Selection of Features of Smart Cities in the Western Region of Romania

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Abstract

The concept of "Smart city" is used more and more by urban policymakers, implicitly by those from Romania. Within this work, the attention is focused on "smart city" projects implemented by the territorial administrative units of the Western Region of Romania, a mapping of these types of projects being carried out according to the smart pillar on which they were implemented: mobility, environment, economy, citizens, living and governance. The objectives of this work are represented by the identification of the set of smart city projects implemented in the Western Region of Romania, as well as their classification according to the pillar on which they were implemented and the infrastructure intended to be developed through the project. The research tool used was content analysis. The objectives assumed in the research were achieved, and the results highlighted the situation of the smart city projects implemented in the Western Region of Romania.

Key words: smart city, west region of Romania, smart pillars, smart city projects, urban development
J.E.L. classification: H0, H70, O10

1. Introduction

In this article, the analyzed topic has as a starting point a challenging global field for the sustainable development of an urban area. The purpose of this research is to make a detailed mapping of the "smart city" projects implemented by the territorial administrative units at the level of the West Development Region of Romania. This article uses document analysis as a research method, while the research tool was that of content analysis. The researches carried out over time in Romania have highlighted the fact that the field is in a state of emergence, with multiple institutions that are trying to implement smart city projects (Cîrnu, et al., 2017, pp. 316-317). At the level of Romania, the democratic period after the 1989 Revolution was marked by a strong interest of the public administration authorities regarding the urban development through classical methods, aimed at hard infrastructure, to the detriment of projects that would facilitate the development of the soft infrastructure of an urban area. These practices have been maintained in the last 10 years, although the global focus has shifted from the implementation of hard infrastructure measures to the implementation of projects aimed at soft infrastructure. In the context of environmental changes and the different challenges generated by public policymakers worldwide, they have turned their attention to projects aimed at preserving the environment and implicitly implementing a large number of projects on the smart environmental pillar.

2. Literature review

The researchers developed and adapted a series of definitions for the concept of "smart city", depending on the period and the point of view approached when referring to this concept. In 2000, Hall defines the concept of a smart city as being related to "the integrated monitoring and development of the infrastructure of high importance of a city, and which includes: roads, bridges, tunnels, subway lines, airports, telecommunications, water, energy sources and buildings, as well as

carrying out maintenance activities with a predictive role within them, with the role of maximizing the living conditions for citizens. (Bowerman, et al., 2000, pp. 1-2)

In 2001, Beatty outlined a profile of a digital city, which was seen as an open, complex space and which benefits from an adaptive system of computer networks and urban information resources, all of which formed a virtual digital space for the city (Beatty, 2001, pp. 4-5). Thus, it can be seen that the emphasis is placed on the importance of developing tangible and large-scale infrastructure within a city, at the same time as the preventive measures related to the developed infrastructure (Cocchia & Dameri, 2010, pp. 2-3).

In 2010, Giffinger presented "a smart area concept, which included regional competitiveness, the implementation of telecommunications infrastructure, the development of transport, the increase in the quality of life, the care for nature and last but not least, the implementation of policies at governmental level" (Giffinger, 2010, pp. 4-5). In the previous definition, a general perspective can be seen, in which the areas of intervention were stipulated at the conceptual level of a smart area.

A widespread mistake among urban decision-makers that needs to be   clarified, namely the confusion of the concept of "digital city" with "smart city" (Cocchia & Dameri, 2010, p. 2). A smart city includes a digital city, but it is much more than that, because a smart city is not only aimed at developing the ITC infrastructure, but is aimed on top of the overall development of urban infrastructure in an eco-friendlly manner and integrating people into the intelligent ecosystem thus created.

In 2014, Frost and Sullivan approach the concept of a smart city in a structured manner, in which they highlight the smart city as consisting of eight dimensions: governance carried out in a smart way, sustainable and smart energy, smartly built and managed buildings, smart mobility of citizens at city level and within peri-urban areas, citizens' access to a smart infrastructure, smart technologies and smart health system, all of the above being offered to smart citizens.

Another perspective is offered to us by De Santis et co., which presents a smart city as a city that is constantly changing and adapted to the wishes and needs of citizens. This perspective has a bottom-to-top starting point in the decision-making process at the urban level (De Santis, et al., 2014, pp. 3-4).

Thus, although most of the definitions presented concern the smart city from different perspectives, there is an important principle that unites them all - the importance of meeting the requirements and needs of citizens, with the role of increasing the standard and living conditions for them.

Today, the concept of smart city is viewed from a holistic perspective, in which there are presented multiple areas of interest (such as sustainable development, architecture, implementation of ITC, decentralization of decisions, etc.) which represents an "area of debate and decision" for multiple categories of stakeholders in several fields (such as urban planners, architects, geographers, IT and digitalization specialists, politicians and members of the academic community) (Appio, et al., 2018, pp. 2-3). All these professional groups are brought together due to the desire to innovate and identify alternative ways for urban areas management. Thus, lately, urban planning is beginning to be more and more the task of strategic planning specialists trained for this field, able to manage large-scale urban projects that target several areas. For this reason, there is currently   a major need to set up inter-disciplinary teams to implement smart city measures, given that in the current society of speed and rapid innovations, people who have niche qualifications do not cope with multiple tasks and situations determined by the external context.

As a model of good practices for smart city, to which urban and deportable areas within Romania should tend, we believe that Barcelona is the city that has implemented over time a series of smart measures that have given it a leading place in the top of smart cities in Europe, with a public administration based on cutting edge technologies, but at the same time the urban policymakers are very careful with the needs of its citizens. Barcelona's road of becoming a smart city began about 30 years ago when fiber optics were installed, a novelty at the time, thus connecting two buildings in the city.

Although the city comprises several research institutes that deal with the technical process itself to integrate innovation into the urban reality, the innovative core is District 22 which is the center where smart decisions are implemented in Barcelona, and includes both the technology part and the management part of the process itself (Madakam & Ramachandran, 2015, pp. 6-7). Among the

actions that are carried out are the introduction of electric cars at the same time as the very fast charging stations for them, the rehabilitation of old buildings to manage energy waste and the installation of cooling and heating systems from renewable sources within them.

The first paradigm of action was Smart City 1.0, being based on technology (technology based paradigm) within it can be seen that decision makers want the implementation priority of the latest innovative technologies, in order to bring them efficiency within urban governance practices. It was aimed at a large-scale technology in all fields of activity at urban level, but without having a sustainable development strategy.

The second paradigm was that of Smart City 2.0 and was also based on technology, but unlike Smart City 1.0. in which the vision was purely technological, within this paradigm it was based on a mapping of the urban environment, aiming at a synergistic integration of technology with urban development strategy, in order to generate the maximum advantage at urban level. A disadvantage of this approach is given by the fact that the opinions and expectations of citizens are not integrated in the process of carrying out the strategy, also having a bottom-to-top approach (Alexandrova & Vishnivetskaya, 2019, pp. 4-5).

Smart city 3.0 is the third paradigm in which a high emphasis is placed on citizens, seen as the creators of the urban environment in which they live. This can be understood from 2 distinct perspectives and the measures taken must be focused on them: educating citizens and encouraging them to have opinions on the development of their own urban area through continuous innovations. However, this paradigm also takes into account the technological dimension of things, with sustainable progress being pursued with the help of technology. Thus, this new model brings together in a unique way 4 dimensions of a smart city: communication, cooperation, culture and last but not least, technology (Carta, 2019, pp. 3-4).

3. Research methodology

The research in the smart city study takes into account the model that includes 6 smart pillars: mobility, environment, economy, citizens, living and governance. The method used is that of document analysis, within the article being carried out a mapping of the smart initiatives implemented at the level of the 4 municipalities of county residence in the West Region. The method was used because it represented a viable option for this type of research, aimed at identifying all the projects implemented by the territorial administrative units at the level of the respective localities.

The objectives of the research have been defined in such a way as to highlight the real situation at regional level:

- Objective 1: Determine the pillar with the most projects implemented at regional level by the territorial administrative units.
- Objective 2: Determine the type of urban infrastructure (hard or soft) on which most projects have been implemented.

In order to achieve the first objective and to be able to carry out an objective analysis at the level of the West Region, the 6 pillars of a smart city were analyzed in order to obtain a realistic and accurate framing of the smart projects carried out at regional level. According to the existing information, from the point of view of the implemented smart projects, there are significant gaps between Romania and Western Europe (Eremia, et al., 2016, pp. 14-15). The model of western European countries is the basis of comparison and serves as good practice model for the Western Region.

In order to ensure a uniformity in the research carried out, it was decided to use the model based on 6 smart city pillars:

1. **Smart mobility -** Urban mobility is one of the basic strategic priorities through which a sustainable development can be ensured for a given city. Interconnection and development of transport infrastructure shall be aimed at. The strategic directions within the pillar are: traffic management, infrastructure and public transport, development of non-motorized transport infrastructure, strategies for smart mobility.

2. ***Smart environment –*** The aim is to approach a holistic strategy that includes environmental and energy aspects. The 2 keywords are the starting points for the development of an integrated strategy for this vertical, with the aim of combating pollution from multiple sources and for a better management of energy resources. The strategic directions within the pillar are: energy and green space management, green buildings, protection of natural resources and monitoring of the natural environment.

3. ***Smart economy –*** The "smart economy" pillar aims to increase the prosperity of the community from the level of a smart city through measures aimed at increasing employment, facilitating entrepreneurial and innovative approaches, improving the relationship between the business environment and employees, in order to provide a better life for citizens on the one hand and to develop business space on the other hand. The strategic directions within the pillar are: training programs, entrepreneurship and innovation, internationalization and smart economy strategies.

4. ***Smart citizens –*** This pillar has at its core the citizens who are the basic cells of any smart city, the citizen being seen as a trigger for change and innovation. In a smart city, citizens are the stakeholders from whom the changes must start and to which the development trends at the level of an urban area must be oriented. Unlike the old top-down approaches to urban planning, the post-modern era in which we find ourselves has led to an increase in the dynamism of the social environment and a change in people's mentality regarding urban changes. The strategic directions within the pillar are: education and creativity in the digital era, involvement in decision-making, inclusive society.

5. ***Smart living*** - The smart living pillar within a smart city refers to the set of measures that are intended to be implemented with the aim of increasing the quality and conditions of the living environment both from the point of view of the urban area itself and from the point of view of their final beneficiary, the citizen. Technology must not go over all the other elements at the level of a city such as tourism, cultural and social life, management of urban area / green spaces or health services, but must work together in a synergistic manner with them in order to provide citizens with the best experience possible. The strategic directions within the pillar are: tourism and culture, security, medical services, accessibility to technology, management of the urban area.

6. ***Smart governance*** - The smart governance pillar presented from a regional perspective refers to all the measures by which urban institutions manage the city and interact with the citizens within a community in order to facilitate their access to different services or products on the one hand and to the way regional authorities manage their relations with the set of central bodies and authorities at the level of government on the other side. The strategic directions within the pillar are: public services, participative management and transparency, institutional management, multi-level governance.

Regarding the second objective, all the implemented smart city projects will be divided into 2 distinct categories of infrastructures – hard and soft, targeting the actual characteristic of the implemented project:

1. ***Hard infrastructure*** – The projects developed on this type of infrastructure have in their composition a strong tangible dimension, which is necessary for the physical network created to operate at optimal parameters.

2. ***Soft infrastructure*** – The projects developed on this type of infrastructure have in their composition a strong intangible dimension, and an example of this would be digital applications or potential new strategies and processes created, consisting of innovation.

The data were centralized from the conspected documents, represented by press materials and websites available to the general public (web pages of economic or technological profile or official websites of the territorial administrative units). The reference period of the projects identified is between January 2010 and May 2021. The projects included in the analysis are exclusively completed. Thus, the projects that had the "smart" label assigned were centralized and classified both according to the six pillars and according to the characteristic of the developed infrastructure – hard or soft.

The institutions whose smart city projects have been analyzed are represented exclusively from the local administrations the territorial administrative units of the county residence municipalities, within the West Development Region of Romania: Timisoara, Arad, Resita and Deva. The projects were implemented exclusively at the level of territorial administrative unit, while their financing was made from 3 sources – financing from the local budget, financing from the government budget or financing from non-reimbursable European funds.

There have been identified strategic directions on every smart pillar:

1. *Smart mobility* - The strategic directions within the pillar are: traffic management, infrastructure and public transport, development of non-motorized transport infrastructure, strategies for smart mobility.

2. *Smart environment* –The strategic directions within the pillar are: energy and green space management, green buildings, protection of natural resources and monitoring of the natural environment.

3. *Smart economy* – The strategic directions within the pillar are: training programs, entrepreneurship and innovation, internationalization and smart economy strategies.

4. *Smart citizens* – The strategic directions within the pillar are: education and creativity in the digital era, involvement in decision-making, inclusive society.

5. *Smart living* - The strategic directions within the pillar are: tourism and culture, security, medical services, accessibility to technology, management of the urban area.

6. *Smart governance* - The strategic directions within the pillar are: public services, participative management and transparency, institutional management, multi-level governance.

4. Findings

Following the application of the content analysis tool, the following results were recorded:

1. *Smart mobility* – a total of 11 projects have been implemented, of which 4 on hard infrastructure and 7 on soft infrastructure: Timisoara (2 on hard and 4 on the soft one), Arad (1 on hard and 1 on soft), Reșița (1 on hard), Deva (2 on soft)

2. *Smart environment* - a total of 10 projects have been implemented, all of them targeting the hard infrastructure: Timisoara (7 projects), while Arad, Resita and Deva have been implemented one project for each municipality.

3. *Smart economy* - a total of 5 projects were implemented, of which 2 on hard infrastructure and 3 on soft infrastructure: Timisoara (2 on hard and 1 on software), Reșița (1 on software), Deva (1 on hard).

4. *Intelligent citizenship* - a total of 5 projects have been implemented, of which 1 on hard infrastructure and 4 on soft infrastructure: Timisoara (2 on software), Arad (1 on software), Deva (1 on software), Resita (1 on hard).

5. *Smart housing* - a total of 14 projects were implemented, of which 10 on hard infrastructure and 4 on soft infrastructure: Timisoara (5 on hard and 1 on soft), Arad (3 on hard and 1 on soft), Deva (2 on hard and 2 on software).

6. *Smart governance* - a total of 10 projects have been implemented, all of them targeting hard infrastructure: Timisoara (3 projects), Arad (2 projects), Deva (5 projects).

The assessment carried out on the concrete measures and projects of smart city type at urban level according to the 6 pillars highlighted a number of aspects, among which the following can be mentioned:

1. For the *smart mobility* pillar all the 4 county residence municipalities have implemented projects. Most of the projects implemented targeted infrastructure development, public transport and traffic management, but it is necessary to develop a complex plan and a simplified strategy, with a focus on the area within the city in order to create a strategic coherence in ensuring mobility within the city.

2. For the *intelligent middle* pillar all the municipalities of the county residence at the regional level have implemented projects. In particular, the quantitative dimension of this pillar was targeted, which aimed at the development of hard infrastructure. The projects were implemented mainly on

"Energy and green space management", and on "Strategies to facilitate sustainability", only the city of Reșița had such an integrated strategy.

3.	The *smart economy* pillar was of interest to Timișoara, Reșița and Deva, being largely covered through the implementation of entrepreneurship, innovation and competitiveness projects, but with a channel mainly on the hard dimension of the things (infrastructure development). However, the strategic direction focused on training and mentoring showed less interest at regional level. The future perspectives on the smart economy pillar at regional level are very good because from 2021, the West Regional Development Agency will be the Management Authority for the Regional Operational Programme 2021-2027 and will facilitate a freer and easier access for entrepreneurs to both financing and tangible aid programms, as well as to increase their competitiveness and innovation capacity. Thus, the before mentioned aspects merged with the specific local and urban approach will make the Western Region a real growth pole based on a society made up of innovative people and competitive businesses.

4.	Within the *smart citizens* pillar, all the 4 municipalities of county residence have implemented smart projects, on 2 strategic directions - the involvement of citizens in the decision-making process and inclusive society. A positive aspect can be seen regarding the county residence municipality of Deva that collaborated with another municipality at county level to develop a participatory budgeting platform. The system was developed on a common logic and architecture, but on a separate structure for each city, which leads to the conclusion that the process of glocalization is applied at an early scale at regional level, which means global perspective, but at the same time interest for the local specific. An important aspect to note is the lack of projects for the strategic direction of education and creativity in the digital age for second or third age people. The desire is to be able to bring a uniformity at the level of the Western Zone in terms of digital knowledge in order to use the infrastructure provided by the various institutions involved in the development of smart measures.

5.	The *smart housing* pillar was of interest to 3 county residence municipalities – Timisoara, Arad and Deva. Through the implemented projects, the development of the hard infrastructure at the city level was aimed, using the classic technologies used in a smart city. In this category are the projects aimed at the acquisition and implementation of surveillance cameras, urban internet systems, their different sensors, etc. On the other hand, a minority share of all projects was carried out on soft infrastructure, such as web applications aimed at making citizens' lives more efficient, but which have a lower impact at a general level compared to hard infrastructure. In terms of strategic directions pursued at urban level, that of urban security presented the highest attraction for decision-makers, followed by the strategic direction of accessibility to technology and the facilitation of the internet and other digital services for citizens. It can be seen that the facilitation of public health services for citizens had no project implemented at regional level.

6.	Within the *smart governance*pillar, 3 county residence municipalities have implemented projects at regional level – Timișoara, Arad and Deva. Smart projects targeting public services and facilitating transparency for citizens were of the highest interest. This highlights of interest in institutional transparency at urban level and in facilitating the digital deployment of high-importance public services. However, increasing the transparency of public institutions should be continued from a strategic point of view with the implementation of measures to facilitate participative management. Also, the integrated management systems implemented at intra-institutional level should be strengthened through a system that facilitates multi-level governance and ensures a bi-directional connection with local, county, regional and national bodies (at the governmental level).

The first objective was to identify the pillar with the most projects implemented at regional level by the territorial administrative units of the county residence municipalities. Most smart projects have been implemented on the smart living pillar, with 14 smart projects. On the next position was the smart mobility pillar with 11 projects, and on the third place implemented were the environmental pillars, namely smart governance.

Figure no. 1 Implemented smart projects on pillars
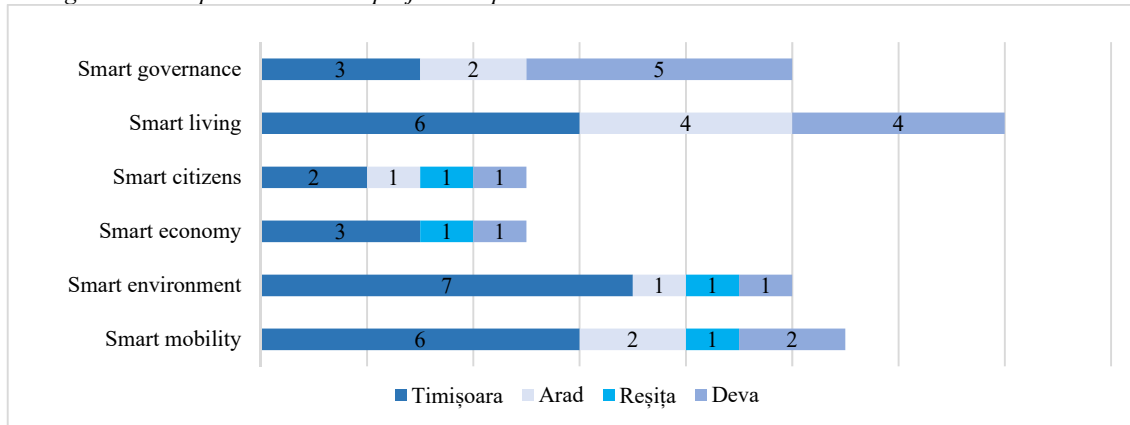
Source: Own Data Processing

The second objective of the research was to identify the type of infrastructure targeted primarily within the projects implemented by the territorial administrative units at regional level - the hard or the soft one. Out of the total of 55 implemented projects, 28 of them the soft infrastructure was targeted, while 27 smart projects targeted the hard infrastructure.

Figure no. 2 Smart projects implemented by types of infrastructures
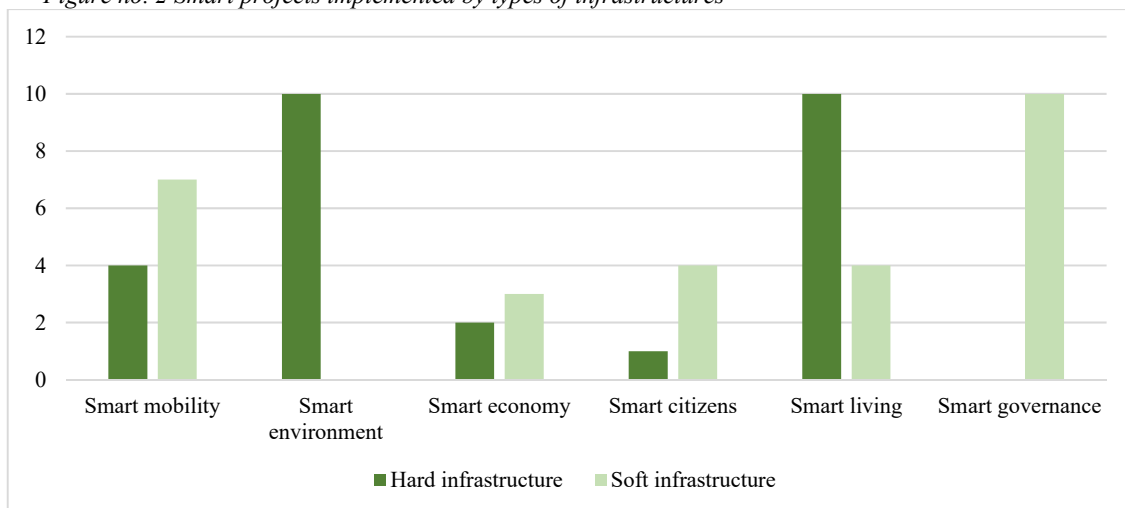
Source: Own Data Processing

5. Conclusions

One of this article analysis objective was to identify the characteristics of smart city projects implemented by the territorial administrative units of the county residence municipalities from the Western Region of Romania between January 2010 and May 2021. Most of the projects were implemented on the pillar of "smart living", which shows that the local public administration authorities have shown an increased interest in raising the living standards of citizens at the level of the four urban development poles at regional level. The European trend of interest in combating climate change was in third place at regional level, along with the smart governance pillar, which illustrates the interest in strengthening administrative capacity. Also, interest in the problems generated by the lack of infrastructure and new ways of travelling within urban agglomerations at regional level has been on the second place in the analysis carried out.

The second objective of the analysis highlighted the fact that 51% of the projects were developed to improve the software infrastructure, contrary to the specific investment at national level. This aspect illustrates that the Western Region is in a paradigm transition, following the new international

and european trend, which aims to develop mainly a soft infrastructure, detaching itself from the classical trend of the post-1989 Romania in which investments in hard infrastructure were a priority.

A spatial limit to the research is that the analysis focuses exclusively on the Western Region of Romania, while the remaining seven regions are not taken into account. Also, the sample of the territorial administrative units focuses strictly on the four urban development poles that are represented by the county residence municipalities of the four counties at regional level, while the rest of the cities and municipalities were not mapped in the analysis, due to the lack of information.

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