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# SMART CITIES IN EUROPE. A FOCUS ON ROMANIA

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**Abstract**
*This article explores the evolution of urban settlements throughout history and highlights the crucial role they play as engines of economic, cultural and technological development. The positive link between urbanization and economic growth is outlined, but also the negative aspects related to urbanization that have a global impact. The focus is on the concept of "smart" cities that integrate digital technology into infrastructure and services, with the aim of improving the quality of life of citizens and contributing to a more sustainable future. The article focuses on the analysis of examples of "smart" cities in Europe and offers a series of suggestions for the implementation of this concept in Romania. In the end, I conclude that if Romania were to follow the example of "smart" cities in Europe and implement similar strategic plans, the country could reach a higher level of (socio-economic) development and modernization, becoming a prominent participant among "smart" cities in Europe.*
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**JEL Classification**: H70, O18, O52, R11, R58

## 1. INTRODUCTION

Since ancient times, urban settlements have represented a superior form of organization of mankind, being a new step in the organization of human collectivities. They appeared in key locations, helping merchants to move around and sell their merchandise (fabrics, medicine, or gems). Today, cities are the main centers of economic, cultural, scientific, technological and educational development and growth. Economic growth and urbanization have a positive and strong link representing the best hope for increased opportunities, providing efficiency benefits, resulting in remarkable gains in productivity and competitiveness. Since urbanization also left its mark with numerous negative aspects and problems at the global level, with the Information Technology and Communications Revolution there was the opportunity to solve them. In the last 10 years, cities have become much more digital, improving both the standard of living of society and the environment.

"Smart" cities represents cities that integrate digital technologies into networks, services and infrastructure. It aims to improve the quality of life for its citizens and ensure a better future for current and future generations. In this context, I propose that in this limited scientific article I emphasize the importance of these "smart" cities, analyze the most important cities smart from Europe concluding with a series of suggestions and recommendations for Romania. Since these represent a component of our future, I consider it necessary to approach this topic both at the European and national level, in order to identify the level of digitization (and not only) that Romanian cities currently have and guide them in future development strategies.

## 2. BRIEF ANALYSIS OF SPECIALIZED LITERATURE

Analyzing the specialized literature, we encountered several notions, regarding the concept of "smart" city. Harrison *et al.* (2010), stated in one of IBM corporate documents, that the term "smart city" represents an interconnected, digitized and instrumented city. The term *instrumentability* refers to the ability to directly transmit the real world with the help of sensors, digital devices or appliances. Yovanof and Hazapis, mentioned in 2009 that the notion of "smart city" arises at the intersection of societal knowledge with the digital city. Another perspective, from the point of view of education, Winters (2011) mentions the fact that a smart city represents a center of higher education with well-educated people and skilled workforce. Smart cities act as magnets for people and creative workers, allowing a virtuous circle to be created, making them smarter.

Consequently, a smart city has multiple opportunities to exploit its human potential and creatively promote the living environment (Partridge, 2004). The concept has evolved over time, from author to author, today the explanatory dictionary defining the concept of city smart as an area in the urban environment, which is developed and creates sustainable economic growth, integrating, technologies and systems in an efficient and secure way, in order to improve the impact on the environment and increase the quality of life of the inhabitants.

## 3. ANALYSIS OF THE DISTINCTIVE FEATURES OF SMART CITIES IN EUROPE

Annually, in Europe, the ranking of countries captures increases and improvements in innovation performance, so that from 2015 to 2022, the EU improved its position against its global competitors, ranking after Australia, Canada, China, South Korea and the United States, the latter of which continues to be the most innovative country in the world. According to the DESI2022 report, Finland ranks first among the 27 EU member states in digitalization and innovation (see Fig. 1). It is a leader in the provision of commercial services, continuing to implement its digital development strategies through the digital progress program, Digivisio 2030 and the current strategy on artificial intelligence.

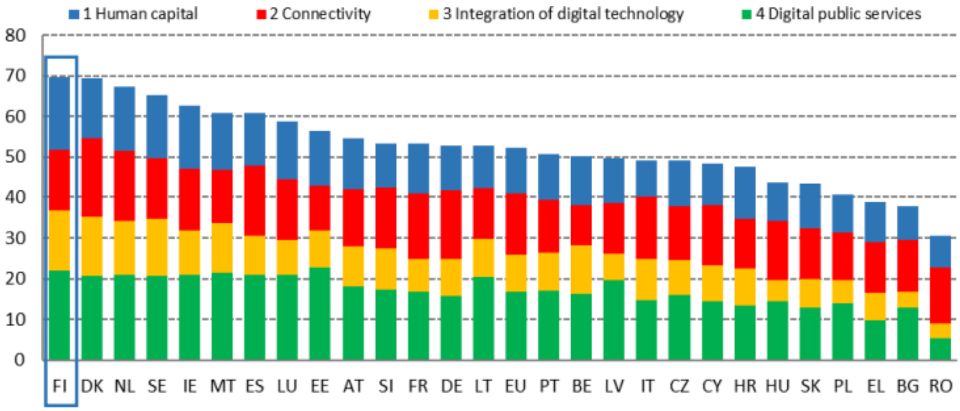


**Figure 1. The Digital Economy and Society Index (DESI) at the level of 2022**
Source: https://digital-strategy.ec.europa.eu/ro/policies/desi

If at the national level, Finland occupied a leading place, according to the study carried out by Futureiot "Global Smart Cities 2022", this was not only due to a specific city, in the top 3 ranking the cities of Copenhagen, Amsterdam and London (see Tab. 1). These cities have the best results in successfully implemented projects, taking major steps in sustainability projects based on smart technology.

**Table 1. Classification of cities smart globally 2022**

| Rank | Town | Pct. | Rank | Town | Pct. |
|---|---|---|---|---|---|
| 1 | Copenhagen | 81.5 | 16 | Berlin | 68.2 |
| 2 | Amsterdam | 74.6 | 17 | Hong Kong | 68.0 |
| 3 | Beijing | 73.7 | 18 | Dubai | 63.8 |
| 4 | London | 73.6 | 19 | Madrid | 63.2 |
| 4 | Seoul | 73.6 | 20 | Tokyo | 63.0 |
| 6 | New York | 73.3 | 21 | Rome | 61.2 |
| 7 | Sydney | 72.6 | 22 | Auckland | 60.1 |
| 8 | Singapore | 71.4 | 2. 3 | Kuala Lumpur | 58.2 |
| 9 | Washington | 71.2 | 24 | São Paulo | 50.7 |
| 10 | Paris | 70.2 | 25 | Bangkok | 49.1 |
| 11 | Toronto | 70.1 | 26 | Buenos Aires | 45.1 |
| 11 | Zurich | 70.1 | 27 | Jakarta | 43.5 |
| 13 | Barcelona | 69.7 | 28 | Mexico City | 42.6 |
| 14 | Frankfurt | 69.1 | 29 | New Delhi | 40.3 |
| 15 | Dallas | 68.7 | 30 | Manila | 39.1 |

Source: https://futureiot.tech/

**Copenhagen** ranked in the top of the smartest cities due to the implementation of strategic initiatives such as digital invoicing, reduced energy consumption and non-renewable sources, being installed over 60,000 $m^2$ of solar panels and the buildings are reorganized considering the reduction of energy consumption. Copenhagen has digitized building heating and cooling systems to reduce emissions and environmental costs. The city is equipped with smart bikes, equipped with sensors that notify cyclists and the authorities about the traffic situation and air quality in real time (it has one of the most efficient air quality systems). At the same time, the city is also known and awarded for its waste management which is based on sensors and centralized data. In 2021, over 1,200 businesses benefited from the program led by Danish Business Authority in collaboration with Danish Business Hubs, who provided maturity analyzes to SMEs, and guided them in further digitization.

**Amsterdam** has tried for almost nine years to become a smart city, using numerous information technologies, implementing more than 170 "smart city" projects. Among the main digitization measures were the inclusion of smart street lighting with lamp brightness adjustment according to pedestrian traffic and applications that allow residents to rent their parking spaces. This city has become outstanding at the European level by creating homes with smart energy meters, air and water purification projects, limiting noise and also reducing pollution through initiatives dedicated to citizens. The Dutch Coalition for Artificial Intelligence and the Smart Industry Program aim to make Amsterdam a leader in digital, innovative and high-tech expertise. The city annually participates in various projects at European or even worldwide level in which it submits its portfolio of projects for which it allocates millions of euros.

**London**, ranked third in the smart cities category in 2022, has stood out for years with high-performance 5G connectivity, having the most towers in the entire city, ensuring full fiber optic coverage. London also has public lampposts equipped with a collection of sensors and charging points for electric vehicles. Another strength for London is the presence of more than 46,000 technology companies based in this city, generating an income of more than £44 billion, and increasing employment in the digital sector. It is also home to one of the largest natural hubs for artificial intelligence with over 750 providers. Another benefit for which London was ranked among the smartest cities are the many ecologically certified buildings (the largest number at European or American city level), which include nature through roofs, living walls and saddle access to outdoor green space. By the year 2020, the city was equipped with over 5,000 charging points, turning London petrol stations into electric vehicle hubs (Shell company). In recent years, the city has an innovative system to optimize traffic flow and reduce congestion through smart traffic lights, camera networks and sensors that monitor traffic by providing data to the system.

## 4. GOOD PRACTICES FOR ROMANIA

Romania is constantly trying to develop solutions and innovations in the field of automation, autonomous learning and artificial intelligence. It is known for its strong technological capabilities and potential, developing a growing community of entrepreneurs and tech talent.

### 4.1. Smart cities in Romania

Romania's digital systems have made rapid progress in recent years, contributing to the long-term development of the national economy. According to the SmartCities2022 report carried out by Vegacom, the City of Cluj Napoca was classified in the top of the smartest cities in the ranking of 144 cities.

**Table 2.Top 10 cities with completed projects in the "Smart city" area (June 2022)**

| No. Town | Completed projects |
|---|---|
| 1. Cluj-Napoca | 56 |
| 2. Iasi | 39 |
| 3. Alba Iulia | 31 |
| 4. Bucharest | 23 |
| 5. Bucharest Sec. 4 | 21 |
| 6. Craiova | 14 |
| 7. Brașov | 12 |
| 8. Avrig | 12 |
| 9. Hârşova | 12 |
| 10. Sibiu | 12 |

Source: https://vegacomp.ro/wpr/wp-content/uploads/2022/07/radiografia-smart-city_2022.07.14.pdf

As we note in Table 2, Cluj Napoca registers the most projects in 2022smart completed, followed by Iași with 56 projects and Bucharest with 54 projects. All these successfully completed projects aimed to implement healthy economic activities, which reduce the negative impact on the environment, contribute to improving the quality of life of the inhabitants through the use of intelligent systems.

According to Table 3, we note that the number of implemented projects is increasing, during the analyzed period (from 247 in 2018 to 564 in 2022) and a beautiful competition is highlighted, beneficial both for the inhabitants and for the national economy. The increase in the number of projects has come about due to government encouragement and support, offering tax breaks and funding opportunities. According to the ANIS association, in the last five years, the share of the IT&C industry has increased to a volume of 13.6 billion euros, i.e. 6.2% of

Romania's GDP, thus causing a large increase in the demand for specialists on the market.

**Table 3. Dynamics of smart city ranking (2018-2022)**

| Town | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **R** | **P** | **R** | **P** | **R** | **P** | **R** | **P** | **R** | **P** |
| Cluj-Napoca | 4 | 18 | 5 | 16 | 2 | 54 | 2 | 58 | 1 | 63 |
| Iasi | | | ***4*** | ***18*** | ***4*** | ***19*** | ***3*** | ***56*** | ***2*** | ***56*** |
| Bucharest | 6 | 13 | 3 | 19 | 11 | 11 | 4 | 39 | 3 | 54 |
| Alba Iulia | 1 | 103 | 1 | 103 | 1 | 106 | 1 | 106 | 4 | 49 |
| Bucharest (4) | | | | | 5 | 18 | 5 | 35 | 4 | 35 |
| Sibiu | 8 | 11 | 6 | 13 | 7 | 16 | 7 | 27 | 4 | 35 |
| Oradea | 3 | 19 | 7 | 13 | 6 | 17 | 8 | 26 | 5 | 26 |
| Timisoara | | | | | 3 | 26 | 8 | 26 | 5 | 26 |
| Arad | 8 | 11 | 4 | 18 | 4 | 19 | 6 | 29 | 6 | 25 |
| Braşov | 8 | 11 | 2 | 20 | 5 | 18 | 9 | 18 | 10 | 18 |
| Piatra Neamt | 7 | 12 | 8 | 11 | 8 | 15 | 10 | 15 | 12 | 15 |

*Note*: R – Rank; P - Number of projects

Source: developed by the author based on the SmartCities2022 classification report

Although Romanian cities continue to carry out various projects for the development of the community and the environment, numerous challenges persist that prevent them from being in greater numbers and benefiting from recognition and appreciation at the European level. Among the great challenges they encounter are: the adaptation of technology among the elderly; attracting investments for small and medium-sized companies; the presence of well-qualified workforce; the presence of unpredictable economic factors; insufficient measures by the state.

### 4.2. Case study: Iasi

As we note in Table 3, the city of Iași has been continuously developing in recent years, ranking second in 2022, with 56 projects. Transforming the city into a real one smart city has led to many challenges, but everything is possible when you have well- defined objectives, a strong team and a well-defined goal that will generate improvements in the conditions of the inhabitants. Among the many projects through which Iașul has stood out recently are:

1. The "Digital Transformation for Entrepreneurs" Conference on March 23, 2023, which aimed at proposing innovative solutions for SMEs and public institutions in the production and health sectors;

2. "Digitalization of Public Services" organized on 19-20 May 2023 by the Ministry of Research, Innovation and Digitization in collaboration with the Electronic Government Agency of the Republic of Moldova. The project includes the creation of the first hackathon, launching the great challenge to leave a mark in Romania's digital transformation.

3. "Smart City Caravan", organized since 2017 by the Romanian Association under the patronage of the Ministry of Energy, being the only program to promote Smart City solutions and projects in Romania until 2020.

4. "Palas Campus", project that includes the construction of the largest office building in country, based on the principles of sustainability and minimal impact on the environment. It includes office spaces, over 4,500 square meters of green spaces (parks, relaxation areas), shopping areas, bike lanes, electric car parking and charging stations and over 1,200 photovoltaic panels;

5. The "Regional Operational" program through which Iasi gradually obtained over 119 means electric transport (50 trams and 65 buses);

6. "Iasi after the blocks is our city", project established in 2022, which had the right aim to restore 4.5 ha of green spaces, create pedestrian walkways, rehabilitate road traffic, modernize children's playgrounds, arrange parking lots and install platforms for waste.

7. "Green Map" - provides for the installation of 22 sensors capable of monitoring the level of pollution, air pressure, temperature, humidity and carbon dioxide levels.

8. "yeParking" - park-sharing application that includes several hundred parking spaces from the city of Iași, with the aim of making the most of the existing parking lots.

The city of Iași has registered real progress in recent years, thanks to the development of smart projects, residents benefit from numerous facilities such as: paying taxes online; digital document management; energy efficient buildings; smart meters; smart thermostats; video surveillance with automatic image processing capability; own secure IT system; mobile applications for public transport; digital information screens in buses and information boards in stations with real-time information transmission; Science and technology park "Tehnopolis" and many other useful benefits that develop and create the concept of smart and digitized city every day.

## 5. CONCLUSIONS

After analyzing smart cities in Europe, we noticed high levels of development and growth in the field of technologies. European cities are real examples for Romania, from which we have a lot to learn. Among the suggestions and recommendations for the authorities and citizens of Iasi, in order to achieve a smart city, one could consider: creating more partnerships with non-governmental organizations; improving the quality of the services offered by the local public administration through digital solutions (creating pedestrian crossings smart, intelligent management of green spaces); creation of platforms to attract investments both internally and externally; developing the concept of "smart citizens in a smart city" through the creation of innovative centers and civic imagination; creating applications to encourage recycling and waste collection; increasing energy efficiency (by installing more solar panels, photovoltaics, heat pumps); the creation of buildings with green walls and roofs and the mandatory presence of green spaces nearby.

If Romanian cities would continue to increase the number and quality/scale of projects in the area smart city, to take the European examples and implement such strategic plans, I believe that this country will reach a very high level, in the long term, maybe even in the top 10 European smart cities.

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