Romanian Municipalities and the Smart city Framework

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Abstract

European funding opportunities have become accessible to member states, promoting the adoption of digital technologies for fostering transparent local governance, sustainable living practices, and responsible resource management. As municipal administrations endeavour to enhance the quality of life for their residents through the application of digital solutions, the incorporation of smart city strategies has emerged as a pivotal focus in urban development. Researchers have explored this subject from various perspectives, publishing case studies showcasing successful practices in cities in recent times. This study seeks to illustrate how Romanian cities have integrated the smart city framework into their strategic planning, while also addressing the challenges they have encountered. Furthermore, it will highlight the benefits of implementing this concept and shed light on several drawbacks that may serve as opportunities for future improvement.

Keywords: *digitalization, local government, management, smart city framework.*

JEL classification: M15; O30; O32; O38; R58

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1. Introduction

The Smart City concept is a relatively new one for Romanian municipalities and scholars with Romanian affiliation started to analyse the subject starting from 2008 when referring to intelligent cities and from 2013 when addressing smart cities according to (Ibănescu et al., 2022). The authors referred to the statistics of Web of Science Core Collection (Clarivate Analytics) and presented that over three quarters of the literature concerned emerged in the last decade, underlining the importance of the subject as a current one for Romania.

(Ibănescu et al., 2020), citing (Dameri and Cocchia, 2013) and (Moir, Moonen and Clark, 2014) affirm that in the timeline, the term "digital city" gained significant traction in both literature and political discussions from 1997 to 2009. Subsequently, with the implementation of the Europe 2020 Strategy in 2010, the term "smart city" took center stage as the prevailing concept. The authors continue by citing (Caragliu, Del Bo and Nijkamp, 2011; European Parliament, 2014; Engelbert, van Zoonen and Hirzalla, 2019) and highlight the fact that smart cities in Europe significantly depend on the financial support provided by the European Commission Framework Programmes, especially those that focus on research and

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innovation programmes. These initiatives perceive cities as crucial catalysts for enhancing resilience and competitiveness (Ibănescu et al., 2020).

As published literature strived the importance of European funding for smart city projects of member states, we developed a graph that encompasses the absorption rate of EU funds by Romania.

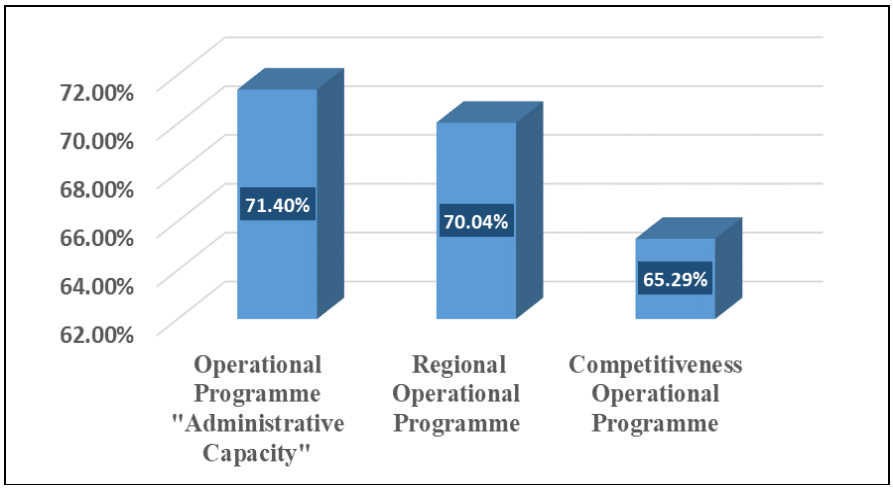

Figure 1. Current absorption rate of EU Funds – Operational Programmes that smart city projects are eligible for financing

Source: developed by the author with data from Romania's Ministry of Investments and European Projects – 31st of May 2023 (Ministerul Investițiilor și Proiectelor Europene, 2023)

(Figure 1) presents a clear image that the three most important Operational Programmes that offer financial means to be accessed in digital transformation projects. With an absorption rate of over 70% for Operational Programme "Administrative Capacity" and Regional Operational Programme and with 65% for the Competitiveness Operational Programme, there is room for improvement for fully benefiting from these opportunities, as December 2023 is the deadline for the implementation of the 2014-2020 Regional Operational Programme (Agenția pentru Dezvoltare Regională Centru, 2022).

2. Methodological approach

The literature studied for this article was related to the smart city subject in Romania. As the subject started to be addressed more frequently by Romanian scholars only in recent years, I based my research also on smart city approaches from around the world, underlined in relevant literature.

Many researchers evaluate and compare smart cities with different approaches. For this study, we performed a comprehensive analysis that was based on the six key components of the smart city framework: Smart Government / Governance, Smart Life / Living / Safety & Health, Smart Citizen / People, Smart

Environment / Sustainability, Smart Infrastructure / Mobility / Transport, and Smart Economy (Arroub et al., 2016; Bokolo Jnr, 2021; Ibănescu et al., 2022; Stegerean et al., 2022; Winkowska et al, 2019). The analysis will underline the most notable examples of smart city projects that were implemented in Cluj-Napoca, Iași and Alba Iulia. These three cities from Romania are large urban areas that completed the most smart city projects in the recent period.

For gathering the data for the study, we used online sources that were available, from the websites and platforms of the municipalities, to the smart city strategies of the towns. Visits for observing the projects implemented were also performed in all three cities. These approaches were used by other scholars in similar analyses (Anthopoulos, 2017; Bibri and Krogstie, 2020; Ok and Yoo, 2017; Shah et al., 2019).

3. Current status of the smart city concept in Romanian cities

The introduction of smart city initiatives is currently in its early stages within the major cities of Romania. Limited information is currently accessible regarding the strategies that have been adopted, and the corresponding reports are not yet fully accessible to the general public (Ibănescu et al., 2022; Vrabie and Dumitrașcu, 2018).

In order to present which was the yearly evolution of smart city projects in Romania, we used data retrieved from a report developed by Vegacomp Consulting, called Moving to Building New Urban Spaces in Romania: Smart City in the Hidden City. Smart City Scan in Romania. The report is at its sixth edition and is the most comprehensive for Romanian cities. The company behind it has been active in the field of smart cities since 2014 and was awarded the Social Innovator of the Year title from the Romanian Smart City Association in 2020 (Vegacomp Consulting, 2022).

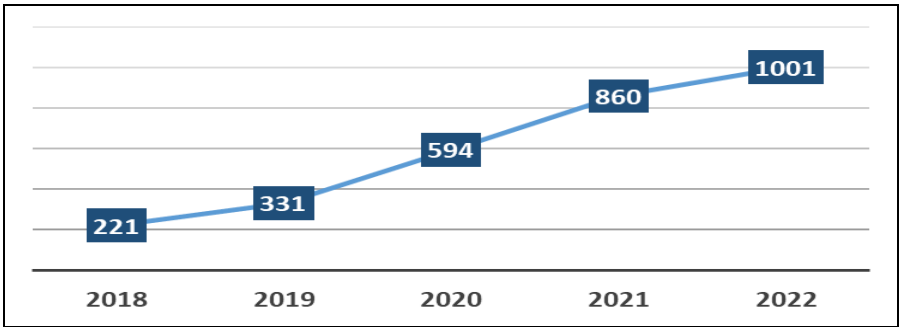

Figure 2. Yearly evolution of smart city projects in Romania
Source: developed by the author with data from (Vegacomp Consulting, 2022)

(Figure 2) shows a consistent and upward trend in the number of such projects, thus suggesting a higher level of interest, investment, or implementation

of such initiatives in this country. In 2022 a milestone was reached, with the number of smart city projects in Romania exceeding the 1000 mark.

As the smart city projects are developed by municipalities across the country, we compiled a ranking of these cities based on the number of projects.

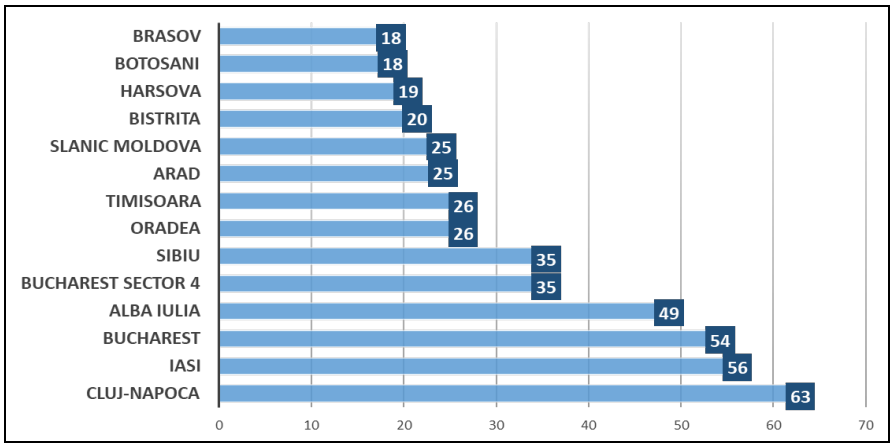

Figure 3. Ranking of the first cities in Romania based on the number of smart city projects

Source: developed by the author with data from (Vegacomp Consulting, 2022)

As shown by (Figure 3), Cluj-Napoca ranked on the first place with 63 projects, followed by Iași with 56 and Bucharest with 54. The fourth place is taken by Alba Iulia with 49 projects and on the fifth place there is a tie between Bucharest Sector 4 and Sibiu. It is important to underline the fact that Bucharest is the only municipal area that is not part of a county. Being the country's capital and the largest city in Romania, the local government is represented by Bucharest General Municipality. The city is also divided in 6 sectors, each having a sector city hall (Preda et al., 2022).

The development of smart city projects is crucial as some of them are not completed on time or are not completed at all. We analysed if the ranking changed if only completed projects were considered.

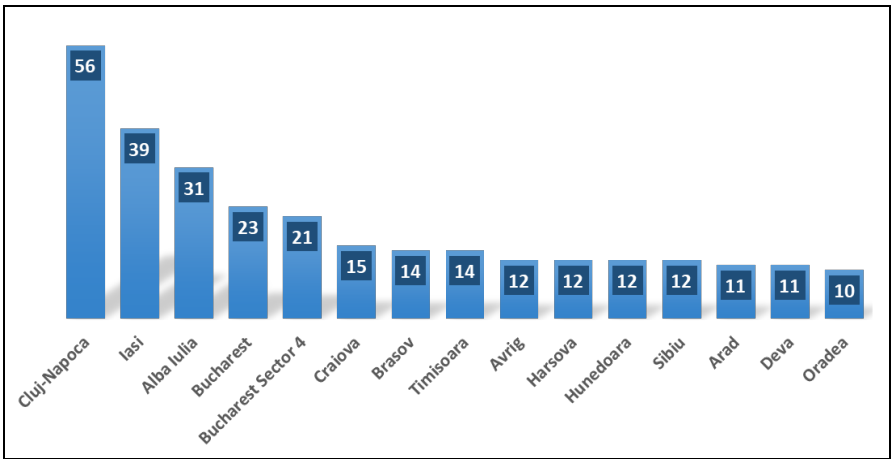

Figure 4. Ranking of the first cities in Romania based on the number of completed smart city projects

Source: developed by the author with data from (Vegacomp Consulting, 2022)

(Figure 4) shows an unchanged situation for the first to cities in the ranking with Cluj-Napoca and Iași maintaining their first and second place also when considering the completed projects. Alba Iulia managed to complete more projects than Bucharest, both as a General Municipality and as Sector 4. A dramatic change is the one of Sibiu, that only managed to complete 12 projects and is at a tie for the ninth place with the municipalities of Avrig, Hârșova and Hunedoara.

When comparing municipalities in terms of completed projects it is important to note that the duration of implementing a project can vary based on complexity, legislation and founding, as well as when was the starting date of a particular project.

4. A comparison between three major Romanian smart cities

Three cities have been selected for a more detailed analysis based on the number of smart city projects, especially the completed ones. The three cities are Cluj-Napoca, Iași and Alba Iulia. Bucharest was not included in this comparison due to the more complex administration of this city and the separation of projects between the General Municipality and the sectors.

Literature published in the recent period presented 6 components that are part of the smart city framework, as follows: Smart Government / Governance, Smart Life / Living / Safety & Health, Smart Citizen / People, Smart Environment / Sustainability, Smart Infrastructure / Mobility / Transport, and Smart Economy (Arroub et al., 2016; Bokolo Jnr, 2021; Ibănescu et al., 2022; Stegerean et al., 2022; Winkowska et al, 2019).

The analysis below will underline the most notable examples of smart city projects that were implemented in the aforementioned three cities, dividing the projects into the six components of the smart city framework.

Table 1. A comparison between Cluj-Napoca, Iași and Alba Iulia, regarding the smart economy projects

Cluj-Napoca	Iași	Alba Iulia
The Center for Innovation and Civic Imagination	Fortus Industrial Park	"Alba Iulia Innovation and Smart Specialization Campus“
Start-up City Cluj-Napoca project	"Tehnopolis" Science and Technology Park	www.targulagro.ro website
Financing start-ups, co-working spaces	The Regional Center for Artificial Intelligence	e-OKEY – web-based platform for managing small and medium-sized businesses
Business incubator and accelerator	The Brain Institute	
	The Innovative Regional Cluster - Inovtic (founding member)	

Source: developed by the author using data from (Asociația Cluj IT, 2021), (Boc, 2022), (Panu, 2021), (Florea, Cardasim and Bonghiu, 2019) and (Primăria Iași and IAȘI AI, 2023)

(Table 1) focuses on the smart economy component. The most notable smart city projects in Cluj-Napoca mostly focus on encouraging local entrepreneurs and aspiring ones with a business incubator and accelerator, as well as a strategy for start-ups and a local center for innovation. The projects developed by the Municipality of Iași tackle technology and industrial parks, as well as establishing entities that stimulate innovation in the field of artificial intelligence.

An important project developed by Alba Iulia targets one of the most important problems, the one of facilitating the connection between the local producer and the final customer. With the development of an electronic platform, www.targulangro.ro, the fresh produce of local entrepreneurs can reach the tables of nearby citizens with only a few electronic steps. Unfortunately, the platform is not used so often in recent years and a campaign that could reach both citizens and producers could be effective and revitalize the initiative.

Table 2. A comparison between Cluj-Napoca, Iași and Alba Iulia, regarding the smart government / governance projects

Cluj-Napoca	Iași	Alba Iulia
“Antonia”, the first virtual civil servant for a city hall in Romania	Online tax payment options	Online tax payment options
Online tax payment options	The platform primaria-iasi.ro	Online system for receiving citizen complaints - integrated City Alert module which allows the transmission of alerts in the
Online scheduling for various services, Issuance of town planning and cadaster	Digital City Hall (online scheduling for various services, Issuance of town planning and cadaster documents, Digital document	

Cluj-Napoca	Iași	Alba Iulia
documents, Digital document management, online tracking of documents Mobile applications (My Cluj, Cluj Now)	management, Open Data, Report a problem, Status check for documents)	application by the Inspectorate for Emergency Situations e-Alba Iulia application

Source: developed by the author using data from (Asociația Cluj IT, 2021), (Boc, 2022), (Panu, 2021), (Florea, Cardasim and Bonghiu, 2019) and (Primăria Iași and IAȘI AI, 2023)

When analyzing the data available in (Table 2), some similarities can be noticed when it comes to the projects regarding smart government / governance in all three cities, such as the facility of online tax payment. The digitalization of the local administration is another aspect that was tackled by all three city halls with online services that are provided to citizens.

Mobile applications play an important role in digitalization and in facilitating the interaction with the citizens, and these initiatives proved to be successful around the globe. Both Cluj-Napoca and Alba Iulia developed such applications that are available for the general public.

Cluj-Napoca continued to improve this component, and used the data from a survey from 2019, when the citizens questioned were mostly satisfied with the public servants that worked in the city hall, the quality of services offered by the municipality, the local administrative system and the local authorities (Universitatea Babeș-Bolyai, 2019).

Iași City Hall announced in March 2023 that it launched the Open Data Platform, an initiative that is present in most smart cities around the world The municipality enabled the option for all public institutions, companies and NGOs to publish their open data on the platform (Primăria Municipiului Iași, 2023).

Table 3. A comparison between Cluj-Napoca, Iași and Alba Iulia, regarding the smart infrastructure / mobility / transport projects

Cluj-Napoca	Iași	Alba Iulia
Tranzy - mobile application for public transport Traffic monitoring and management system and electric vehicle charging stations Molnar Piuariu, the first smart street in Romania Free Wi-Fi points installed in the city (including public transport)	Smart traffic management (monitoring systems, adaptive managed intersections) Electric vehicle charging stations Tranzy - mobile application for public transport HereItIs - urban mobility mobile app	Buses equipped with high-speed Wi-Fi, real-time geolocation Smart Surveys platform in buses – pilot project Air quality measurement (8 parameters) in buses Smart public lighting

Source: developed by the author using data from (Asociația Cluj IT, 2021), (Boc, 2022), (Panu, 2021), (Florea, Cardasim and Bonghiu, 2019) and (Primăria Iași and IAȘI AI, 2023)

Smart infrastructure / mobility / transport projects are vital for a city and can be seen as the backbone of every urban area. The data in (Table 3) underlines this idea, with the municipalities of Cluj-Napoca and Iași already integrating mobile applications like Tranzy with the public transport system and facilitating the use of it by more citizens. The digitalization of public transport is evident in all three cities, along with the use of sensors and other equipment for better traffic and light management.

The feedback from citizens in important before implementing a new project, as well as after implementing it, in order to tailor it to the needs of the people. Cluj-Napoca improved on this aspect, and invested important resources for a better public transport system, addressing the aspects revealed by the survey from 2019. From 234 citizens questioned, only 12 citizens graded the public transport with ten and almost 45% of the respondents graded it with seven or eight (Universitatea Babeș-Bolyai, 2019). The same survey revealed that there was room for improvement when public services related to infrastructure were concerned and this issue was addressed in the years that followed.

Table 4. A comparison between Cluj-Napoca, Iași and Alba Iulia, regarding the smart life / living / safety & health projects

Cluj-Napoca	Iași	Alba Iulia
Smart buildings for energy efficiency	Online and digital solutions integrated in hospitals	Peditel – telemedicine solution intended for mothers with small children
Energy efficiency for apartment buildings	Smart watches, smart health and smart fitness assistants, monitors for infants and children, home monitors for blood pressure, pulse, body fat, diabetes.	SolarBox-2 – thermodynamic solar system for hot water production, with solar panel, implemented in a nursery
Investment in tele-medicine and digital solutions for hospitals	Smart and energy efficient buildings	Public blood sugar level testing and arterial age measurement using smart equipment
Step-Hear - mobile application in order to aid people with sight deficiencies		

Source: developed by the author using data from (Asociația Cluj IT, 2021), (Boc, 2022), (Panu, 2021), (Florea, Cardasim and Bonghiu, 2019) and (Primăria Iași and IAȘI AI, 2023)

Citizens' quality of life is important for every local government. With initiatives that are part of the smart life / living / safety & health component of the smart city framework, significant improvements can be made for the everyday life of residents. Smart buildings that are energy efficient can be found in both Cluj-Napoca and Iași.

(Table 4) also presents significant improvements in healthcare in all three cities, with a focus on tele-medicine and the use of smart equipment for monitoring and providing healthcare both remotely or on site. These investments have been

accelerated by the pandemic and the access to European funding and need to be continued as healthcare is an important aspect in quality of life in any city, especially in a smart city.

Table 5. A comparison between Cluj-Napoca, Iași and Alba Iulia, regarding the smart environment / sustainability projects

Cluj-Napoca	Iași	Alba Iulia
Reduced rate taxes on the green buildings	GPS monitoring of the fleet of garbage collection vehicles	Alba Iulia Green City initiative
190 ha of new and expanded green spaces and 100.000 trees planted by 2030	Monitoring of street cleaning vehicles via GPS	Smart sensor networks for the environment
Metropolitan ring - includes bike track, Metropolitan train and Metro	Sensors in water networks and other utilities	Increasing the areas of green spaces by 40% by 2030
All public transport fleet will be green by 2026	New energy efficient trams	Smart waste management – sensors placed in containers
Green Friday (free public transport), bike sharing systems, solar powered parkings and dedicated bike and bus lanes, mobile apps	Green Friday (free public transport)	Green Friday (free public transport)
Smart waste management – sensors placed in containers		
GPS monitoring of the fleet of garbage collection vehicles		

Source: developed by the author using data from (Asociația Cluj IT, 2021), (Boc, 2022), (Panu, 2021), (Florea, Cardasim and Bonghiu, 2019) and (Primăria Iași and IAȘI AI, 2023)

Urban areas tend to bring more pollution that affects the quality of life. With smart environment / sustainability projects, this issue is addressed, as presented in (Table 5).

One of the major pollutants is represented by exhaust emissions from cars. The use of public transport is encouraged in all three cities with initiatives like “Green Friday”, that provides the use of public transport free of charge in one day of the week. The use of energy efficient busses, trams and trolleybuses is also important and taken into account by all three cities.

Green urban spaces can help in the reduction of carbon emissions and both municipalities of Cluj-Napoca and Alba Iulia have implemented appropriate projects.

Cluj-Napoca continued with the approach related to green urban spaces that was appreciated by citizens in the survey from 2019, when over 55% of the citizens questioned offered a grade above 8 (Universitatea Babeș-Bolyai, 2019).

Waste management is in the focus of all three cities with the use of various sensors for monitoring both garbage collecting trucks and recycle bins. The municipality of Cluj-Napoca offers the possibility for citizens to monitor the garbage collection trucks via GPS and to report if their waste has not been collected as scheduled. Such GPS monitoring is also used in Iași.

Table 6. A comparison between Cluj-Napoca, Iași and Alba Iulia, regarding the smart citizen / people projects

Cluj-Napoca	Iași	Alba Iulia
Investment in digital solutions for schools Contribution to the education of citizens regarding the benefits of advanced technologies (special projects for familiarizing seniors with digital tools) Increasing accessibility to digital workforce education	Contribution to the education of citizens regarding the benefits of advanced technologies Investment in digital solutions for schools	The rise to the "Brained City" level of the city of Alba Iulia initiative Investment in digital solutions for schools Microsoft for Education project

Source: developed by the author using data from (Asociația Cluj IT, 2021), (Boc, 2022), (Panu, 2021), (Florea, Cardasim and Bonghiu, 2019) and (Primăria Iași and IAȘI AI, 2023)

As smart cities are intended to be centered upon the needs of the citizens and the community, smart citizen / people projects have to be implemented with responsibility.

The advancements in new technologies that can be integrated in schools and the pandemic, accelerated the investments in digital solutions for the local education system in all three cities. With students that learn to use technology from a young age, smart cities will provide a competitive labor market and foster innovation.

A survey that addressed the impact of digitalization on the service sector in the Cluj area during the pandemic, revealed that over 68% of the employees affirmed that the newly acquired digital skills will help them in a significant way in the near future (Trincă, Nistor and Stegerean, 2021).

All citizens have the right to be familiarized with the new advancements in technology in a smart city and such projects exist in Cluj-Napoca, Iași and Alba Iulia.

5. Conclusions

The number of smart city projects in Romania increased rapidly in recent years, demanding more expertise from public servants and challenging the smaller municipalities from a resource point of view (Vegacomp Consulting, 2022).

European funding is crucial for the implementation of the projects, especially the Recovery and Resilience Plan, as Romanian Government has budgeted almost 6 billion €, which constitutes more than 20% of the total 29.2 billion €, towards digitalization and digital transformation strategies and programmes (Ministerul Investițiilor și Proiectelor Europene, 2021; eMIP, 2022).

Data security needs to be tackled by existing and newly aspiring smart cities (Demertzi, Demertzis and Demertzis, 2023). The increasing number of cyber attacks, such as exploratory threats, third party vulnerabilities, the sabotage of critical infrastructure, data manipulation can be addressed through appropriate measures and increased cyber situational awareness. (Demertzi, Demertzis and Demertzis, 2023; Sengan et al., 2020).

When a Romanian town decides to implement a comprehensive smart city framework and access funding, it can take the examples of cities like Cluj-Napoca, Iași and Alba Iulia, as they demonstrated that the local administrations have the ability and expertise to implement the projects. A collaboration between city halls can help other towns to overcome the setbacks and learn good practices from more experienced local governments on this issue.

In the case of any research, some limitations can occur and have to be outlined. One possible limitation of the current research is the one that it did not use data from within the institutions that were analysed, and focused on the external perception of citizens regarding the projects and on the publicly available sources of information. In order to overcome this aspect, a detailed analysis is being considered in the near future, that will also include interviews and a survey for the local governments in Romania. The future study will approach also the Smart Village concept, eloquently represented by Ciugud, the first and most developed smart village in Romania (Kolbay, 2023).

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