GIS-BASED MODEL FOR THE ASSESSMENT OF THE SMART SUSTAINABLE DEVELOPMENT OF THE MUNICIPALITIES OF NORTHEAST BULGARIA

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Abstract: In recent years, Bulgarian municipalities have introduced smart development systems. The Bulgarian state is at the top of the world rankings regarding household internet access and connection speed. The authors develop and validate a GIS-based model for the analysis and evaluation of sustainable cities. The authors conclude that in a global digital economy and society, Bulgarian regions need to improve the accessibility of WI-FI networks to meet the challenges of Smart Development. In recent years, the authors have observed a growth of Smart Cities initiatives in large areas of Northeast Bulgaria. However, Bulgarian municipalities in the study area are lagging in deploying smart governance systems.

Key words: Smart sustainable development, GIS, model, Bulgarian municipalities, territorial sustainability.

1. INTRODUCTION

Creating appropriate conditions and an information environment is an important prerequisite for the long-term smart sustainable development of Bulgarian municipalities. Important factors for this are the introduction and use of ICT and achieving territorial sustainability through effective smart governance. Modern ICT development predetermines the construction of sustainable cities. In this regard, a sustainable city integrates modern information and communication technologies, urban systems management, applying smart solutions together with the concept of sustainable development. The Internet of Things and wireless networks create intelligent data collection and management conditions using the multi-level smart city architecture [1]. The construction of smart city architecture is due to smart city planning [2].

The Bulgarian state is improving internet access and technology. In this regard, Bulgaria is deploying successfully 5G technologies. These significant advances in the implementation of smart governance solutions at the macro level do not automatically transfer to the local level. The authors identify this problem in the smart sustainable

development of municipalities in the Northeast region. In this regard, the authors develop a GIS-based model to analyze and evaluate Smart city construction in the Northeast region under study. The authors introduce following a certain sequence based on criteria and evaluation indicators to assess the sustainability and smartness of four municipalities - Varna, Dobrich, Shumen, and Targovishte. The analysis is based on criteria such as - the presence or absence of electronic services; and the possibility to order and pay for services electronically. The authors use good research practices in the study [3]. The results show that the studied cities are beginning to become smart and sustainable cities.

2. INTELLIGENT SUSTAINABLE CITY DEVELOPMENT THEORY FRAMEWORK

In the modern conditions of digitalization of socio-economic and territorial processes, the achievement of sustainable development is dictated by the efficient use of resources and their management using information and communication technologies (ICT). Achieving sustainability in the development of territorial units is directly dependent on achieving smart development in the context of building a Smart City. 'Smart spatial development' refers to the strategic and holistic approach of using technology, data, and innovation to promote sustainable and efficient development in a specific geographical area. This includes using different aspects of smart city concepts to optimize resource use, improve quality of life, and promote economic growth.

Research in the field of smart cities examines the smart city in three main aspects: technology, population, and politics [4]. The main focus for turning cities into intelligent systems is on the use of IC technologies [5]. Other authors emphasized increasing energy efficiency and achieving environmental sustainability, as the main element of smart cities [6]. The realization of this concept is related to the rational management of urban systems and their resources. In modern conditions, improving the management process of urban systems is related to the application of the concept of IoT, which allows the integration of platforms into a single system and increases their interconnection [7]. Cyber security, privacy protection, and the formation of an information society are essential parts of the development of smart cities. The growing informatization of processes in modern society also gives rise to several challenges related to the confidentiality of information and data protection [8]. Citizen-local government interaction through ICT requires significant measures in terms of data security policy and data privacy [9]. A main emphasis in the application of ICT is the limitation of unfair and corrupt practices [10].

The concept of the smart city foregrounds digital technologies and the possibilities of integration with the existing (traditional) infrastructure [11]. Such an example can be municipal services such as public transport, theaters, cinemas, health and educational facilities, local and state institutions, and other socio-cultural activities. In this way, simplification and optimization of processes, and improvement of the user experience, which does not require radical changes in the established patterns of behavior, are achieved. The smart development of cities is defined as one of the main

factors for achieving the goals of sustainable development [12]. Thus, the two concepts have their points of contact.

Many authors working in this field derive different models for evaluating smart and sustainable development through different systems of indicators related to both concepts [13]. Through the application of Geographical Information Systems, it is possible to visualize and spatially analyze the progress of territories according to key indicators for intelligent and sustainable development. Several GIS-based models of spatial analysis and evaluation [14], as well as the integration of GIS technology and smart city tools [15], are found in the scientific literature.

The concept of smart development focuses on creating a smart, sustainable, and future-oriented environment that integrates technology, data, and people to shape the development and growth of a specific territory. Thus, achieving smart development is directly linked to achieving sustainable development. In many areas, they overlap and share common goals. One of the main goals of smart and sustainable development is the optimization and rational use of resources. Smart development uses approaches based on information and communication technologies to improve the efficiency of resources and their management and to limit their irrational use and harmful impacts on people and nature. Sustainable development promotes the conservation and efficient use of resources, considering long-term viability and minimizing environmental impacts.

Both smart and sustainable spatial development approaches have a long-term perspective in their planning processes. Both approaches value the use of new technologies and digital solutions to increase efficiency, improve services, and address environmental and social challenges. Integration of systems and processes underpins both approaches. In general, smart, and sustainable territorial development share common goals, yet the two concepts also have their differences [16].

Table 1. Differences between smart and sustainable development

	Intelligent development	***Sustainable development***
Focus	*use of innovation and technology in all spheres of social and economic life*	*the balance between economic growth, social justice, and environmental protection*
Range	*narrower, focused on technology-oriented solutions*	*broader, covering a wide range of sectors and processes*
Approach	*an integrated approach guided by technological advances*	*a multidimensional and integrated approach*
Balance	*driven by technological progress and innovation*	*the emphasis is on balancing the three dimensions*
Time	*provides immediate benefits and short-term returns*	*long-term challenges, continuous efforts, and adaptations over time*

Smart development focuses primarily on the deployment and use of technology, data centers, and innovation to optimize processes, increase efficiency, and improve the quality of life in a specific territorial unit. Sustainable development focuses on striking a balance between economic growth, social progress, and environmental protection and encompasses a broader set of principles including long-term viability, resource conservation, environmental balance, and social equity. However, the focus of both concepts has tangential points - rational use, allocation, and management of resources, and improving the living environment and well-being of people through ICT and innovation.

3. RESEARCH METHODOLOGY AND METHODOLOGICAL FRAMEWORK

For the implementation of the GIS-based model for the assessment of smart and sustainable development of the municipalities of the Northeast planning region in Bulgaria, it is necessary to adopt a conceptual framework - a sequence of steps and actions for its implementation.

The main objective of the study is to analyse and assess the smart and sustainable development of municipalities in the Northeast Planning Region through a developed model.

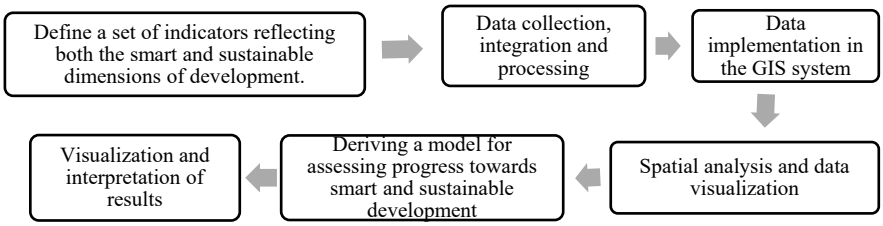

Figure 1. Methodological framework

The developed model is based on the view that the studied issues are characterized by complexity and a combination of different scientific fields. Therefore, the analysis and evaluation of sustainable cities require the application of interdisciplinary and network approaches that underpin the model proposed by the authors. For completeness of the methodological apparatus, the authors use descriptive, comparative, and GIS analysis in the study of municipalities.

The research algorithm includes the introduction of a system of indicators for the assessment of smart and sustainable urban development. Based on the proposed system of indicators and criteria for the evaluation of municipalities, the authors calculate their weighted values, which express the generalized model for the evaluation of municipalities. The data included in the model covers the period 2015-2021. In this way, it covers the implemented policies and initiatives from the two program periods for the EU 2007-2013 and 2014-2020, as well as the measures under the current program period 2021-2027.

4. RESULTS AND DISCUSSION

4.1. Some remarks about the model for assessing a smart sustainable city

The model developed by the authors is aimed at assessing the smart sustainable development of municipalities in Bulgaria. This model evaluates the smart development of municipalities and their territorial sustainability. The main objective of the model is to identify the degree of sustainability and smartness of cities and thus outline the roadmap for their future development. A review of the scientific literature shows that most of the studies are focused on the evaluation of individual systems of city management - drinking water consumption [17], energy consumption [18], energy efficiency [19], etc.

An important stage in the development of such a model for the analysis and evaluation of Bulgarian municipalities is the definition of criteria and indicators in different areas such as economic, environmental, social, ecological, smart, etc. The complexity of developing an accurate and precise model depends on the choice of indicators. This is also the biggest challenge for researchers. According to some authors, the criteria that indicators should meet are - objectivity, relevance, measurability, representativeness, accessibility, comparability, and the possibility of validation [20]. The model presented in this study attempts to meet all these criteria by refracting smart development through the prism of achieving territorial sustainability. However, the model is debatable because it uses both quantitative and qualitative indicators. Other challenges that such a model must overcome are the balance between different groups of indicators and the wide variety of definitions available in the literature.

4.2. Indicators for measuring territorial intelligence and sustainability

Since the concepts of smart and sustainable development of territorial units have a common vision and share similar goals, it is necessary to consider common, interrelated factors and criteria for achieving smart sustainability. On this basis, it is necessary to derive a comprehensive system of indicators to measure progress towards smart sustainability, based on the priorities and objectives of both concepts. Such common assessment indicators could be:

* Digital infrastructure. Infrastructural provision is one of the main components of a smart city, as it facilitates connectivity, improving communication and access to services. The digital infrastructure includes the territory's broadband network connectivity, the share of the population with access to the Internet, and others.

- Adoption of the IoT concept – individuals/businesses/administration using Internet-connected devices and systems, and use of the Internet to interact with administrative bodies and public institutions.

* Smart Governance. This indicator determines the progress of local government in terms of the digitization of services and processes and is directly related to the digital infrastructure. It is most often expressed in the e-governance services provided by the municipality, such as:

- Availability of digital delivery platforms, by local administration and citizen access to public services.

- Availability and accessibility of public data for public use and transparency of information.
- Availability of platforms and mechanisms for citizen participation in decision-making processes.

* Sustainable infrastructure. This indicator determines the provision of the territory with physical infrastructure directly related to sustainable development - reduction of harmful effects on the environment from human activity, improvement of mobility, public utilities, development, and people's lifestyle. Includes engineering and technical infrastructure such as:

- Energy infrastructure - renewable energy installations, energy-efficient buildings, energy-efficiency systems, and technologies.
- Transport infrastructure - provision of different modes of transport to populations and settlements, quality of transport infrastructure, transport management systems (smart mobility).
- Social infrastructure - provision of hospitals, healthcare facilities, and access to social services.
- Waste management - the proportion of population and settlements covered by waste collection systems, waste collection, and treatment facilities, and intelligent waste management systems.
- Water management - efficient use of water, water supply and sanitation systems, wastewater treatment plants.

* Innovation and technology. This summary indicator measures the investments made and the innovations and technologies implemented by local authorities to improve the public services provided the business environment, and the improvement of living standards. Includes development of innovation, research, and development - investment in research, and collaboration between academia and industry.

- The presence of innovation centers, technological enterprises, Start-up systems, the share of employees in these types of enterprises, and the digital skills of the population.

* Environmental sustainability - This indicator expresses the ecological condition of the territory and the measures taken to limit the harmful effects on the environment. It is directly related to the sustainable infrastructure indicator and includes activities related to environmental management and protection:

- Air pollution - levels of harmful emissions and greenhouse gases, promotion and investment in renewable energy sources, reduction of fuel use.
- Biodiversity conservation - protected areas, biodiversity conservation investments, habitat restoration, and sustainable land use practices.
- Waste management - measures to improve waste and wastewater management, reduce the amount of waste generated by households and industry, involve citizens in waste management, and separate waste collection.

* Social and cultural sustainability This indicator measures the measures and actions taken by local гожернмент and the provided social services related to social justice, well-being, and the quality of life of citizens, an essential element for achieving sustainable development:

- Access to services - health, education, justice, transport, and mobility.

- Social justice - material and social deprivation, populations at risk of poverty, and social exclusion.
- Preservation of cultural and historical heritage - measures and investments to preserve cultural diversity, support local cultural practices, and maintain heritage sites.

* Economic development. This indicator determines the economic condition of the territory and includes indicators for measuring economic growth:

- Assessment of the overall economic performance and growth of the territory - GDP growth, GVA, the economic activity of the population, number of enterprises, amount of investment in different sectors of the economy
- Socio-economic development indicators - employment and household income, labor migration.

The economic condition of the territory determines its possibilities for achieving intelligent and sustainable development and is related to all the listed indicators, as an opportunity to undertake measures and activities to improve the environment for people's living and activities.

Each of the indicators is relevant to all elements of sustainable development and they cannot be categorically grouped by the respective dimensions of sustainable development. A change in the values of one indicator has an impact on the values of another indicator.

This system of indicators and benchmarks provides a generalized framework for assessing the smart and sustainable development of municipalities. Using these indicators, the progress of territorial units can be assessed, areas for improvement can be identified and efforts can be directed towards achieving a smarter and more sustainable urban environment.

4.3. Application of a model for assessing progress toward smart development and territorial sustainability

Based on the indicators and criteria, it is necessary to derive a generalized model for assessing the progress of municipalities toward achieving smart and sustainable development.

Once the indicators have been identified and the necessary data and information collected, it is necessary to determine the direction of movement of the value of each indicator. The assessment of smart sustainable development is the determination of the baseline and target values of the selected indicators. The indicators' baseline values are those measured at a certain starting point in time, which must be the same for all indicators. As the study is for the period 2015-2021, the baseline values are the 2015 indicator values. The data are from the National Statistical Institute of Bulgaria [21] and Eurostat [22].

The target values are the desired values of the indicators at a future point in time, which again should be the same for all indicators. The target values of the indicators should reflect the objectives that the local government wants to achieve. Achieving the target values means that the municipality is developing in the desired direction and that the development process is balanced and sustainable. The target values for some of the indicators have been taken as EU averages (for example average income levels of the

population, unemployment, persons at risk of poverty and social exclusion, education level of the population, harmful emissions, waste generated, energy efficiency, etc.).

In the next stage of the assessment, the weights of each of the indicators should be determined. In assessing progress toward smart sustainable development, it is necessary to consider which factors have a greater impact on the development of the territory and which less and to weigh each indicator higher or lower accordingly. Weighting is also necessary in cases where the difference between the baseline and target importance of an indicator is small and small changes in the importance of an indicator can lead to large progress in sustainability. Accordingly, weights are also needed when there is a large difference between the baseline and target values of an indicator and a large change in the value of the indicator leads to small progress. The sum of the weights of the sustainability indicators for the municipality/region should equal one ($\sum k = 1$).

Once the baseline and target values of the indicators and their weights have been determined, the process of calculating the progress of the municipality about each of the indicators can proceed:

$$I_{mn} = It_{mn} - Ib_{mn} \quad (1)$$

where: *Imn* - the desired progress of the *m*-th municipality for the period concerning the *n*-th indicator; *Itmn* - target value of the *n*-th indicator for the municipality; *Ibmn* - baseline value of the *n*-th indicator for the respective municipality.

This index shows the change in the value of each of the indicators for smart and sustainable development for a period of consideration towards the achievement of the set goals.

After calculating the progress of each municipality with each indicator, the progress rate of the municipality indicator should be found. This is calculated using the formula:

$$K_{mn} = \frac{Ic_{mn} - Ib_{mn}}{I_{mn}} \quad (2)$$

where: *Kmn* - coefficient of the progress of the *m*-th municipality concerning the *n*-th indicator; *Icmn* - current value of the *n*-th indicator of the *m*-th municipality.

This coefficient expresses the progress of the respective municipality according to a certain indicator at the present moment - the current state against the set target values.

When defining the desired progress and the progress coefficients of the municipality, the desired direction of progress must be taken into account, that is, what the municipality is aiming for - a decrease or an increase in the value of the indicator When the desired change in the indicator is n the direction of decrease, as in the intromission levels" and "was generated", the formulas take the following form:

$$I_{mn} = Ib_{mn} - It_{mn} \quad (3)$$

$$K_{mn} = \frac{Ib_{mn} - Ic_{mn}}{I_{mn}} \quad (4)$$

To calculate the value of development, it is necessary to derive a common indicator that provides a synthesized assessment of the municipality's progress in terms of smart and sustainable development. This indicator should bring together the individual coefficients of progress about each of the indicators:

$$I_{ssd} = \frac{\sum k_n * K_{mn}}{n} \quad (5)$$

where: *Issued* - index of smart sustainable development; *kn* - the weight of the municipality's progress factor about the *n*-th indicator ($\Sigma kn = 1$); *n* - the number of indicators.

The development of a municipality is considered smart and sustainable if *Issd* has a positive value. A positive value of the index means that none of the individual progress coefficients for the indicators has a negative value, that is, there is no deterioration in any of the sustainable development indicators. By applying this index, development is assessed according to the Pareto optimality criterion. It is assumed that intelligence and sustainability are achieved if the situation of any indicator improves, provided that there is no deterioration in the situation of another. The closer the value of *Issd* is to one, the closer the city/municipality is to the goals. Negative values indicate regression, and zero values indicate lack of development [23].

The model thus derived for assessing smart and sustainable development and determining the values of indicators, coefficients, and indexes is implemented in a GIS environment using the smart mapping feature of ArcGIS Online [24].

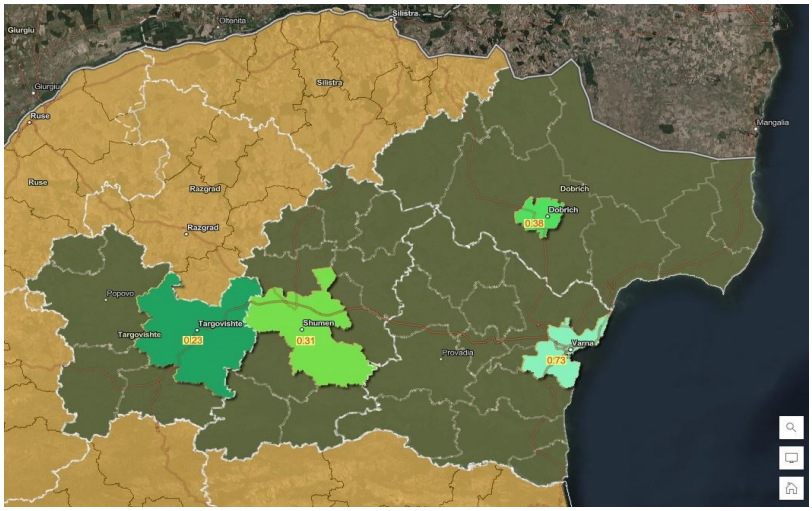

Figure 2. Smart Mapping of the Smart Sustainable Development Index of Municipalities using ArcGIS.

From the implementation of the GIS-based model for assessing the progress towards smart and sustainable development of the municipalities of the North-Eastern Planning Region, it is observed that for the period 2015-2022, all four municipalities have made progress, but the municipality with the most significant progress is Varna - the highest values of the index for smart and sustainable development. It can be said that Varna municipality has made significant progress but still lags compared to the EU average. The other municipalities have made relatively little progress. Thus, Varna is positioning itself as a major urban center, an engine of growth for the North-East planning region in Bulgaria.

Despite the high scores of the four municipalities in terms of e-services provision, the high percentage of the population with internet access and the relatively good provision of ICT infrastructure, etc., there is a significant lag in the EU average (the desired state) in terms of progress towards smartness and sustainability. This is due to the low levels of social and economic resilience of the municipalities of Dobrich, Shumen, and Targovishte. They have significant problems such as a declining and aging population, low levels of population education and digital skills, higher levels of unemployment and risk of poverty, lower incomes, low levels of investment, etc.

5. CONCLUSION

The main urban centers of the North-Eastern Planning Region in Bulgaria are making progress in terms of smart and sustainable development. However, this progress is insignificant, especially for the municipalities of Dobrich, Shumen, and Targovishte. From the analyses made, it is noticed that about the indicators for intelligent development - application of ICT, digital infrastructure, access to the Internet, electronic services provided by the municipalities, and others, greater progress is reported. Regarding the other indicators related to sustainable development, however, social, economic, demographic, political, and environmental, the progress of the municipalities is extremely small, below 0.5, with only the municipality of Varna with 0.73. This is a basic prerequisite for the low values of the Index for achieving intelligent and sustainable development. This requires taking significant measures by local and national governments to achieve sustainability.

The application of the Geographical Information Systems allows the implementation of multi-criteria spatial analysis and the comparison of municipalities according to various indicators. Through GIS, a model of the development of the territorial units was made, thus clearly showing the differences in the development of the territory.

The proposed evaluation model provides a general idea of the smart and sustainable state of municipalities. This model cannot be defined as universal. Although it covers many indicators and measures, each territory is characterized by specific needs and peculiarities, thus, the indicators included in the model can be changed and adapted to specific territories of analysis.

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REFERENCES

[1] Gaur, A., Scotney, B., Parr, G., McClean, S., Smart city architecture and its applications based on IoT, *Procedia Computer Science*, 2015, vol. 52, pp. 1089-1094, https://doi.org/10.1016/j.procs.2015.05.122.

[2] Ekman, U., Smart city planning: Complexity, *International Journal of E-Planning Research (IJEPR)*, vol. 7, no. 3, 2018, pp. 21, DOI: 10.4018/IJEPR.2018070101.

[3] Jonathan, O., et al. A comparative study of e-Government successful implementation between Nigeria and Republic of Korea. *In Asia-Pacific World Congress on Computer Science and Engineering*, 2014, pp. 1-7. IEEE.

[4] Nam, T., Pardo, T., *Smart city as urban innovation: Focusing on management, policy, and context*, 2011, available at: http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=1E7AE9DD70EEA413FD04705.

[5] Washburn, D., Sindhu, U., Balaouras, S., Dines, R.A., Hayes, N., Nelson, L.E. Helping CIOs understand "smart city" initiatives: Defining the smart city, its drivers, and the role of the CIO. *Forrester Research*, Cambridge, 2010.

[6] Cugurullo, F., *The origin of the smart city imaginary: from the dawn of modernity to the eclipse of reason*. The Routledge Companion to Urban Imaginaries, Routledge, 2018.

[7] Ioannis Adamopoulos, Aristidis Ilias, Christos Makris, Yannis C. Stamatiou. Intelligent surveillance systems on the Internet of Things based on secure applications with the IBM cloud platform. *International Journal on Information Technologies and Security*, vol.15, no.2, 2023, pp. 59-74. https://doi.org/10.59035/XVRS3592.

[8] Romansky, R., Privacy and data protection in the contemporary digital age, *International Journal on Information Technologies and Security*, vol. 13, no.4, 2021, pp. 99-110.

[9] Romansky, R. A survey of digital world opportunities and challenges for user's privacy. *International Journal on Information Technologies and Security*, vol. 9, no. 4, 2017, pp. 97-112.

[10] Anguelov, K. Opportunities for prevention of corruption in public procurement in electricity distribution companies in Bulgaria," *2019 16th Conference on Electrical Machines, Drives and Power Systems (ELMA)*, Varna, Bulgaria, 2019, pp. 1-3, doi: 10.1109/ELMA.2019.8771508.

[11] Batty, M., Smart cities, Big Data. *Environment and Planning B: Planning and Design*, vol. 39, 2012, pp. 191 - 193, https://doi.org/10.1068/b3902ed.

[12] Clement, J., Ruysschaert, B., Crutzen, N. Smart city strategies – A driver for the localization of the sustainable development goals? *Ecological Economics*, vol. 213, 2023, 107941 https://doi.org/10.1016/j.ecolecon.2023.107941.

[13] Tsun Lai, C., Cole, A. Measuring progress of smart cities: Indexing the smart city indices. *Urban Governance*, vol. 3, no. 1, 2023, pp. 45-57, https://doi.org/10.1016/j.ugj.2022.11.004.

[14] Stessens, P., Khan, A. Z., Huysmans, M., Canters, F. Analysing urban green space accessibility and quality: A GIS-based model as spatial decision support for urban ecosystem services in Brussels. *Ecosystem Services*, vol. 28, Part C, 2017, pp. 328-340, https://doi.org/10.1016/j.ecoser.2017.10.016.

[15] Turek, T., Stępniak, C. Areas of integration of GIS technology and smart city tools. Research findings. *Procedia Computer Science*, vol. 192, 2021, pp. 4681-4690, https://doi.org/10.1016/j.procs.2021.09.246.

[16] Ahvenniemi, H., Huovila, A., Pinto-Seppä, I., Airaksinen, M., What are the differences between sustainable and smart cities? *Cities*, 60, 2017, pp. 234-245, 10.1016/j.cities.2016.09.009.

[17] Feizizadeh, B., Ronagh, Z., Pourmoradian, S., Gheshlaghi, H. A., Lakes, T., & Blaschke, T. An efficient GIS-based approach for sustainability assessment of urban drinking water consumption patterns: A study in Tabriz city, Iran. *Sustainable Cities and Society*, 64, 2021, 102584. https://doi.org/10.1016/j.scs.2018.05.005

[18] Moghadam, S. T., Toniolo, J., Mutani, G., & Lombardi, P. A GIS-statistical approach for assessing built environment energy use at urban scale. *Sustainable Cities and Society*, vol.37, 2018, pp. 70-84. https://doi.org/10.1016/j.scs.2017.10.002

[19] Groppi, D., de Santoli, L., Cumo, F., & Garcia, D. A. A GIS-based model to assess buildings energy consumption and usable solar energy potential in urban areas. *Sustainable cities, and society*, vol. 40, 2018, 546-558. https://doi.org/10.1016/j.scs.2020.102584

[20] Garau C, Pavan VM. Evaluating urban quality: Indicators and assessment tools for smart sustainable cities, *Sustainability,* vol. 10, 3:575, 2018. https://doi.org/10.3390/su10030575

[21] National Statistical Institute of Bulgaria, Available at: https://www.nsi.bg/en.

[22] Eurostat, Available at: https://ec.europa.eu/eurostat/data/database.

[23] Nedeva, I. Methodology for assessing the sustainable development of industrial zones. *Scientific Papers of Ruse University* (*Nauchni trudove na Rusenskia universitet)*, vol. 10, part 1.2, 2010. Available at: http://conf.uni-ruse.bg/bg/docs/cp10/1.2/1.2-15.pdf. (in Bulgarian)

[24] *A Guide for Smart Communities: Using GIS Technology for Local Government Management*. ICMA ESRI Washington 2018, https://icma.org/sites/default/files/18-137%20GIS%20e-rimer%20Report_final.pdf.

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