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# A COMPARISON BETWEEN TWO ROMANIAN DEVELOPMENT REGIONS FROM A SMART CITY PERSPECTIVE

**Alexandra GONTEAN**

Babes-Bolyai University, Cluj-Napoca, Romania  
alexandra.gontean@econ.ubbcluj.ro

**Vlad-Tudor TRINCĂ**

Babes-Bolyai University, Cluj-Napoca, Romania  
vlad.trinca@econ.ubbcluj.ro

## Abstract

Smart city initiatives are becoming more visible nowadays in Eastern Europe, due to the rapid steps taken in terms of digitalization during the pandemic and the funding opportunities available. The comparison of two Romanian development regions will be the main focus of this study, which will highlight the fact that there are no notable differences between the two development regions while demonstrating that a number of factors influence the degree of smart city project implementation within the communities. Both interested parties and academics studying the smart city framework may find value in the study's findings.

**Keywords:** Smart city, Local government, Digitalization.

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## 1. INTRODUCTION AND LITERATURE REVIEW

The smart city concept has emerged as an important topic on the Romanian landscape especially during and after the pandemic, as rapid changes had to be integrated in order for city halls to be able to assist citizens and provide modern and reliable public services. Digitalization is in direct link with smart city policies as it enables all projects to be connected in an ecosystem that is easily accessible.

Romanian scholars which focused on the issue of smart cities started to study the topic since 2008, by referring to the term "intelligent city" and from 2013 onwards by referring directly to the term "smart city" (Trincă, 2023a). As for the "smart city" term, it was referred to for the first time in the year of 1991 by (Drohojowska, 1995). The interest for researching the topic increased in the 21st century, especially after 2010 (Dameri & Cocchia, 2013).

Previous studies have demonstrated that local authorities cannot use a generic policy when developing policies associated with the smart city ecosystem as the local context is crucial for the projects of a particular community (Clement & Crutzen, 2021). The specific issues that are encountered in a community have to be addressed and taken into account, especially because the smart city initiatives are aimed at contributing towards the wellbeing of the community, simplifying citizens' life and fostering innovation for developing a robust local economy.

As per previous research, there are six smart city dimensions that encompass the framework, each tackling a different aspect from a community. One important component is the Smart Government one, which tackles with the efficiency of the public administration, reducing bureaucracy and transitioning to a digital and more transparent administration. From an economic perspective, fostering innovation, attracting more tourists, enabling local businesses to thrive and reach more customers or even having a more flexible labor market are fundamental aspects of this component. From aspects related to renewable energy and minimizing the environmental impact, they are all included in the smart environment component of the framework. The smart citizen/ people component promotes programs for well informed and educated individuals who are actively participating in the community as well as take part in the decision-making process, since citizens are essential to the smart city framework. The transportation network is the backbone of every community, and in this particular instance of smart cities, it tackles with a green and connected public transport, a series of sensors and other technological innovation for traffic management. The last component of the framework gathers initiatives associated with increasing the quality of life for the residents, having a modern healthcare system that incorporates various innovations and technological advancements, as well as monitoring equipment and sensors that ensure the safety of the citizens (Stegerean et al., 2022; Trincă, 2023b, 2024).

In this research the focus will be on two development regions from Romania. The development regions correspond with the NUTS-II divisions from the European Union, yet they do not have a legal personality, nor do they have administrative responsibilities. They are used for the European funds allocation process and for the coordination of development projects at the local level (David, 2020).

According to (Surd et al., 2011; Carausan, 2012; Haase, 2017; David, 2020) there are eight development regions in Romania, that gather the counties of the country.

Romania still has a quite complex administrative system that involves both central and local level authorities. The development regions have demonstrated to be effective in terms of European projects implementation.

## 2. RESEARCH METHODOLOGY

In this study, we will analyze to what extent there is a significant connection between the components under study (smart government and smart economy), the level of knowledge of civil servants and the extent to which the projects have been implemented.

In order to collect data for the analysis, a quantitative research method was used, more specifically a questionnaire. This research instrument is frequently used by researchers that aim to gather data from respondents and process it in order to investigate a certain issue.

The questionnaire was distributed between the 12th of September and the 23rd of October 2023. The targeted respondents were represented by public servants working in city halls from Romania. From a total of 164 responses that were received, we considered the ones that were from the two development regions that are the subject of the present study.

For the first Development Region (Region A), there were 13 answers, and for the second Development region (Region B) there were 11 answers. The two regions selected for analysis had a similar amount of answers, both from the urban and the rural area, thus the premises were set for a comparison between the two.

For studying the correlation between the four elements mentioned above, the fsQCA statistical model was used. This is the acronym for the Fuzzy-Set Qualitative Comparative Analysis. Researchers from the University of California created specialized software for the aforementioned concept (Ragin & Davey, 2022).

The reasons for using this particular statistical model, mentioned by other authors such as (Kraus et al., 2017; Ragin, 2000; Rihoux & Ragin, 2009; Trincă, 2024), were multiple, and will be listed below:

- It incorporates both quantitative and qualitative evaluations, thus capturing certain combinations that are deemed to be sufficient for a specific so-called outcome, by measuring whether a case belongs to a particular set.
- It is particularly useful when the number of specific cases is too large for a qualitative analysis, yet too limited for most standard statistical tools and methods.
- Recently, more studies focusing on business and management are considering the use of fsQCA.

## 3. RESULTS AND DISCUSSION

As the fsQCA model uses data ranging from 0 to 1, the data had to be calibrated in order to be processed. The questionnaire employed the Likert scale for collecting the answers, so that the calibration was performed similarly to the practices of authors like (Pappas & Woodside, 2021).

The following table will present the calibration process:

TABLE 1. THE CALIBRATION OF THE LIKERT SCALE VALUES FOR THE FSQCA ANALYSIS

The Likert scale value	The tresholds for fuzzy set calibration
1	0
2	0.25
3	0.5
4	0.75
5	1

Source: author's compilation

We defined the causal conditions that were used when performing the analysis as presented below:

- **SC\_KnowLvl** - the knowledge level of the respondents in what concerns the smart city concept
- **SC\_Govt** – the degree of importance placed on the Smart Government/ Governance component of the smart city framework by the respondents' municipality
- **SC\_Econ** - the degree of importance placed on the Smart Economy component of the smart city concept by the respondents' municipality

The result was characterized as SC\_ImplLvl, which represents the degree of smart city project implementation in the respondents' municipalities.

Using the fsQCA program, which makes the Fuzzy-Set Qualitative Comparative Analysis easier to utilize, we tested the causal condition SC\_KnowLvl to study the influence it has on the outcome represented by SC\_ImplLvl.

The following figures were elaborated, using the XY plot function of the fsQCA software.

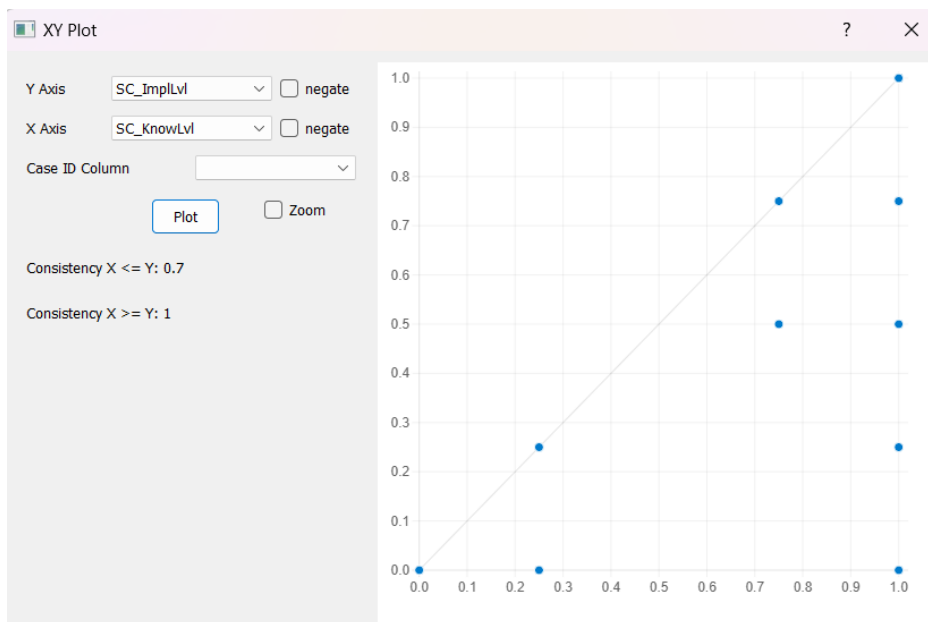


FIGURE 1. THE DISTRIBUTION OF CAUSALITY BETWEEN THE CAUSAL CONDITION **SC\_KnowLvl** AND THE OUTCOME **SC\_ImplLvl** IN THE XY PLOT GRAPH FOR THE MUNICIPALITIES FROM DEVELOPMENT REGION A

Source: author's compilation, using the XY Plot function in the fsQCA software

From the figure above, we can affirm that the score of consistency of 0.7 for the relationship  $X \leq Y$ , emphasizing the fact that SC\_KnowLvl is a subset of SC\_ImplLvl. We can consider the consistency score of 0.7 as a moderate one, that suggests that there can be room for improvement to make the association between the condition and the outcome stronger.

The coverage score (consistency with  $X \geq Y$ ) is 1, meaning that there is a consensus between all the respondents of the questionnaire with regards to the obtained result.

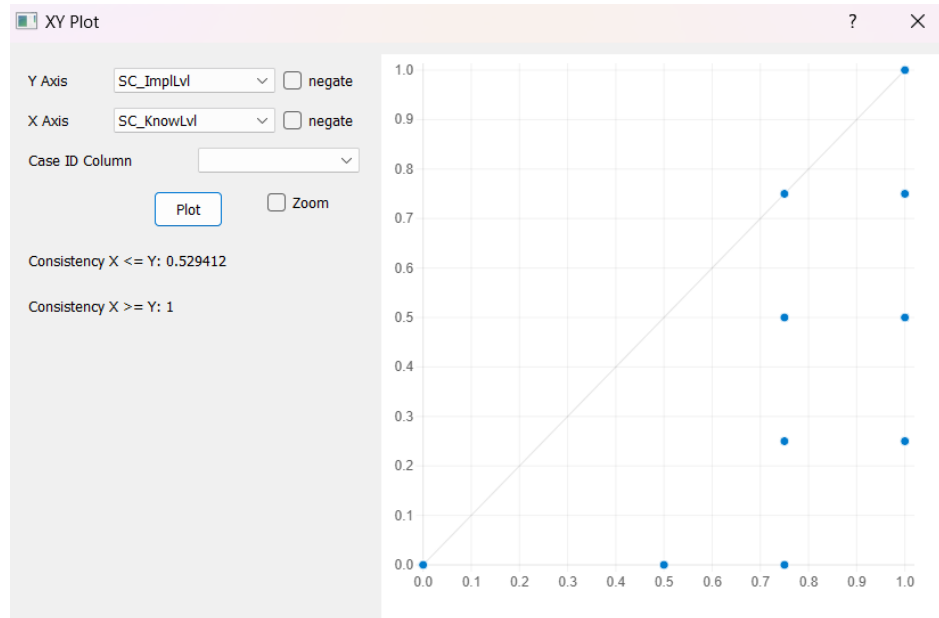


FIGURE 2. THE DISTRIBUTION OF CAUSALITY BETWEEN THE CAUSAL CONDITION SC\_KNOWLVL AND THE OUTCOME SC\_IMPLLVL IN THE XY PLOT GRAPH FOR THE MUNICIPALITIES FROM DEVELOPMENT REGION B

Source: author's compilation, using the XY Plot function in the fsQCA software

When observing Figure 2 that focuses on Development Region B there is a much lower consistency (0.53) for the relationship  $X \leq Y$  compared to the one of Development Region A. We can consider this score also a moderate one and still state that SC\_KnowLvl is a subset of SC\_ImplLvl, taking into account also the coverage score, which is identical with the previous development region.

In the next analysis we will focus on the Smart Government component of the framework, and the impact it has on the implementation level of the projects. We began our comparison with Development Region A, followed by Development Region B.

Figure 3 presents a consistency score of 0.62 for the case  $X \leq Y$ . Here, we are discussing a reasonable level of consistency. This particular value is a higher one than in the situation of Development Region B, which scored 0.58, indicating a medium degree of consistency. We can confirm that SC\_Gov is a subset of SC\_ImplLvl in both situations.

When comparing the coverage scores, we can see a significantly higher score in the case Development Region B. However, a coverage score of 0.82 for Development Region A in this case means that over 82% of the studied cases cover the result.

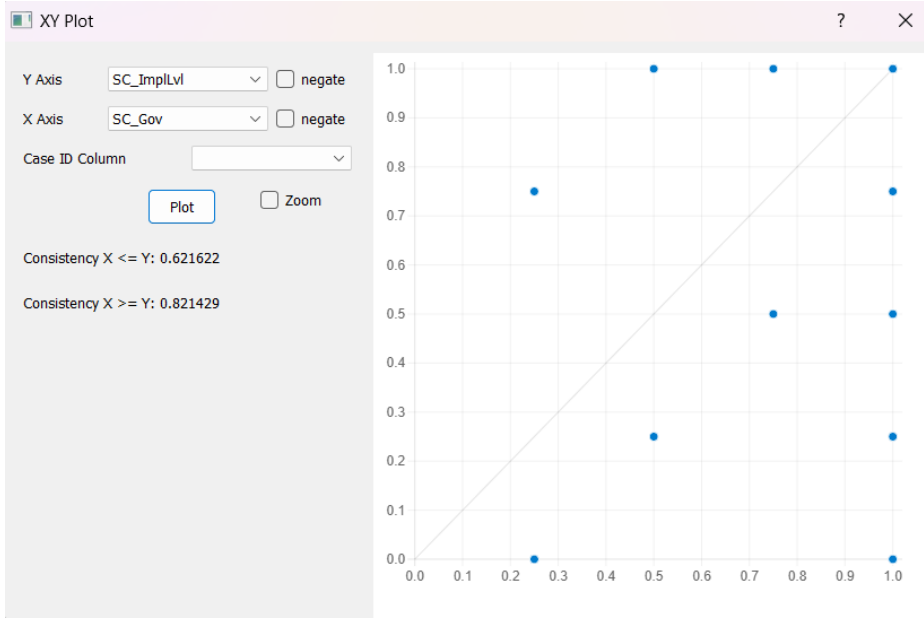


FIGURE 3. THE DISTRIBUTION OF CAUSALITY BETWEEN THE CAUSAL CONDITION SC\_GOV AND THE OUTCOME SC\_IMPLVL IN THE XY PLOT GRAPH FOR THE MUNICIPALITIES FROM DEVELOPMENT REGION A  
Source: author's compilation, using the XY Plot function in the fsQCA software

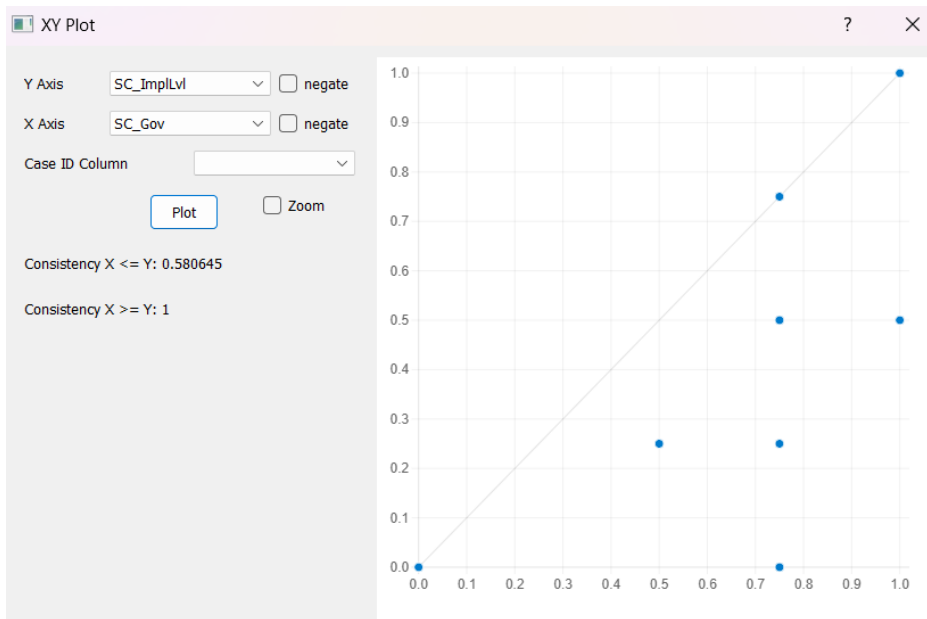


FIGURE 4. THE DISTRIBUTION OF CAUSALITY BETWEEN THE CAUSAL CONDITION SC\_GOV AND THE OUTCOME SC\_IMPLVL IN THE XY PLOT GRAPH FOR THE MUNICIPALITIES FROM DEVELOPMENT REGION B  
Source: author's compilation, using the XY Plot function in the fsQCA software

In the final section of the analysis, we examined the causal relationship between the two development regions' circumstances in what concerns the Smart Economy component of the smart city framework and the outcome SC\_ImplLvl, which stands for the degree of smart project implementation in the local communities.

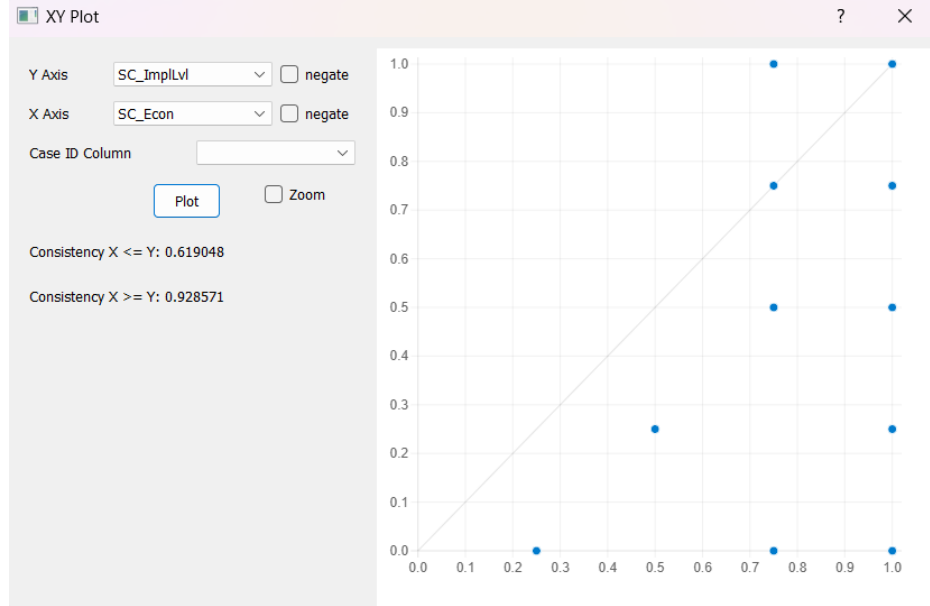


FIGURE 5. THE DISTRIBUTION OF CAUSALITY BETWEEN THE CAUSAL CONDITION SC\_ECON AND THE OUTCOME SC\_IMPLLVL IN THE XY PLOT GRAPH FOR THE MUNICIPALITIES FROM DEVELOPMENT REGION A  
Source: author's compilation, using the XY Plot function in the fsQCA software

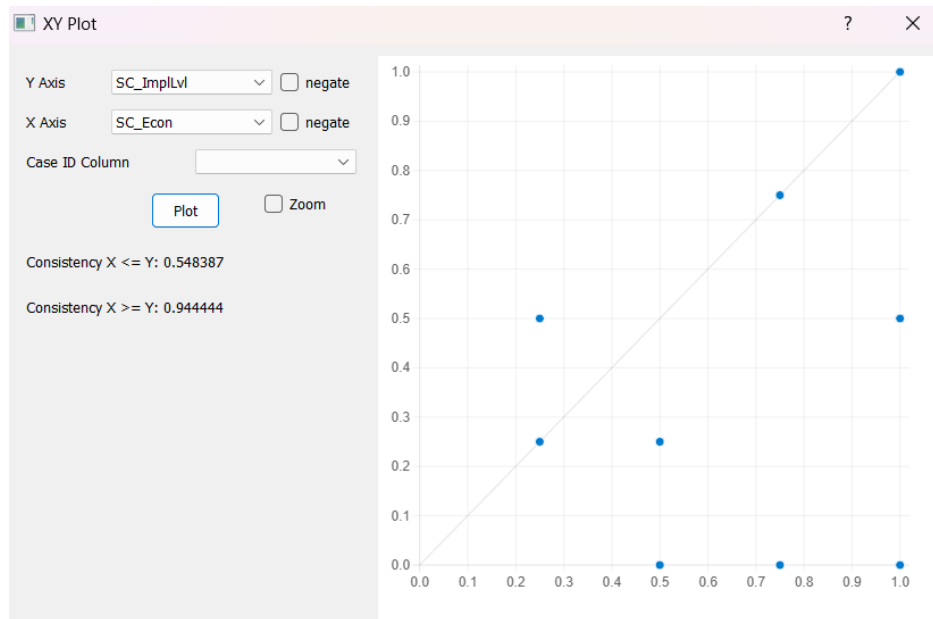


FIGURE 6. THE DISTRIBUTION OF CAUSALITY BETWEEN THE CAUSAL CONDITION SC\_ECON AND THE OUTCOME SC\_IMPLLVL IN THE XY PLOT GRAPH FOR THE MUNICIPALITIES FROM THE DEVELOPMENT REGION A  
Source: author's compilation, using the XY Plot function in the fsQCA software

A similar situation is encountered for the causal condition SC\_Econ just as it was the case for the causal condition SC\_Gov, meaning that the consistency score that resulted for the  $X \leq Y$  relationship was greater in Development Region A example as opposed to Development Region B case. With a moderate consistence degree in the first instance (0.62) and a medium consistence degree in the second case (0.55) we can still affirm that in both cases X is a subset of Y, meaning that SC\_Econ is a subset of SC\_ImplLvl.

Examining the coverage scores for the two cases, we found that the Development Region A's score was 0.93, which was quite comparable to Development Region B's score.

For Development Region A, the consistency ratings were between 0.62 and 0.7, whereas for Development Region B, they ranged between 0.53 and 0.58.

According to (Pappas & Woodside, 2021), if a consistency score exceeds 0.5, we are referring to a degree of consistency that is a medium one, or a membership that is intermediate, thus underlining that all three causal conditions (SC\_KnowLvl, SC\_Gov, SC\_Econ) are subsets of the outcome SC\_ImplLvl. In both cases of the development regions we can see that the causal conditions have an impact on the implementation level of the projects, yet data suggests that other factors are also involved as the consistency scores are not significantly high.

When considering coverage, both development regions have scores that surpass 82%. Development Region B has higher coverage scores, ranging from 0.94 to 1. For Development Region A, the ratings ranged from 0.82 to 1.

#### 4. CONCLUSIONS

The present study compared two Romanian development regions. The correlation between two aspects of smart cities (Smart Government and Smart Economy), the degree of public servants' understanding of the framework for smart cities, and the degree of smart initiative implementation in development regions' communities served as the basis for the comparison.

The data studied resembles the fact that all causal conditions were subsets of the outcome SC\_ImplLvl. This aspect leads us to the idea that projects and initiatives associated with the two smart city dimensions play an important role in the level of implementation of the smart city framework within municipalities. Another important contributor is also represented by the level of knowledge that the local public servants possess regarding the framework.

The aim of the research has been reached, as we can now state that there is a direct connection between the two smart city components, the knowledge level of the public servants and the implementation level of



the projects for both development regions that entered the study. The comparison between the two development regions showed that there are not significant differences, and that the situation is quite similar in regards to the studied topic.

As any research, the present one has a series of limitations that will be discussed. The first limitation that is to be highlighted is the one of not having such a high number of responses from the two development regions that were part of the research. We can underline that the responses came from multiple counties in the case of both development regions, and from various sized municipalities so that the premises for a clear image were set. As consistency scores were not that high in case of both development regions, we can present a possible limitation, as other factors are also involved in influencing the implementation level of the smart projects that are to be analyzed in future studies. Another limitation was the one of referring in the research on only two specific development regions. This aspect could be addressed in future studies, that will consider and compare the total number of regions.

From the managerial implications' perspective, the most important aspect is the one that the local government is largely responsible for the effective implementation of the smart framework within the community. This element brings into the spotlight the necessity of having public servants that possess the adequate knowledge for elaborating and implementing the initiatives. Ensuring a balance between the involvement of both citizens and the private sector could be challenging for local elected leaders, yet a comprehensive smart city plan cannot be implemented without having all actors involved.

Future research perspectives include the development of a comparative study that involves all development regions from Romania, in order to have a clear picture from the country's level upon the topic of smart cities. Extending the study to other countries could also constitute a research direction for both us, and other scholars.

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