Green spaces in Bucharest - present situation, current developmental programs and future aspirations

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Abstract

The following article aims to review the situation of the green spaces in Bucharest, by going through a case study with the goal of emphasizing crucial aspects for this city to become "smarter" than it currently is, in terms of sustainable development. This article is based on geophysical data and urban characteristics of this capital, compared to the other major European cities. We also present some of the previously proposed governmental initiatives in terms of natural spaces and lifestyle improvement, as well as what citizens believe to be improvements of their current living conditions. Through our research, we found that Bucharest possesses various sectors with a large demographic index. These condensed housing sectors, usually involving tall apartment buildings, could benefit from small parks, as well balcony or "vertical" gardens. Considering the great number of schools of this capital, green initiatives can be implemented in educational set-ups as well. Implementing previously proposed ideas such as the creation of a "green belt" would significantly improve the air quality, landscape and pedestrian security of the busy Bucharest. After all, maintaining a green and healthy urban area brings major benefits, and it should be a common goal for all its citizens. Besides the general public, this review article can be of particular interest to the city council and to researchers interested in civil engineering and urban development. Lastly, we strongly believe in the importance of the present study, since it contains up-to-date information and it customizes sustainability initiatives to the economical and social conditions of this city.

Keywords: environment, urban sustainability, air-quality, green belts, smart green cities

1. Introduction

A city is often described by its geographical size, its demographical density or its financial capital. A thorough characterization may also include the total kilometers length occupied by its roads, their quality, the number of skyscrapers in its downtown, the maintenance of its buildings, its employment rate or the access to technology of its citizens. This last factor, which has been under high development in recent years, as means of connecting individuals with the public and the private sectors, has also generated the concept of smart *cities*.

By *smart cities*, I am referring here to the programs established within urban areas, based on technological advancements that provide citizens life improvements on a variety of areas: administration, environment, mobility. Many international organizations have

shown how digital technology can be embedded across various city functions (Bowerman et al. 2000, Cocchia 2014, Viechnicki et al. 2015, Smart Cities Council 2016). For good living conditions, a city should provide its citizens good air quality, waste management and purified air. Thus, being "green" is a major component of *smart* cities (European Commission 2014).

Green spaces provide other health benefits (Maas et al., 2006) and occupy the top of the list of important factors for deciding habitats: some families are choosing to grow their children in a metropolitan region, farther from a busy city. On the other hand, other families prefer to be geographically close to their work place and therefore choose to live in a demographically dense urban area. Nowadays, when deciding the location of our home, we can choose being close either the city center or the nature: a busy and eclectic place, with more people per square kilometer (km^2), or a more quiet and relaxing area, where surroundings are rather green than gray. Should nature be completely segregated from the city? Having more buildings or more people living per km^2 does not have to imply that we settle for less green, or not at all. Recently, research and international organizations emphasized that urbanized areas must blend green spaces with the built, industrialized, construction sites (Cicea and Pirlogea, 2011, Green City Index, 2012).

By bringing "green back to the city", we would like to refer here to a diversified green urban infrastructure. This general term includes parks, forests, street trees, public and private gardens (part of business sites, for example), sport facilities, graveyards, urban drainage systems (ponds), urban agricultural spaces, green rooftops, vertical gardens and academic campuses (Luca et al., 2015). Preserving nature is often forgotten when development is seen solely dependent on the amount of construction projects. On the other side, climate change, a hot topic in the current world, is not necessarily perceived as a shared responsibility within a city, between its administration and its citizens. Nonetheless, it is important to point out how everyone can benefit from building and living within a green *smart city*.

1.1. Motivation for the study

In this review, we present some of these benefits and emphasize crucial aspects of a 21st century *smart city*, whose goal is to be attractive for both citizens and tourists. As an example, we focus on Bucharest, a large Eastern European capital. We discuss its main characteristics and a reasonable long-term development about its green infrastructure. In order to attain long-term goals, short-term plans are required, like the implementation and maintenance of substantial green spaces. When discussing future plans, urban planning and mobility projects need to be considered as well. The first step would be make citizens take action. Our key message is that Bucharest city hall can show its concern with climate change by increasing the number of green spaces available to its citizens and by inciting their civic spirit.

When developing a plan for a green *smart city*, history, geographical location and current context are crucial. In the context of Romania, it is important to emphasize how being a post-communist; Eastern-European country has influenced the urbanization of its capital.

2. Geophysical and historical characteristics of Bucharest

Bucharest is the 6th largest city in the European Union (EU) after London, Berlin, Madrid, Rome and Paris. It has a metropolitan population reaching 1,900,000, with an urban population of 2,400,000 (Recensământul Populației și Al Locuințelor, 2011). Before proceeding into the green directives required by the Romanian capital, we must provide a relevant city portrait, by focusing on the geographical and climate constraints.

2.1. Temperature, precipitation and soil

The climate within a city is an important factor to consider, since it has an influence on vegetation. The predominant climate of Romania is a humid continental one, with winters often below 0°C and as low as -20°C, summers around 23°C, and can go up to 40°C. Precipitation levels are considered rather low, higher in spring, with a low air humidity, with heavy storms not uncommon in the summer (Onete and Paucă-Comănescu, 2011). These atmospheric characteristics have affected the number of trees kept in residential areas, for security reasons. However, we should not forget the cooling effect that green spaces have for warm cities (Kleerekoper, van Esch et al., 2012).

Precipitation levels in Bucharest are estimated to be at 585 mm/year (Onete and Paucă-Comănescu, 2011). Onete et al. also mention that, based on their land use, the main regions of the city, will have particular climatic characteristics: for example, the urban buildings in the central zone help produce extremely high temperature, industrial zones will have polluted air, fog and heavy rains, whereas peripheral residential zones will have stronger winds and lower temperatures.

The main types of soil and the various kinds of vegetation that can grow are beyond the scope of this work. We advise the interested reader to read Lăcătușu, et al. (2008), for the origin and the characteristics of the main types of soil found in Bucharest. On a side note, it is important to consider main construction sites, landscape and drainage works when suggesting any urban vegetation projects.

2.2. Geographical location

The city is situated in the Romanian Plain, on a few small hills, of 50-100 m altitude. It has access to two rivers (Dâmbovița and Colentina) and has around twenty lakes, amongst which Lacul Morii is the largest in surface (2.46 km^2), and Lacul Pantelimon has the largest volume (but most of its surface is situated outside the city). Lacul Herăstrău, situated in the park with the same name, is the oldest lake manmade in the city and occupies 0.77 km^2. Numerous lakes are situated on the Colentina River, and some belong to the major recreational areas (Cișmigiu Gardens, Herăstrău Park, the Botanical Garden and Parcul Tineretului). One of them has even been considered an urban delta (Lacul Văcărești). Figure 1 depicts the placement of these main aquatic and recreational areas.

Fig. 1. Aerial view of Bucharest. The blue line shows the numerous lakes built on the Colentina River (Herăstrău, Floreasca, Tei, etc.). Blue circles represent lakes: 1. Lacul Morii (largest in surface), 2. Lacul Pantelimon (deepest), 3. Lacul Herăstrău (oldest manmade lake in Bucharest). The green squares are the major recreational areas: 1. Cişmigiu Gardens, 2. Herăstrău Park, 3. Botanical Gardens and 4. Tineretului Park. The green "V" denotes Văcăreşşti Natural Park, recently declared a protected area.
Source: Geoportal.

2.3. Historical context

We want to briefly address the historical characteristics of this city, depicted in the timeline of Figure 2 below. First mentioned in 1459, it became the capital of Romania in 1862. It is also known as the "Little Paris" in the 19th century, and its population increased dramatically in the second-half of this century. The architecture is a mix of neo-classical, interbellic, communist-era and modern (and many buildings require restoration). The city suffered considerable damage in the Second World War (WWII) as well as in 1977, when a 7.7-magnitude earthquake caused 1,500 death and numerous construction losses. During the communist regime, which lasted 30 years, tower blocks and massive buildings were built, the most imposing of all being the Palace of the Parliament. Lastly, becoming a member of the European Union (EU) back in 2007 offered a transparent view on the international standards about climate and urbanism. Many funds have since been directed to improve the Romanian economy and life quality, as well as to implement EU sustainable programs that would fight climate change, which we will discuss in the following sections.
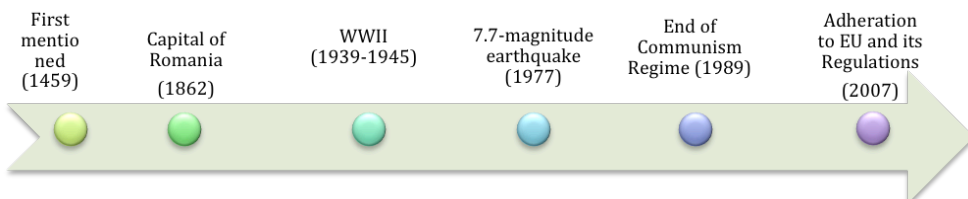

Fig. 2. Timeline for historical events that are important for the urban development of Bucharest.

In Bucharest Urban Plan published in 2010, researchers from the Architecture and Urbanism University "Ion Mincu" described the growth process of this city as *tentacular*, with an "uncontrollable extension" in the period 2000-2010 (Conceptul Strategic București 2035, 2010). Its history and **geographical** location can be seen as reasons behind its slow transition from an "oppressed" society towards a European capital. The city grew spontaneously, without a clear plan, and that environmental balance and life quality were not the major concerns in any of the previous development periods, especially during communism.

Throughout the interbellical, communist and post-communist historical periods shown above, Bucharest underwent major construction periods: many districts became crowded, while others saw a substantial increase of office buildings, causing a mobility of the population and the need of more transport connections between various areas. Urban areas with a high building index and an inadequate level of green can create what are called "heat islands", which are defined by regions where the temperature is higher within a city than what it is in the surrounding rural environment (Kleerekoper et al., 2012).

Moreover, some districts of Bucharest are considered less secure than others. Well-illuminated and open green spaces could provide substantial benefits for the security of the people living in these areas. They do not feel that their city is fighting against climate, nor happy with the cleanliness and the noise level (Quality of Life in European Cities, 2016), and green spaces would be means to show more involvement from the part of the public administration.

2.4. Current worldwide urban assessment

When it comes to quality of life in major cities, Mercer has proposed a complex assessment, based on a variety of indexes. Mainly, it focused on what citizens needed to be happy, and what is their perception about their city in regards to green spaces and climate change (2016 Quality of Life Rankings, 2016). In the results section of this paper, we will present the Mercer QoL (Quality of Life) score and the Green City Index (GCI) for Bucharest and other eight European capitals. The later index is a project sponsored by Siemens in collaboration with the Economist Intelligence Unit, studied environmental governance, first for thirty European Cities, and then as a whole, on a worldwide scale (The Green City Index 2012).

In this century, climate change is a concern at the global, continental and the city level. An international study published at the end of 2013 analyzed various climate models, at a high resolution, and the simulations confirmed a temperature increase of 1 to 5 in Europe, until the end of 21st century (Vautard 2013). It also predicted the occurrence of extreme events, a high frequency of intense rains, heat waves and draughts. Considering these and other alarming predictions, fifty nations signed, at the end of 2015, the Paris Agreement, a long-term project that aims to decrease global warming to less than $2^{o}C$, a warming condition that dates back to the industrial revolution. Having the world population increase to 9 billions by 2030, and to 10 billions by 2050 would make the world urban population follow an increasing trend as well (see Fig. 3). Urban population of Romania

follows a similar rise as the world population, but percentages in Europe are 20% higher. In what concerns the impact of the cities on climate change, cities produce 80% of the greenhouse gas emissions (European Green City Index 2009), so it becomes a major concern to try to address air quality improvement within urban areas.
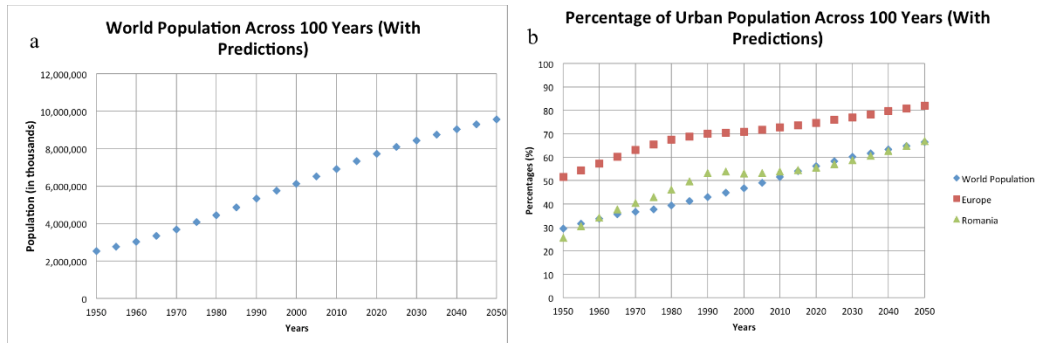

Fig. 3. (a) The rising trend in the world population count, for 1950-2050, with numbers shown as thousands; (b) From this total population, the percentage representing the people living within cities is also increasing, on a global scale, national scale (for Romania), and sitting at higher mean levels for Europe, in general.
Source: United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision, CD-ROM.

Due to the previously mentioned social concerns, the best link between life quality improvement and ecological resilience within an urban setting seems to be the creation and renovation of green spaces. Moreover, we believe that these processes can bring a major improvement in what concerns the walkability index, a measurement criterion that will raise also with increased sidewalks and the promotion of green transport alternatives (see Figure 4a). In Bucharest, sidewalks are actually shared between people and cars, often used as a parking space. This is another reason why we think that an increase in the green infrastructure is important, improving the walkability index and promoting green alternatives to the use of motorized vehicles. Besides promoting a "smarter environment", *green transport* is mainly part of the "smart mobility" component of *smart cities* (Figure 4b).
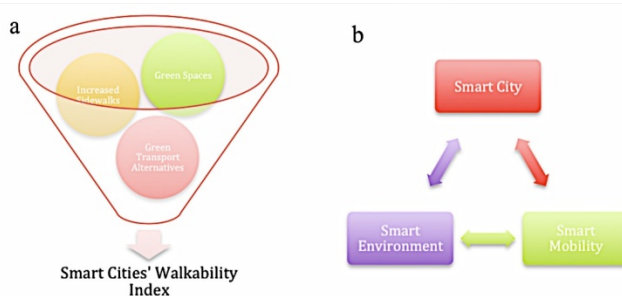
Fig. 4. (a) Cities should be pedestrian-friendly and promote transport ways that are alternative to individual cars, which lead to increased traffic, frustration and pollution. (b) Although the concept *Smart City* has various components, we created here an inter-linked triangle between *Smart City,* its environment and mobility aspects, since there cannot be one without the other.

In the section that follows, we will compare the main characteristics, green-indexes and initiatives in Bucharest and other major cities of EU, chosen based on some similarities (either in size, population/population density, GDP/capita). As "green" assessments, we summarize the findings of the Economist Intelligence Unit, who organized, in cooperation with Siemens, a major study entitled "European Green City Index" and published in 2009. Thirty qualitative and quantitative indicators were chosen to describe thirty European capitals, describing major environmental factors such as greenhouse gas emissions, waste management, water consumption and environmental governance. These factors were transformed to marks given to each capital, Bucharest receiving a mark of 39% and ranking 28th, with the highest marked being allotted to Copenhagen (87%).

3. Case Study
3.1. Assessments of two groups of European capital with similar characteristics
Table 1 contains geographical and demographical characteristics of five cities from the EU, chosen based on their geographical location (they are all part of the Eastern region) and their similar economical condition (i.e., GDP/capita). Amongst them, we observe that Bucharest has the highest density, with the largest number of people in its urban area and a surface, which is at least a half of all the other cities' area. However, this is not necessarily a problem, as a lot of metropoles have much higher densities (for example, Barcelona, with 16,000 habitants/km^2). After all, cities with high densities require special care in how they dispose waste and promote public transport, to maintain order and harmony, since their image is more likely to degrade.

Table 1. Bucharest and four neighboring capitals are described below, by their size and the economic power of their citizens. We also include the year of entry in the EU, the mark and the rank received by Green City Index, as well as their performance in the Quality of Life Survey organized by Mercer.

City	Surface (km^2)	Population	Density (/km^2)	GDP/head (€)	EU Entry	GCI Mark (/100) & Rank (/30)	QoL Rank
Bucharest	228	1,900,000	8,333	19,800	2007	39.14 & 28th	109th
Budapest	525	1,700,000	3,237	23,814	2004	57.55 & 17th	17th
Prague	496	1,200,000	2,419	25,023	2004	49.78 & 24th	69th
Sofia	492	1,200,000	2,439	12,954	2007	36.85 & 29th	115th
Zagreb	641	800,000	1,226	19,000	2013	42.36 & 26th	98th

There seems to be a correlation between how early the cities entered in the European Union, and how well they performed in the two assessments shown above. We will graphically analyze this correlation after Table 2. Although far in the list, the quality of life is perceived better by the citizens then by the one of Sofia within the Mercer study, and it is also performing a little better within GCI, when compared to its neighbor. However, a lot of areas have problems that still require solutions.

Amongst the cities mentioned above, Budapest performed the best in the CGI 2009, ranking 17 out of the 30 European cities chosen for the study: many factories closed in the city, since 1989, benefitting the environmental impact of the city. Many initiatives were put in place, like 10% energy intensity, gas for heating and hot water, encouraging, district heating and sewages initiatives, amongst others mentioned by the study.

As a comparison between the Eastern and the Western blocks of Europe, we present, in Table 2 shown below, 4 of the 5 best ranked cities. The choice was based on their city surface, similar to Bucharest (Amsterdam), on the population (Vienna), on the density (Copenhagen), or simply because they received an award as a European Green City Index. Here, we observe that all cities entered EU before the 2000s, but also that their GDP per capita is double the one of the cities shown in Table 1. "Money matters" was one observation of the CGI study, but we also have to consider how that money has been used and reinvested. It has to be used to improve the urban conditions at the disposal of the citizens or their education. With the proper education, citizens are able to assess and decide what life standards they want to build for themselves. It seems unfair, at first, to compare these cities with the ones from Eastern Europe, which have had a more difficult history, up until the fall of the Berlin Wall, in 1989. As it has been well pointed out by CGI, cities from this part of the continent were environmentally neglected (in the communist period, or during the wars). Even now, other problems seem more important than sustainability, for example unemployment, economic growth or lack of social programs. Bucharest ranked last, however, among 30 cities in Europe in environmental neglect, before Sofia and Kiev, but Ukraine is not in the EU, showing that, even after the entrance in the European Union, administrative projects or civic concern in what deals with sustainability have not been on the list.

Table 2 has the same columns as Table 1 above, but we present here the assessments for four Western European capitals that are top-performances in the environmental and life-quality assessments.

City	Surface (km^2)	Population	Density (/km^2)	GDP/head (€)	EU Entry	GCI Mark (/100) & Rank (/30)	QoL Rank
Amsterdam	219	845,000	3,858	41,443	1958	83.03 & 5th	11th
Copenhagen	86.4	590,000	6,828	43,640	1973	87.31 & 1st	9th
Stockholm	188	933,000	4,963	39,415	1995	86.65 & 2nd	19th
Vienna	415	1,860,000	4,481	35,239	1995	83.34 & 4th	1st

Source: Green City Index 2009 and Mercer Study 2016

Other important conclusions that were pointed out in the 2009 European Green City report were that East European cities had lower incomes and also ranked lower, with

Lithuanian capital, Vilnius, being an exception. Although it has a low GDP per capita (lower than Bucharest), Vilnius ranked best, amongst the 30 cities, in the air-quality, due to its lack of heavy industry and the abundance of forests in the immediate areas the best in air-quality level, lack of heavy industry and many forests in immediate area. It should also be considered that it has a total population close to half a million people, and it is trend that smaller cities perform better, being more walkable, less dense and less polluted. However, a vast public transit network can help a large city and it is actually a necessity for the well being of its citizens.

Geographical location impacted the CGI in the sense that, environmental sustainability depends on the resources available, but also on how these are used. Some governments might not see the advantage of high-quality green infrastructure that might not look affordable on the short term. Overall, the main factors affecting the GCI were summarizes by wealth, history, people, size and geographical location.
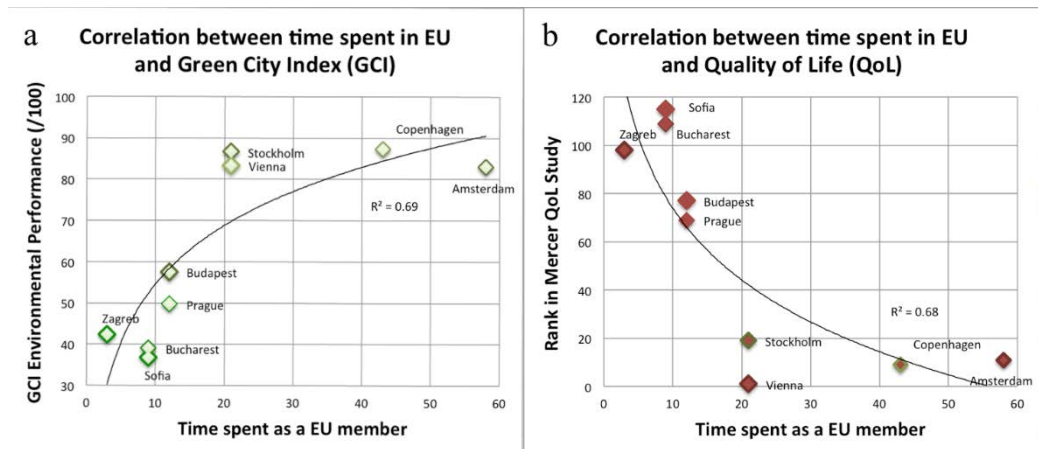

Fig. 5. We present here the correlation hypotheses, between the Time each country spent as a member of the European Union and the performance of their capital in the two aforementioned studies, the Green City Index (Panel a) and the Quality of Life survey (Panel b). Each regression is logarithmic (so it slows down its increase toward the tail on the right), and the R^2 value for both regression lines, which is a measure of the fit, is around 0.68-0.69 for both panels. A perfect fit would be 1.00.

Figure 5 above shows that, although there is a good correlation between the EU imposed norms, good performances can also occur differently. The relevant examples would be the capitals of Sweden and Austria: Stockholm and Vienna occupied the 19th and 1st rank on the Mercer Study, respectively, and were 2nd and 4th in the CGI report, but they have spent roughly 20 years within the European Union. The administration, however, set certain standards. How these two European capitals became icons for the top cities in the world, as well as the chronology of all their successful urbanistic projects could be the entire subject of another review article, and they are interesting topics, but beyond the scope of this paper. We will continue our analysis by mentioning the various components, which make a city simultaneously *green* and *smart*.

3.2. More Green City Index Ratings

As we previously mentioned, the CGI Study comprised 30 assessed factors, grouped in eight major categories. If we look, in Table 3, how Bucharest performed compared to other selected cities, it becomes clearer that this city lacks of an efficient environmental governance, waste and land use, in addition to proper CO_2 management.

No city can be perfect and there is no best recipe to becoming a green city, where people are happy within it. If we compare European capitals, we have to consider how the social and historical consolidations are widely different. However, lessons can be drawn from neighboring countries. Within the Eastern European block, understanding and analyzing good implementation of environmental programs can be suitable steps in developing a customized solution. Even previous mistakes or weaknesses of other procedures can be seen from a positive light and become tools. We present here the reasons behind the best and worse scores in the 8 categories for the 5 cities initially compared, based on their similarity for population size, GDP statistics and pertaining to the same geographical location, the Eastern European block (see Table 3). For a thorough analysis of the reasons behind the scores, we refer the interested reader to the main study.

Table 3 contains the principal components of the environmental urban assessments of the Green City Index Group. We present the marks (out of 10), for all the 9 European capitals shown in Tables 1 and 2, in order to have an overall comparison for the performance of Bucharest.

City	CO_2	Energy	Buildings	Transport	Water	Waste and land use	Air Quality	Environment Governance
Bucharest	**3.65**	3.42	4.79	4.55	4.07	**3.62**	4.54	**2.67**
Budapest	4.85	2.43	5.01	6.64	6.97	6.27	5.85	8
Prague	3.44	3.26	3.14	4.71	8.39	6.3	6.37	4.22
Sofia	2.95	2.16	6.25	4.62	1.83	3.32	4.45	3.89
Zagreb	3.2	4.34	3.29	5.29	4.43	4.04	4.74	4.56

Source: Green City Index 2009

- Budapest does best in the category of transport means, ranking 10th, and the worse in the energy category, ranking 23rd out of the 30 capitals. In 2008, the capital of Hungary was the recopied of the European Mobility Week Award for its efforts in raising public awareness of air pollution and investing in electric-powered vehicles for its public transport. Despite these progresses, the quantity of energy consumed, per capita, is still considered high, with renewable sources of energy almost non-existent. There are however, some future projects in place in order to building apartment buildings equipped with solar cells and better heating control systems.
- Prague, the capital of Czech Republic had as the best-ranked categories water (10th), and waste and land use (14th), whereas the worst categories were buildings (25th) and environmental governance (26th). Similar to Budapest, energy consumption is sitting at a high level, but water usage is better managed here than in the majority of the other capitals from the study. The waste levels were estimated at 480 kg/waste/head, a better result than the 511 averages for the 30 cities. Although not helping significantly the transport category, ferry-transport system of Prague is to be noted.

- Sofia is one the two cities that performed worse than Bucharest in the capital, and the worst ranked capital from the European Union. Its buildings are considered amongst the "green" ones of Europe, ranked 14th based on the energy consumption (in gigaJ/head), intensity and % of energy derived from renewable. Incentives to make buildings more energy-efficient, by giving small owners to homeowners from the European Bank for Reconstruction and Development. However, the rest of the categories on which the study has been made have placed this capital in the bottom of the ranking, with the worst category being the water subgroup, which includes consumption, leakage, treatment and efficiency policies.
- The last capital mentioned in Table 3 is Zagreb, ranked 26th overall, but 19th in transport, 27th in CO_2. 37% of people using public transit for daily transport, there have been incentives to use biofuels for transit and improvements were also done about sewage systems, previously polluting the Danube and the Black Sea basin.

Based on these examples, the following section is aiming at presenting some present solutions, organizations and polities set in place in Bucharest. Focusing on the present situation, but also on possible future projects seems to be the way to transform this capital, which has been often neglected and where environment policies have not necessarily been in the list of priorities.

4. Proposed Solutions
4.1. A Focus on the Policies Implemented and Their Progress
Some initiatives worth to mention are the Green Building Council, a non-profit association of businesses and organizations whose goal is to help construction project become ecological, implement energy efficient projects and organize various events on sustainability, and theGreen Cadaster, a municipal project that was launched at the end of 2011, based on EU directives, and it is available on the City Hall Official Website.

There has also been an active engagement of the community as a whole, through different Non-Governmental Organizations (NGO):

- Optar, a NGO supporting alternative transport and proposing different sustainability projects, events and petitions.
- Civic Alert, an online application that citizens can use in order to better centralize and follow any complaints to the public administration, in what concerns reported danger on the street or civic offense.

4.2. Additional activities improving the green index
A recent study also pointed out that, since Bucharest has many elementary schools, we can benefit by taking care of the little gardens annexed to these areas, or within the neighborhood, by implementing educational activities of tree and flower planting, and getting pupils involved in the activities (Iojă et al., 2014). Other ecological activities can

include rainwater harvesting, paper recycling, and different solution-seeking competitions for a smart city, for example. The younger you implement ecological educational within the usual habits, the most likely will be that the new generation is going to make an impact, appreciate the environment and incite everyone to care.

Another good initiative, which has been implemented within some Western European city halls, is having a wide administrative plan to spread green areas uniformly around the city, by electing an environmental coordinator in each administrative unit (European Green City Index, 2009). A good infrastructure is crucial and it is the first step for improvement and development. If people are given green alternatives, the city shows that their life quality and the image of their city are crucial. This way, people are more likely to change their behaviors and bad habits too. Other than this indirect change, a city can apply direct encouragement, through incentives, and, last case scenarios, severe fines as a punishment for not respecting eco-rules set in place (recycling initiatives, keeping the environment clear etc.)

A problem of this Eastern European capital seems to be the large population density in some particular districts. This would not be necessarily a problem, but people need to be given the proper living conditions, and that includes, buildings with good living conditions, adapt the surroundings to the lifestyle. In some areas, parking places are definitely required but most importantly, the city should promote a good and healthy life style. In Figure 6 below, we have circled five residential areas that are relatively far from the large major parks on the city. The three regions in the bottom half of the map represent areas with high densities (that can go above 30,000 people/km^2, as shown on the geoidea.ro portal). If the public administration would put more effort in constructing a green belt or a green network within the cities, it could have major implications in reducing traffic. Parks, for example, are good areas for bike paths. Their pavements, on the other hand, would considerably increase the walkability index previously mentioned and incite people into walking and biking within a safe environment.
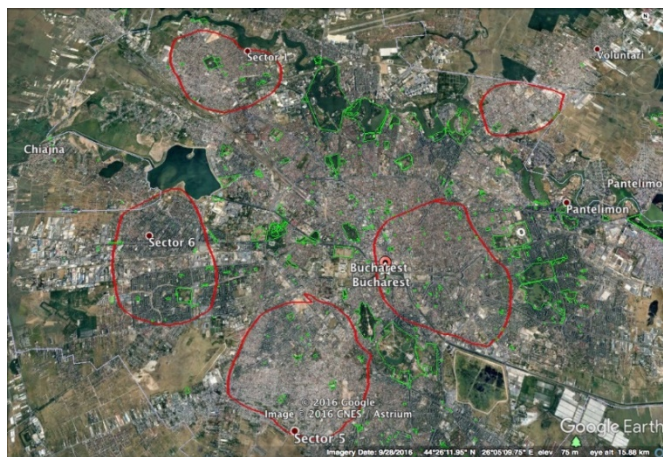

Fig. 6. Five urban areas with a high density. We suggest that the green initiatives mentioned below to be addressed in the districts to which these areas belong.

The financial cost seems to be an important matter. Some green alternatives appear like irrelevant ideas in the context of this city (take the example hybrid cars or photovoltaic panels). It is important to remember that these investments pay off in the long-term.

Other relevant incentives from other cities have been diligently studied in The Green City Index (2012) and are briefly mentioned below:

• San Francisco released municipal's audits about energy consumption, a good example of transparent administration.
• the city of Delhi has carefully drafted certain consumption norms applicable to cleaning and the maintenance of current infrastructure.
• It is often seen that big events help cities develop successful policies, such as the Olympic Games 1992 in Barcelona or the Commonwealth Games 2010 in Delhi.

These urban plans can also be done in the context of external initiatives, in order for the city to get more visibility and attract more tourists, potential investors and events to be organized:

• Convenient of Mayors is a European Commission launched in 2008, where mayors commit to cutting carbon emissions by at least 20% by 2020, within their city.
• European Green Capital, which started in 2010, saluted the initiatives of the cities with more than 100,000 citizens in their plans to provide sustainable conditions for their citizens (see Green Urban Areas 2003 for a good example of a winner city)
• Climath-On and Climate KIC Initiatives are also important international organization that provide some suggestions in how to fight the planet, both as an individuals and within a community. "Environmental Guide for Lazy People" and "Climate A to Z" are relevant reports mentioning what the progress towards a sustainable future should be based upon.
• Climate Innovation Summit, on November 8, 2016, where business, academia and the public sector presented together their ideas in order to move forward with the Paris Agreement).

5. Conclusion

For Bucharest, the study concluded that there seems to be a lack of implication from both the mayor, and the population as a whole, having a shared responsibility in creating a healthy and good environment to live in. Providing a healthy environment for the habitants, in the short and the long run, should be a priority on the city administrative agenda. Ecological resilience, human welfare and cities sustainability are all interlinked.
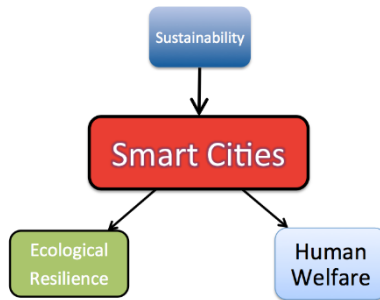
Fig. 7. Incorporating sustainability within the *Smart Cities* concept adds multiple benefits, that can be particularly organized under two main categories: cities become ecological resilient and the human welfare can increase significantly.

Smart Green Cities are not just pleasant, but necessary, in order for them to become resilient to climate change. The EU Environment, Maritime Affairs and Fisheries Commissioner, Karmenu Vella, said that "Today more than two thirds of Europeans live in towns and cities. Urban areas concentrate most of the environmental challenges facing our society but also bring together commitment and innovation to resolve them." (European Green Capital 2016). Since cities are also the major educational and research centers, they have the responsibility in creating good living conditions and use technological progresses for their own benefit.

For Bucharest in particular, it might be relevant to think of initiatives that could solve concomitantly the other developmental problems, such as traffic, waste management, or water leakage. Cities need to manage well energy, water recourses, waste and their transport network, by properly utilizing monetary and people resources.

After all, a citizen is a person that, by living within a certain country/city, has some rights, but also some obligations. Our obligation should be maintaining a harmonious environment around us, do our part and submit our vote. If the administrative power does not reflect our desire, we must get involved, show engagement in the various causes that keep us at heart. It creates an example for the new generation, it brings major improvements, and, most of all, and everything done with passion always pays back.

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