

Smart-City- Awareness amongst Croatian citizens

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Abstract - Globally, the concept of smart-cities is imposed as one of the crucial elements of the development of local government. There are a few examples of smart-city initiatives in the Republic of Croatia and an insignificant number of formal certification. By using widely standardized indicators we shall introduce citizens with the indicators for developing smart-cities. The aim of this paper is to detect the smart -city awareness of Croatian citizens in terms of its importance and their initiative towards local government. According to the research results, the paper will recommend methods and their implementation into the key segments for achieving real assessment of ICT infrastructure, and therefore approach the development of a self-sufficient Croatian smart city model.

Keywords - smart-city; globally standardized indicators; local government; open governance; Republic of Croatia

I. INTRODUCTION

Today, in the Republic of Croatia (further: Croatia), there are no smart-cities, such as defined in the smart-city key indicators within the Horizon 2020 Programme named “CITYkeys indicators for smart city projects and smart cities”, co-funded by the European Commission (used both as a guide and a tool for writing this paper). [1] Usually, key indicators aim to facilitate and enable stakeholders to invest in projects for smart-city implementation, cities to learn from one another, and to monitor progress, by means of integrated performance. The framework for smart-cities should be carried out in a way to implement tangible elements which are expected to support smart-city development and to achieve environmentally friendly, economically viable and socially desirable urban environments. Technologies are playing an important role in sustainable and smart transformation of any existing city into an intelligent city or when the smart-city is developed from the ground up, it's crucial that it to meets varied people's expectations. The choice of technologies, platforms, tools, and methodologies is crucial for the intended success of smart city projects in any part of the world. [2]

A 'smart city' is a city where investments are focused towards smart citizens who use renewable energy resources wisely and widespread technological networks to combine sustainable economic growth whilst improving the quality of life, through the open government model by the interaction of all stakeholders. [3]

Due to the importance of developing the smart city elements in Croatian cities, the goal of this paper is to detect the smart-city awareness of Croatian citizens in terms of its importance and their initiative towards local government, their familiarity with the meaning and the elements of a smart-city compared to the key indicators from the *supra* mentioned study.

II. METHODOLOGY

Different EU cities confirmed that the implementation of smart-city elements and solutions are high on their agenda, due to the fact that they expect great amount of benefits when they 'become smart', included: sustainability, efficiency, better participation of citizens in the work of local governments and an increase of quality of life in general [1]. Since Croatian cities are still not primarily oriented towards implementing smart-city methods and elements in their cities, we have decided to examine opinions of Croatian citizens on their standpoints regarding implementation of smart-city elements into Croatian cities. We have also compared the responses of citizens who responded to the questionnaire on the crucial elements of smart-cities.

For conducting this research, we have opted for a questionnaire as a tool for collecting data. The data was collected by Web-Assisted Interviewing [4]. Specifically, data was collected from 23rd of January until 31st of January 2018 and the questionnaire was provided in an Internet-only version via Google Forms. The questionnaire was provided to a certain number of participants using Social Media (Facebook, Twitter). We are also very aware of the limitations of this research, due to the fact that only citizens with Internet and social media networks access could have participated in the questionnaire. The value of the questionnaire is limited because the knowledge that we can give depends on the integrity of the respondents and their ability to answer the questions asked. However, this questionnaire can be used as an example of a larger scale project for local self-governments when implementing the elements of a smart city. For this kind of research, the most important is to have a credible random sample of respondents in the questionnaire, where the numbers of respondents in the qualitative research isn't limited with the highest number of respondents.

Participants were introduced with the purpose and objectives of the questionnaire before answering the questions. The questionnaire was conducted for Croatian citizens only, therefore, Croatian language was used.

The reasoning behind using the web questionnaire in Google Forms is the following: the provision to potential participants was conducted without expenses, it offered anonymity and the authors concluded it was optimal for a certain number of respondents [5].

The questionnaire contained twelve (12) questions. The first three (3) were related to defining the participants by several categories authors deemed important (gender, age and the size of the city participants live in). The fourth question asked the participants if they know what the term smart-city means.

The following two (2) questions (with an option for participants to also propose their own answers) offered the participants to select from multiple answers. The fifth question was: "Which of the following are the elements of the smart-city term?", and the sixth question was: "Which of the following elements of the Smart-city are already provided in the city you live in?"

The areas in which cities need indicators to measure their smart city performance are: energy, greenhouse gas emissions, traffic and transport, digital infrastructure and E-services, resource management, citizens' participation, competitiveness, economy, environment, quality of life etc. We have categorized the answers into the five (5) basic categories which the smart-city consist of: Smart governance, Smart living, Smart mobility, Smart environment and Smart people. Some answers belong into the two (2) categories. The selection of indicators for the evaluation framework was based on an inventory of the needs of cities and citizens, the CITYkeys working definitions and the structure of the evaluation framework, and the categorization made by S. Kondepudi and R. Kondepudi [6]. Additionally, some of the answers were not elements of a smart-city (not grouped in any of the above-mentioned categories). False answers served as "red-flags" to indicate if the participants who stated they know what a smart-city is, really understood what constitutes a smart-city in practice. Two other possible answers were "None of the above" and "I am not familiar with the term smart-city". The answers provided are presented in Figure 1 *infra*.

The seventh question offered identical elements and asked the participants to rate each element on a scale from 1 to 5 - one (1) indicating that the element is not necessary in the city participants live in, while five (5) meaning the

Smart governance	Smart living	Smart mobility	Smart environment	Smart people	Uncategorized/false
Citizen-government interconnection	Smart security system	Smart parking	Energy-efficient facades	Smart education and health care	Shared drives with a personal vehicle (carpooling)
Automated collection of data regarding citizen habits		Smart traffic lights	Smart waste disposal		Quality of life reduction
		Smart public transportation	Smart energy savings		Usage of non-renewable energy sources
					Free Wi-fi in bars
					Smart benches

Figure 1: Categorized answers (Questions 5 and 6).

element is (reasonably) needed in the city participants live in.

The set of questions from eight (8) to eleven (11) asked participants the following: "Question 8: Does the introduction of smart-city elements increase the quality of your lives?"; "Question 9: Are you familiar with any initiatives your local government is facilitating regarding smart-city elements?"; "Question 10: When do you expect your city will implement some elements of a smart-city?"; "Question 11: Would you participate in a digital platform which would provide an opportunity for joint decision making on projects relevant to the development of your city?"

The twelfth (final) question was open-ended, and participants were asked whether they think the city they live in is "smart". Participants were asked to write and explain their answer on the above question.

III. ANALYSIS OF THE RESULTS

The questionnaire was completed by a total of 673 respondents, out of which: 28.4% are from 18 to 30 years of age; 31.1% are from 31 to 40 years of age; 28.7% are from 41 to 50 years of age; 9.1% are from 51 to 60 years of age; and 2.8% of the respondents are older than 60 years of age. Out of the total, 59% of participants were male and 41% were female respondents. 67.8% respondents answered they live in cities larger than 35.000 inhabitants, 16.9% live in cities from 10.001 to 35.000 inhabitants, while 15.3% participants live in cities with less than 10.000 inhabitants.

The reason why we grouped respondents in this manner is based on the definitions from the Act on Local and Regional Self-Government, [7] which provides the terms of municipalities, towns and big towns (cities)¹.

According to the research conducted by the United Nations in 2014 more people live in urban areas than in rural areas globally. In 1950, 70% of people worldwide lived in rural settlements and less than 30% in urban settlements. In 2014, 54% of the world's population is urban. The urban population is expected to continually grow, so by 2050, the world will be 1/3 rural and 2/3 urban. Roughly, the population will reverse in comparison to what we had during the 1950s'. 73% of European population already lives in urban areas. The United Nations' research predicts that over 80% of Europe's population will be living in urban areas by 2050. [8] Therefore, the information that more than 2/3 of the respondents live in cities larger than 35.000 inhabitants; is in line with UN's data.

Out of the 466 respondents that stated they are familiar with the term smart-city, 69.1% live in cities larger than 35.000 inhabitants, 17.2% live in cities between 10.001

¹ Croatian Act on Local and Regional Self-Government defines municipalities as units of local self-government (usually) below 10.000 inhabitants, towns as units of local self-government with (usually) more than 10.000 inhabitants, while big towns (cities) are units of local self-government which have more than 35.000 inhabitants.

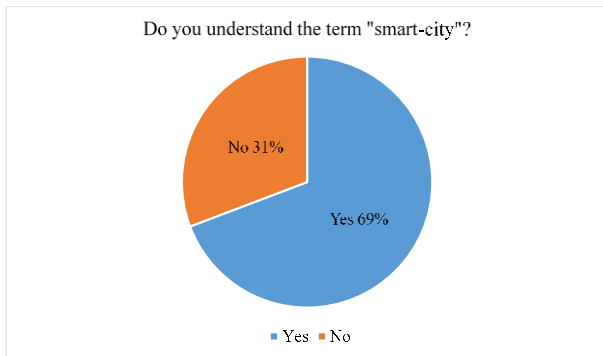


Figure 2: Question 4: Do you understand the term "smart-city"?

and 35.000 inhabitants and only 13.7% live in cities with less than 10.000 inhabitants. Out of the 466 who stated they understand the term smart-city, 39% are female respondents, and 61% male. As for the 207 participants who stated they did not understand the term smart-city, 18.8% live in cities with less than 10.000 inhabitants, 16.5% live in cities with between 10.001 and 35.000 inhabitants, while 64.7% live in cities with the population larger than 35.000. 45.9% are female and 54.1% are male. It can be concluded that mainly inhabitants of big towns (cities) do understand the term smart-city, and roughly equally women and men in an equal percentage.

Respondents correctly noticed some of the elements of the smart-city, such as: citizen-government interconnection (66.1%), energy-efficient facades (39.1%), smart parking (55.7%), smart traffic lights (64.6%), smart public transportation (70.9%), smart energy savings (72.1%), smart security system (62.7%), smart waste disposal (74%), smart education and health care (60.5%), and automated collection of data regarding citizen habits (34.8%), indicating that more than 50% of respondents are familiar with the most smart-city elements. When describing how does the smart-city look like, most of the citizens agreed that a smart-city uses digital technology, combines energy, mobility and infrastructure, increases efficiency, increases citizens participation, enables innovation and improves both social and economic value of the city. These answers again seemingly point out that respondents are familiar with the smart-city topic.

It is interesting to notice that 52% of respondents identified smart benches, 20.2% of them identified free Wi-Fi in bars and 33.1% of them identified shared drives

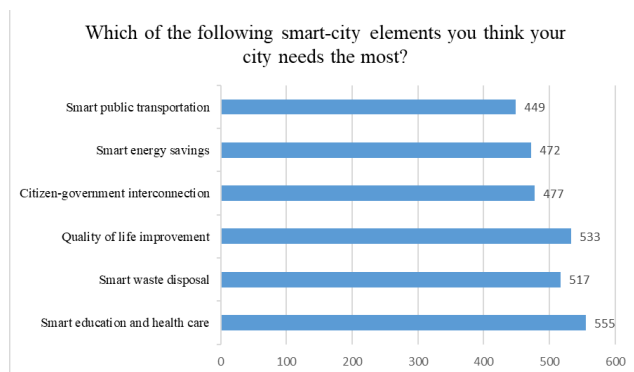


Figure 3: Question 7: Which of the following smart-city elements you think your city needs the most?

(carpooling) as the elements of the smart-city (all of which are false answers). Therefore, it's important to notice that more than half of the respondents are, to some extent, unsure of the term smart-city.

Out of the 350 respondents which selected Smart benches as an element of a smart-city, 76% answered they know what a smart-city is. Also, 72% who selected free Wi-Fi in bars also thought they knew what the smart-city is. Similar percentage is evident in the third false answer: where 79% of respondents who selected shared drives (carpooling) said they knew what the term smart-city means. So, seemingly it looked like the respondents understood the elements of smart-city, but for these non elements they answered incorrectly.

In the question number 6: "Which of the following elements of the smart-city are already provided in the city you live in?" the respondents concluded that 24.8% don't have any of the above elements implemented in their city. 41.5% of respondents stated they have smart benches and 49.9% stated they have free Wi-Fi in bars, which are incorrect answers.

Question seven (7): "Which of the following smart-city elements you think your city needs the most?" represents the opinions of respondents on the smart-city elements needed in their city. The most respondents concluded they primarily need: smart education and healthcare, better citizen-government interconnection, and quality of life improvement, roughly around 80%. (shown in Figure 3). The result suggests that the local self-governments need to educate citizens considerably on the topic because citizens are eager to learn about smart-city methodology.

Question eight (8) was: "Does the introduction of smart-city elements increase the quality of your lives?" Out of the 673 respondents, only 1.5% think that implementing smart-city elements will not improve their quality of life, in comparison to 93.5% who answered positively, while the rest answered: "I don't know". Out of 10 respondents which answered negatively, all of them stated in the final open-ended question that their city is not "smart".

Question nine (9): "Are you familiar with any initiatives your local government is facilitating regarding smart-city elements?" is perhaps the most important question for our research (See Figure 4). The answers indicate that only 19.3% of all the respondents actually knew what their local government is doing regarding smart-city implementation projects. Such a low percentage may indicate one or more of the following:

a) Croatian local governments are not transparent and they are closed to the public;

b) Croatian local governments do not have any plans and/or resources to implement smart-city solutions;

c) Croatian citizens do not have any instruments to inquire or participate in implementing smart-city solutions;

d) Croatian citizens are not interested in local politics and improving the city they live in.

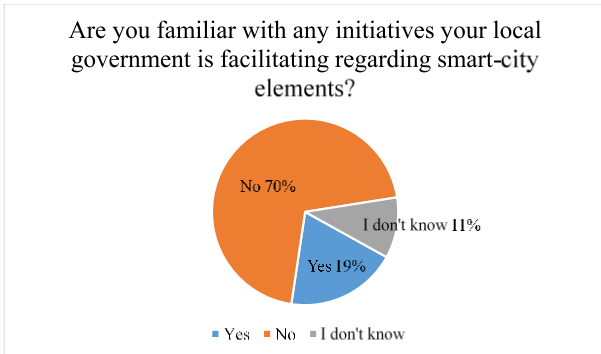


Figure 4: Question 9: Are you familiar with any initiatives your local government is facilitating regarding smart-city elements?

Answers on Question number ten (10): “When do you expect your city will implement some elements of a smart-city?” provide following results: 51% of respondents think that their city will either never implement, or it will take more than 10 years to implement smart-city elements in the city they live in. Only 6% think that it will take less than three years for their local government to implement smart-city elements. The result indicates that people are untrustworthy towards the local governments in Croatia and/or the resources are insufficient for the implementation of smart-city elements (See Figure 5). The reason for this might be that many of the challenges faced by smart cities surpass the capacities, capabilities, and reaches of their traditional institutions and their classical processes of governing, and therefore require new and innovative forms of governance [9].

Surprisingly, a significant percentage of respondents (72%) answered that that they would actively participate in joint decision making within a digital platform on projects relevant to the development of their city. In addition, 26% of them answered that they would participate passively (i.e. following announcements). Therefore, we conclude that Croatian citizens are very interested in participating in local projects, since only 2% of the respondents answered that they would not participate in the (co)decision making processes (See Figure 6).

There are a few succesful cities in Europe (Barcelona and Amsterdam), which developed systems where citizens and companies can easily interact on solving key issues with 'smart' solutions. Barcelona's project "BCN Open Challenge" set out six challenges for businesses and

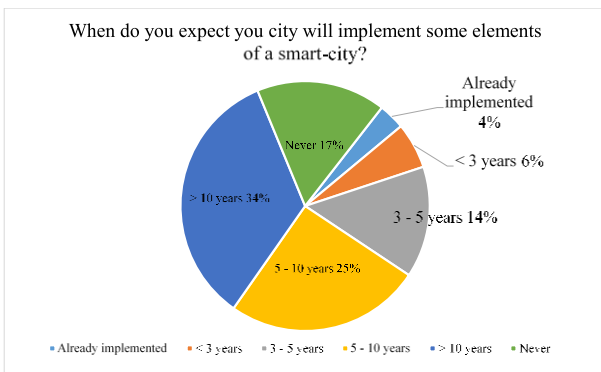


Figure 5: Question 10: When do you expect you city will implement some elements of a smart-city?

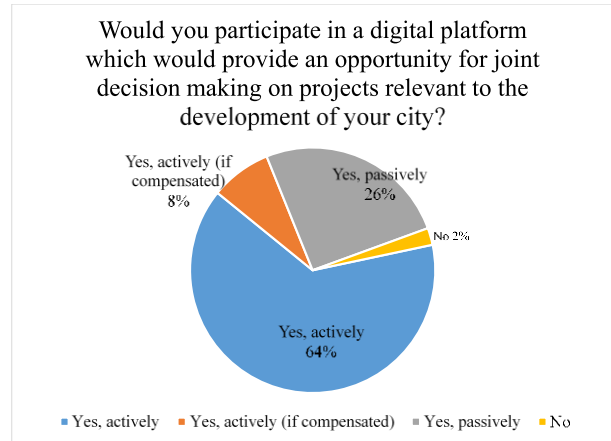


Figure 6: Question 11: Would you participate in a digital platform which would provide an opportunity for joint decision making on projects relevant to the development of your city?

entrepreneurs to provide solutions for transforming public spaces and services. [10] Similarly, Amsterdam Smart City is an online platform which connects all interested parties in one goal: dealing with 'smart city' problems and solutions [11] aiming to improve the functioning infrastructure, access to resources, and safety and security for the population [12].

Croatia needs a fundamental shift, when we think of Croatian cities and about urban development in the near future. Citizen participation reduces government corruption by expanding public insight and decentralizing government power [13] by giving them the ultimate decision in the adoption of the city's services. Building smart-cities through the concession agreements and public procurement models are necessary for the development of all mentioned smart-city elements and improvement of local governments, by helping them become more competent and transparent when awarding concessions and performing public procurement contracts.

The twelfth (final) question: “Do you think the city you live in is “smart” and explain why? was included as an open-ended question. Respondents could freely write and explain their answer. Out of the 673 participants, 589 answered that their city is not “smart” (negative); 22 answered that their city is “smart” (positive); 56 respondents answered answers such as "partly, somewhat, better than the rest, it has potential" (categorized as partly yes); and six (6) respondents did not provide any identifiable answer (Unidentified), as provided in the Figure 7 below. The results indicate that 88% of the respondents' state that their city is not “smart” and needs

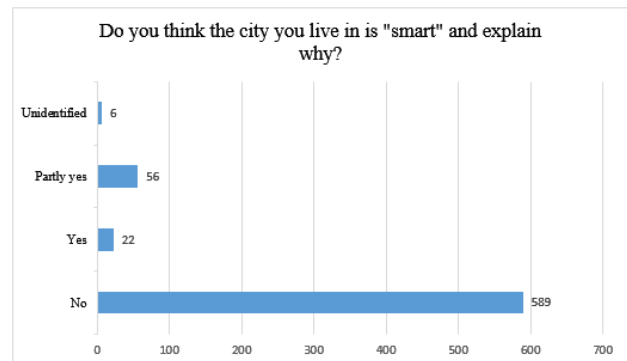


Figure 7: Question 12: Do you think the city you live in is "smart" and explain why?

improvements.

IV. CONCLUSION

The idea behind this paper was to explore Croatian citizens' view towards implementation of smart-city elements into Croatian cities and to use the results of this questionnaire in future practice. There are a few notable limitations in this questionnaire; first, the respondents are coming from different cities of different sizes and from different parts of the country. The questionnaire is intended for the population of Croatia, but the citizens are not related specifically to any region. Therefore, we cannot rule out the possibility that such differences influenced the results.

Secondly, all the questions (except Question 12) were posed as closed-ended. Close-ended questions require respondents to choose from a set of provided response-options. There are also possibilities to use open-ended questions, which we did not use in this questionnaire, (except the last question), since the usage of mixed questions is not suitable for this kind of random sample. Furthermore, Oudejans and Christian (2010) found respondents more likely to respond to narrative open-ended questions when they were interested in the topic of the questionnaire. [14] Also, there are some positive aspects when using the closed-ended questions; answering closed-ended questions is easier as well. Respondents do not have to formulate an answer in their own words. Instead, they only have to check the response option that applies to their answer, making the answering process much easier and less demanding, resulting in better response rates to closed-ended questions. [15]

From the answers of the respondents, it's evident and it can be concluded that the citizens are not familiar with the work and public policies of their local governments. Citizens are highly interested in participating and joint decision making but they are not acquainted with instruments for partaking in local governments decision making processes, due to the fact that local governments don't have and/or don't provide citizens with the plans and/or resources for adopting the elements of smart-cities. Since citizens are not provided with any instruments for joint decision making with the local governments (such as digital platforms mentioned above), we highly recommend adoption of a national-level strategy for better citizen inclusion in joint decision-making processes regarding the implementation of smart-city elements, such as mentioned successful cases from Europe.

There are, however, a few examples of Croatian cities with smart-city technologies. For examples, city of Koprivnica which has implemented smart waste system, E-governance system, electronic bill presentment and payment service (ISO Standard 37120:2014 Sustainable development of communities - Indicators for city services and quality of life) and some other small projects towards becoming a smart-city. [16] In Croatian city of Rijeka, citizens have two smart bus stops offering information which provides a better and more relevant service to citizens and tourists traveling by bus. The bus stops provide users the information on the current locations of the buses and access up to twelve (12) city cameras. [17]

The research has also shown that the Croatian cities need new models of transparent policy making and project performance. Those models should be based on using concession contracts public private partnerships, and innovation partnerships within the public procurement regulations [3].

The significance of this research is to demonstrate citizens' interest regarding possibilities of implementing elements of the smart-city and their active participation towards using models which have proven to be successful in practice. Successful practices, mainly, used concession contracts, public procurement and public private partnership models, which are already available to Croatian local governments, but still underused. This paper should encourage Croatian local governments in using this models in order to boost growth of smart-cities in Croatia.

REFERENCES

- [1] P. Bosch, S. Jongeneel, V. Rovers, H. Neumann, M. Airaksinen, A. Huovila, CITYkeys indicators for smart city projects and smart cities, CITYkeys, 2017.
- [2] P. Raj, A. C. Raman, Intelligent Cities, Taylor & Francis Group, 2015, pp. 80.
- [3] M. Milenković, M. Rašić, G. Vojković, Using Public Private Partnership models in smart cities – proposal for Croatia, MIPRO 2017 - 40th Jubilee International Convention / Biljanović, Petar - Rijeka: MIPRO - Croatian Society for Information and Communication Technology, Electronics and Microelectronics, 2017, pp.1656.
- [4] N. Bradburn, S. Sudman, B. Wiansink, Asking questions: the definitive guide to questionnaire design—for market research, political polls, and social and health questionnaires, John Wiley& Sons, 2004, pp. 302-304.
- [5] R. Kumar, Research Methodology: A step-by-step Guide for Beginners, SAGE Publications, 2010, pp. 139-158.
- [6] S. Kondepudi, R. Kondepudi, What Constitutes a Smart City?- in A. Vesco, F. Ferrero (eds.), Handbook of Research on Social, Economic, and Environmental Sustainability in the Development of Smart Cities, IGI Global book, 2015, pp.12-13.
- [7] Narodne novine, nb. 33/01, 60/01, 129/05, 109/07, 125/08, 36/09, 36/09, 150/11, 144/12, 19/13, 137/15, 123/17. (Narodne novine are an Official Gazette of Republic of Croatia).
- [8] United Nations, Department of Economic and Social Affairs, Population Division (2014) World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352), pp.7.
- [9] A. J. Meijer, J. R. Gil-Garcia, M. P. Rodriguez Bolivar, Smart City Research: Contextual Conditions, Governance Models, and Public Value Assessment, Social Science Computer Review, Vol 34, December 2015, pp. 647 - 656.
- [10] Barcelona City Council, <https://bcnopenchallenge.org/>, retrieved 15/02/2018
- [11] Amsterdam Smart City, <https://amsterdamsmartcity.com/>, Retrieved 15/02/2018
- [12] PwC, Amsterdam, City of Opportunity, 2013, pp.19-30
- [13] D. Araya, Smart Cities as Democratic Ecologies, Palgrave Macmillan, 2015, pp. 19-20.
- [14] M. Oudejans, L. M. Christian, (2010). Using interactive features to motivate and probe responses to openended questions. In M. Das, P. Ester, L. Kaczmarek (Eds.), Social and behavioral research and the internet (pp. 215-244). New York: Routledge.
- [15] M. Fuchs, M. Bošnjak, Open ended questions in Web surveys - Using visual and adaptive questionnaire design to improve narrative responses, Darmstadt, 2014, pp. 73.

[16] Pametna rješenja HT-a i partnera: Grad Koprivnica je prvi pametan grad u regiji s ISO certifikatom, <https://lider.media/znanja/pametna-rjesenja-ht-partnera-grad-koprivnica-je-prvi-pametan-grad-u-regiji-s-iso-certifikatom/>, retrieved 14/02/2018

[17] Rijeka dobila prve pametne autobusne stanice u Hrvatskoj, <https://www.rijeka.hr/rijeka-dobila-prve-pametne-autobusne-stanice-u-hrvatskoj/>, retrieved 14/02/2018