgaria to have a digitalization strategy for the region, which was created jointly by representatives of Varna Municipality, IT companies and universities. Its main goal is to make the city and the region a technological and innovative hub. One of the goals set in the city's management program is to improve the quality of administrative services [29].

In this connection, it should be emphasized that the municipal administration is actively working on projects funded by various European and Structural Investment Funds. Two of them are of interest to us from a research perspective – “Interactive Cities: Effective Urban Management through Digital Tools, Social Media and User Generated Content” (URBACT – Interactive Cities) and “Smart and Sustainable Cities” (mySMARTLife).

The aim of the **URBACT – Interactive Cities** project is to improve urban governance through social media, by providing a broader platform for opinions and recommendations, and by promoting dialogue between citizens and local government. The specific objectives of the project can be summarized in the following main areas:

- 1) Promoting cities as an attractive tourist destination through smart solutions.
- 2) Improvement of communication channels for interaction between local authorities, citizens and businesses.

- 3) Urban development, incl. involving a wider range of citizens in the decision-making process through various social channels.

Several leading cities are involved in this project, including Helsinki, Amsterdam and Barcelona. The city of Varna is part of the group of successor cities that can incorporate the good practices implemented in the leading partners. The main areas of implementation of smart solutions in the urban environment are:

- Overall integration of IoT solutions;
- Reduction of energy costs by up to 20% and increase of energy efficiency;
- Offering data generated through new technologies;
- Promoting pilot initiatives in the field of smart solutions and promoting innovation, etc.
- Increasing the level of interaction between civil society and municipal administration, etc.

In Finland, one of the countries participating in the project through the city of Helsinki, the possibility of civic participation in different processes has been regulated by the law since 2001, using different electronic resources for this purpose. Over 5,000 proposals for improving the urban environment are received annually. The Virium Helsinki Forum has also become a tradition, in which various solutions related to improving the quality of life in major metropolitan areas are presented. This can illustrate well the possibility of using social media for the purpose of building a smart city.

The **mySMARTLife** project is part of the Horizon 2020 program. There are also two categories of cities involved in this project – lighthouse cities and follower cities. The first category includes Nantes, Hamburg and Helsinki, and the second – Varna, Bydgoszcz, Rijeka and Palencia. As in the previous project, the leading cities also implement different ICT solutions, and followers could incorporate know-how and experience. MySMARTLife's main goal is to develop an urban transformation strategy based on three basic principles:

- 1) Extended urban planning based on an integrated approach, social, environmental and economic impact assessment and prospective vision;
- 2) Intelligent people involved in the active participation of civil society in the process of urban transformation.
- 3) Intelligent economy related to a structured economic approach based on urban business models and identification of innovative ones.

The smart economy is an economic framework aimed at guaranteeing employment, high incomes and a variety of services targeted at citizens. The goals of this project are:

- Transformation of cities into more sustainable places in order to implement the concepts of smart people and smart economy;
- Making cities more environmentally friendly;
- Ensuring high quality of life;
- Active participation and involvement of citizens in the development of an integrated urban transformation strategy;
- Digitization of different processes in cities and active use of various electronic platforms;
- Implementation of a specific set of 150 activities in the three leading cities;
- Pass the experience to the four successor cities and share best practices by connecting other cities to the mySMARTLife network.

In summary, both projects aim at sustainable urban development, which can be achieved through active communication between local government and civil society. Much of the smart city projects implemented have been proposed specifically within incubators as a result of the symbiosis between institutions, business organizations and individual citizens. In both projects the city of Varna belongs to the category of “successor city”, i.e. actively participates in the acquisition of know-how and experience from solutions implemented within the project in leading cities. Representatives of Varna Municipality have participated in a few forums held in partner cities.

As an added value from the activities of the two projects URBACT – Interactive Cities and mySMARTLife, the strategic document for Varna Municipality – “Integrated plan for communication through digital tools and user-generated content” was developed.

Several analyzes have also been carried out within the projects concerning the presence of Varna in the online space, as well as related to the institution's communication with partners and within its internal departments.

Varna is not the only city with ambitions for implementation of the smart city framework.

There are several implemented smart cities initiatives in other Bulgarian cities based on open data and different smart solutions through which citizens have access to a variety of real-time information services. A recent judgment may be cited as an example how the social network site Facebook is considered as an important and powerful channel – Sofia Municipality (the capital of Bulgaria) is obliged to share the data from the air quality measurements collected through different sensors to mobile Facebook application for smartphones [30].

Various online and mobile applications are available to Varna citizens and the guests of the city in order to keep them informed and to increase their productivity – they are summarized in Table 1.

Table 1. Different online and mobile applications available to Varna citizens and guests

App	Description
LiveVarna.bg	Information portal of Varna.
Visit.Varna.BG	Official tourist guide of Varna.
ITransport Varna App	App as part of Project “Integrated urban transport in Varna” – shows real-time public transport information in Varna.
LightHouse App	App providing information for city tourists and guests of Varna.
Civi portal	Citizens can report irregularities and problems.
LoveBulgaria App	App promoting Bulgarian tourist destinations.
Tickey App	App for buying an electronic bus ticket in Varna.

The first four applications (bolded in table) are specific for Varna and they are intended only for locals, while the last three are nationwide and have relevant sections for Varna. Some of them have distinctive features of social media tools through which citizens express their opinions, report irregularities and improve different processes within the urban environment, and thus the voice of civil society is heard. These include:

Civi is a free mobile application for Android and iOS that can be used to send reports to institutions in the form of a photo. The application is managed by a team of lawyers who formulate the citizens' alert and submit it to the respective institution. In the city of Varna, the application has been operational since January 2018 [31]. However, statistics show that out of 14 536 irregularities reported through the Civi application for 2018, the city of Varna administration has only solved 213 or just 1.4%, which is a very low share. A comparison of Civi signals in Varna with those in other major cities in Bulgaria for 2018 is presented in Table 2 [32].

Table 2. Submitted and solved signals using Civi application for 2018 in five major Bulgarian cities

City	Submitted alerts	Solved alerts	Solved vs submitted alerts
Burgas	10 397	3 159	30,4%
Sofia	28 107	6 623	23,5%
Plovdiv	4 066	153	3,7%
Veliko Tarnovo	22 347	537	2,4%
Varna	14 536	213	1,4%

The comparison shows that Varna occupies the unenviable last place in the ranking. The share of resolved signals varies from the stated wide limits – from one third to about 1% for Varna. We can conclude that the Varna municipality should take

these signals much more seriously and responsibly and be more proactive in resolving citizens' signals and providing feedback.

Grajdante is another application available for Android and iOS that aims to build a more responsible civil society [33]. It works in the same way as Civi, with citizens being able to report a problem by sending a photo or video and receiving feedback.

Varna Municipality appreciates the opportunity to receive feedback on citizens' opinions through social media tools. Evidence of this are the communication channels provided on its official website www.varna.bg for citizens to file signals, complaints, proposals and inquiries regarding administrative services. In addition to the standard channels (telephone numbers, e-mail), the municipality has put a hyperlink to the platform www.aktiven.bg – a portal that allows citizens to report irregularities within different municipalities in Bulgaria. In this way, Varna city government encourages this type of interaction with citizens.

As we have already noted, the most widespread social network in the world and in Bulgaria is Facebook and the related instant chat application Messenger. The participation of individuals, firms and institutions in Facebook is possible in two ways – through individual and group pages. Individual pages allow different individuals and institutions to create a formal profile in which they publish different content. In contrast, groups allow smaller groups of people with similar interests to share ideas and opinions [34].

Our survey shows that the municipality of Varna does not have an official Facebook account. However, there is a profile on Facebook that is considered to be the unofficial profile of the municipality, called LiveVarna and containing its coat of arms. LiveVarna has over 17 100 followers and over 16 900 likes. There are few posts on the page and no complaints from citizens.

The question arises why Varna Municipality does not declare LiveVarna as its official institutional Facebook profile. In our opinion, the reason lies in the important feature of social networks – the ability to be a tool with great power, but at the same time it easily becomes, to some extent, a threat to the institution. Researchers point out that institutions and organizations could potentially face challenges when using social networks for dialogue with individuals [35], [36]. Public communication of an institution and individual users through a social network can be risky and unfavorable for them and even threaten its reputation. In line with these concerns, an official Facebook page of Varna Municipality could, for example, potentially lead to negative publicity and citizens' attacks. For this reason, in our opinion, the

municipality prefers to remain in the shadows without an official profile.

Although, according to our survey, the unofficial municipal Facebook page is not a place to attract citizens for feedback or complaints on the work of the administration, there are other informal Facebook groups for this purpose. In these groups, citizens can report irregularities and problems in the city and the municipality could use the submitted information. These include:

- “I see you KAT² Varna” with approximately 106 700 members;
- “Noticed in Varna” with approximately 54 400 members;
- “Signals and problems in Varna” (the group is maintained by Civi) with 779 members, etc.

The purpose of the first group is to allow citizens to post alerts and pictures regarding the traffic violations that need to be brought to the attention of traffic police. The publications and posts in the second and third group allow the signals to quickly reach the attention of the municipality and its respective departments, as well as the other members of the group to be informed that a problem has already been put on the agenda or that it has already found its solution.

As mentioned earlier, the Varna municipality does not have an official Facebook page, but in contrast the district mayoralities of the city have independent profiles on the social network. In accordance with the Bulgarian legal regulations, as a city with a population of over 300 000 people, Varna is structurally divided into five districts – Odesos, Primorski, Mladost, Asparuhovo and Vladislav Varnenchik. In addition to all being present in Facebook, the fact that each town hall has its own website (e.g. www.varna-primorski.com) is also impressive.

Table 3. Number of likes and followers of Varna district municipalities profiles on Facebook as of 15/11/2019

District	Number of likes	Number of followers	Ratio (number of likes vs number of citizens) (%)
“Odesos”	1 393	1 417	1,58
“Primorski”	2 236	2 306	2,05
“Mladost”	3 425	3 441	3,78
“Vladislav Varnenchik”	3 953	3 982	8,04
“Asparuhovo”	1 646	1 664	5,86

² KAT is an abbreviation for the traffic police in Bulgaria.

As we can see from the data in Table 3, the number of likes and followers of Varna district municipalities profiles' on Facebook are relatively low (all ratios under 9%) considering the total number of citizens living in the districts. Efforts should be put in order to attract more followers.

Another way of indirect presence of Varna Municipality in Facebook is registered through the Mayor's personal page. It is maintained by its secretariat and has around 80 000 likes and the same number of followers. It should be noted that the profile has received a lot of critical comments and opinions from citizens.

According to the statistics above, other popular social media besides Facebook are Instagram, YouTube, WhatsApp and WeChat. Varna Municipality does not have an official account in YouTube. City's information portal – LiveVarna – has a YouTube profile with 477 subscribers and 103 videos with low viewing rate. Other initiatives-related profiles can be found on that media – for example, a profile created in connection with the city's application for European Capital of Culture for 2019, profile related to the title “Varna – European Youth Capital” for 2017, and others. All of these have low number of subscribers and are not active enough on video publishing. In addition, the municipality or district mayoralties do not have the ability to communicate with citizens through social media tools such as Messenger, WhatsApp, WeChat, nor do they have an official Instagram account.

5. Varna Initiatives Towards Smart City Concept and Exploring City Residents' Attitude to Smart City Initiatives

Besides participation in international projects related to using social media and in relation with smart cities ideas (mentioned in section 4), Varna Municipality has already taken first steps towards implementation of some elements of the smart city framework. Approaching the end of 2019, several initiatives are currently in the process of being implemented in the city of Varna:

- **Intelligent lighting system has been already installed** in one of the main streets of the city. Sensors are used in order to detect pedestrians and cars and to regulate the level of illumination. Intelligent lighting is expected to be installed in other main streets of the city. One of the main goals in the Strategy for sustainable energy development of Varna Municipality for the period 2012 – 2020 is related to the implementation of energy efficient intelligent lighting in the city and system for its automatic management. The serious intentions of the local authorities are confirmed by the fact that the

Varna municipality has issued municipal bonds in order to finance the modernization of the city's street lighting system [37].

- **Building an intelligent traffic control system in the city** – such a system aims at optimizing transportation by installing smart traffic lights that use sensors. They will detect approaching public buses and trolleybuses and retain the green signal in order to give priority to the mass public transport. Each vehicle should be connected to the Internet and should send information about its location via GPS sensors to a single command center. That information should be forward to the smart traffic lights, and thus they should be able to calculate the distance of the approaching vehicles. The solution is part of the Integrated Public Transport project, aimed at encouraging the city population to use public transport and thereby to reduce the car emissions.
- **Establishing 25 intelligent pedestrian crossings** that, through sensors, will detect pedestrians approaching and will send light signals to drivers.
- **Building electric vehicle charging stations** - the implementation of the “smart city” concept also aims at reducing carbon dioxide emissions. In addition to promoting the use of public transportation, Varna Municipality wishes to reduce emissions by building charging stations for electric cars and giving certain preferences for such vehicles, for example free parking within the short-term paid parking zone, paying a lower or zero vehicle tax, etc.
- **Establishing free Internet access** within the WiFi4EU (Free Wi-Fi for Europeans) initiative in various public places – libraries, museums, squares, parks and gardens, etc.

As we have emphasized several times, the citizens of the municipality are a leading and fundamental element of the smart city framework. All these initiatives, actions, measures and use of communication channels are directed to them as a central object of the smart city concept. It is therefore important to know what citizens' attitudes are concerning these initiatives – do they see the need for them, are they ready to support them, what problems they identify in the implementation process of the smart city concept. In order to answer these questions an online survey was conducted. A questionnaire with 15 questions was distributed online among mainly young people. A total of 260 participants (169 women, 87 men, 4 did not answer) took part. The majority of participants (85,37%) reside permanently in the city of Varna. Having in mind that one of the overall ideas of the smart city concept is to improve the quality of life and the dialogue between the city's administration and the citizens, the

first part of the survey was oriented towards the current city's problems that the participants identify. Problems in the following directions were outlined:

- Almost 70% (68,46%) of the participants in the survey indicated that there is not an effective dialogue between them and the authorities;
- The lack of proper forms for communication with the government bodies was cited as a leading problem by 61,70% of the participants;
- 60,77% of the respondents cited the lack of certain e-services that should be provided by the municipality.

The second part of the survey seeks to find out the attitudes and perceptions of municipality's citizens to the smart city concept. Overall, 91% of participants agree with the idea that the citizens should be in the center of the city's ecosystem. Nearly 88% of the respondents think that the implementation of the smart city concept in Varna will have positive effects and will help to solve some of the abovementioned problems. Very high proportion of the participants (93%) agree that they would use different Internet-based applications and portals aimed to improve the quality of life and the effective dialogues between the two parties. Social media seem to be a possible source of data for these portals and applications.

The answers from the survey confirm our thesis that an urban transformation in the city of Varna is needed and that the Varna Municipality can use initiatives under the smart city concept in order to create citizens-friendly urban environment. The survey results prove that social media can be a main tool for better communication and dialogue between city government and citizens.

6. How to Improve the Dialogue Between Citizens and Municipal Administration – Suggestions and Possible Solutions

The authors see some opportunities for improving the dialogue between citizens and municipal administration in the following main areas:

1. The results of the survey lead us to conclude that the presence of Varna Municipality in social networks is not wide enough. It is necessary for the city to have **an official account** on Facebook – the most popular social network for Bulgarian users. A comparison with two other large municipalities in Bulgaria – Sofia and Burgas, shows that they have clearly stated the official status of their Facebook profiles, which means they can be used as a communication channel with citizens. Only a mayor's and district profiles are not enough. Furthermore, the district municipalities have to work to increase their popularity among the citizens of the regions, as empirical research shows that their followers and likes are currently insignificant.
2. In addition to Facebook, the city administration should expand its presence in other popular social media. Particular attention should be paid to Instagram – a network especially preferred by young people. This is also due to study by researchers who highlight that Instagram is currently the most popular social media app among young people worldwide [38]. In order to diversify the possible channels for presence and communication with citizens, other social media tools could be of interest to the municipality, for example Viber as an instant messaging app and YouTube as a marketing and content distribution platform.
3. In the context of the above two recommendations, there is a clear need for a unified and synchronized management of Varna Municipality's positioning on social media. Therefore, in our view it is necessary to establish a municipal administrative unit responsible for improving the municipal administration's presence on social media and better communication with civil society. The municipality could also hire digital marketing specialists to prepare better online content that is significantly faster accessible to a wide audience, especially younger ones, than other traditional media. We recommend the use of chatbots that can automatically respond to or direct part of citizens' inquiries.
4. As mentioned above, as an added value from the work on the two projects – URBACT – Interactive Cities, and mySMARTLife, Varna Municipality has developed the strategic document “Integrated plan for communication through digital tools and user-generated content”. When it was created, the municipality identified some weaknesses in terms of citizen feedback opportunities. In this regard, the findings of this study direct the municipal administration to similar opportunities with social media tools, incl. as a result, active participation of citizens in the process of managing and transforming the city into a smart city framework with all its elements.
5. Signals submitted by citizens using applications such as Civi should be taken more seriously by the Municipality of Varna. The authorities should work more actively on resolving them. The share of resolved signals for year 2018, below 2%, is unacceptably low. Resolving a larger proportion of the alerts is going to increase citizens' confidence in the institution, improve its public image and encourage civil society to identify other available problems in order to solve them.

6. The online presence of Varna Municipality and the five districts with separate sites on the Internet can be unified, as one of the possibilities is to develop a single portal, which contains information for the whole municipal administration as well as for the individual district mayoralties. In this way, citizens will be given a unified view and access to information concerning both the large municipality and the district municipalities. In addition, it is advisable to post links in the current sites (or in the future single portal) to social networking profiles in order to make it easier for citizens to find them.
7. We have already indicated that an important aspect of the smart city concept is the ability to maximize citizens' active participation and facilitate the intensive communication between them and the city government, incl. through social media. In this connection, it is important for citizens to have easy access to the municipality's site from any device, especially mobile. The reason for this is the tendency towards change of users' habits for Internet access mainly through mobile devices, which has been established in recent years. Official statistics show the dominant importance of the use of the "Internet while on the move" [39]. This means i.e. when away from work or home using the internet on a portable computer or handheld device – mobile or smart phones, laptops, and tablet computers. The comparison between data for 2013 and 2018 shows that while in 2013 43% of individuals aged 16 to 74 within the European Union-28 used a mobile device to connect to the internet, in 2018 this share has increased significantly, reaching 69%. For this reason, Varna Municipality needs to redesign its site by making it responsive and thus suitable for better access from various portable devices.
8. The active involvement of citizens in city governance is expected in the context of the smart city concept which is based on their awareness and the ability to quickly access the data and information they need. The so-called "open data" plays a major role in this regard, which municipal institutions should make available freely [40]. At Varna Municipality level, opportunities should be sought to integrate the open data generated from different sources, from different web portals and applications. The aggregation and integration of this data will assist both parties in the process – on the one hand, the employees of the municipal administration and its management in order to make informed and optimal decisions, and on the other, civil society, in order to be better involved in decision-making and take advantage of

various e-services, saving time that can be used for other activities.

7. Conclusion

The increased population of urban agglomerations leads to various problems and challenges to their management. One of the opportunities for urban transformation is the implementation of the smart city concept, which aims at improving the quality of life in cities, ease the decision-making processes, and to position citizens at the heart of the urban ecosystem. This concept is based on data, which can be generated from different sources, one of which are social media. They provide an opportunity for active participation of civil society in the process of managing and transforming urban spaces, as well as providing feedback and proposals.

The implementation of the smart city concept is directly linked to and influenced by social media tools and the data they generate. The interaction between these two leading IT trends in recent years has been examined on the example of the third largest municipality in Bulgaria – Varna Municipality. Our study indicated the following conclusions:

First, based on the findings about the social media importance in many aspects regarding individuals, business and management, our study indicated the current participation of the population in Bulgaria and worldwide in social media and especially in Facebook.

Second, our research interest was focused on exploring to what extent different social media tools are used by Varna municipal administration in the context of the smart city framework which places citizens in the center of the city's ecosystem. The study reveals active participation of Varna Municipality in projects related to the role of social media in encouraging people's involvement in the work and management of municipalities. On the other hand, our study reveals, that **the practical involvement of Varna city administration in communication with citizens through social media tools is still insufficient** – the municipality does not recognize its unofficial Facebook profile as official one (as it should be). According to our view, the reason is related to the concerns of the municipal management regarding reputational threats to its image via publications on the municipality's Facebook page. As some compensation regarding this absence, the Mayor's personal Facebook page and the districts' Facebook profiles can be seen, but probably this is not enough. As a positive fact, it can be emphasized that the citizens of the municipality use several applications and sites (local and national) through which they can give opinions on important

issues for the city, make suggestions, complaints and other feedback. Based on the low share of resolved inquiries for 2018, an insufficiently responsible attitude of the municipality to reported irregularities and lack of measures were revealed through our research.

Third, the first real steps and initiatives taken by Varna Municipality to implement the smart city concept in Varna were summarized (begin with implementation of intelligent lighting system, intelligent traffic control system, etc.). Exploring Varna citizens as central object in the smart city concept and their attitude towards it was studied using an online survey. The results of analysis of online questionnaire survey of 260 participants highlighted the main problems – many respondents see lack of effective dialogue between them and the authorities, lack of proper forms for communication with the government bodies and absence of certain e-services that should be provided by the municipality. In addition, the survey provides empirical evidence about the participants' positive view on the **idea for citizens' key role in the smart city's ecosystem**. Significant number of them see the importance of the concept for problem-solving. Many participants are willing to use different apps and portals aimed at improving the quality of life and the effective dialogue between them and municipality authorities, with a particular focus on social media as a leading communication channel.

Fourth, the study contributes by formulating approaches for improving the dialogue between citizens and municipal administration in the smart city context. The authors emphasize the need for the municipality to work intensively for its **active presence on social networks**, incl. use of an **official Facebook profile**, and to promote the district Facebook municipalities' pages among citizens more intensively. In addition, the study identified the need of **expanded presence in other popular social media**, in particular **Instagram**, which is especially preferred by young people. Unified management of Varna Municipality's positioning on social media is proposed, including possible use of chatbots. It is also highlighted that in accordance with the trend towards prevailing Internet access via handheld devices, a redesigned responsive site of Varna Municipality is needed.

In summary, this study contributes by demonstrating, based on a specific municipality example, the close **relationship** and the **interaction between two leading concepts** in recent years: 1) **social media** and 2) **smart cities** and their importance for successful urban transformation.

Authors' **further research** interest can be directed to study the efficiency of the dialogue between municipality and citizens using different social media

tools, including specialized applications for feedback and reactions. Viewing people as live sensors could be challenging but it is essential for the successful implementation of the smart city concept and it can be an interesting research topic.

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