THE KEY COMPONENTS OF A SMART CITY

Vlad-Tudor TRINCĂ[1] ORCID: 0009-0004-5188-0607

Abstract: *Smart city development has been brought into the spotlight frequently in recent years. As the implementation of digital solutions by municipal governments has accelerated during the pandemic, more municipalities are considering the integration of a smart city framework. City authorities focus on better delivering services to citizens in a modern, efficient and sustainable way. Recent literature shows an ongoing interest among scholars regarding this topic and underlines the need for further research. By underlining opportunities and ways of overcoming the challenges in the adoption of this framework, this paper aims to highlight elements that make a city the perfect candidate for being called smart.*

Keywords: *smart city, management, digitalization*

JEL Classification: O30, O38, M15, R58

Introduction

An important objective for local governments is the one of achieving the effective implementation of a smart city framework (van Twist et al., 2023). This concept is a relatively new one and the interest for further research on this subject is significant as recent data shows that in 2050 seven out of ten citizens worldwide will reside in urban areas (Stegerean et al., 2022). (World Bank, 2022) states that if properly managed, urbanization has the potential to contribute to sustainable growth by fostering increased productivity and innovation. This is particularly significant due to the fact that cities account for over 80% of the total GDP generation around the globe.

Another factor that determines municipalities to integrate the smart city components is the rapid digitalization brought by the pandemic. The majority of processes and services had to be adapted in order to comply with the new requirements and restrictions. With this change, the trend of digitalizing was set (Trincă et al., 2021). Local governments started to implement a comprehensive framework, in order to integrate the modern technologies integrated, in order to better serve citizens' needs in a more efficient way (van Twist et al., 2023).

As per the European Commission, a "smart city" incorporates digital technologies to improve existing networks and services, benefiting both residents and businesses. Beyond effective resource management and pollution reduction, a smart city encompasses various aspects. These include upgraded water distribution and garbage collection equipment, advanced city transportation systems, as well as better energy efficient solutions for generating light and maintaining warmth in commercial and residential spaces. Additionally, it entails fostering a municipality that is increasingly attentive and interactive, enhancing public safety in communal spaces, and meeting the evolving needs of citizens that are getting older. (European Commission, 2023).

(Kinelski, 2022) states that the smart city concept represents "an intellectual capacity referring to the innovative, social, technical, economic aspects of development". Authors (Khatoun

[1] Babeș-Bolyai University, Faculty of Economics and Business Administration, Cluj-Napoca, Romania, vlad.trinca@econ.ubbcluj.ro

DOI: 10.29302/oeconomica.2023.25.1.8

and Zeadally, 2016), define a smart city as a cutting-edge metropolitan region that accommodates the needs of organizations, institutions, and residents in particular.

The policies applied in smart communities will play a crucial role in shaping how cities leverage technology to cultivate innovation networks, promote well-being in societies, and stimulate dynamic economies. These policies are also designed to address the multitude of challenges related to sustainability and urban development, offering solutions for these pressing issues. While these goals are ambitious, they reflect tangible and essential urbanization strategies which involve significant investments and carry long-term consequences. This is why it is critical to do thorough and coherent research on them, both at the policy formulation and policy implementation levels. Smart cities may and should be built strategically in order to produce concrete urban/economic/social development effects. Further study in this area is thus required (Angelidou, 2015). (Toli and Murtagh, 2020) also suggest further research on the smart city framework, definitions and dimensions.

This paper offers a comprehensive examination of the essential elements comprising a smart city, using a literature review process that focuses on studies published in the recent period. The next section of the article is represented by research methodology, followed by the section of results and discussion, with the final section of the paper being dedicated to drawing conclusions based on the findings of the literature review and providing insights into potential future research prospects.

Research methodology

In this research, the main research objective is to underline the fundamental elements that a smart city encompasses, as outlined in recent literature. Two research questions were set, in order for this objective to be achieved:

RQ 1. What are the key components of a smart city?

RQ 2. How should local governments implement the smart city components?

The research questions are answered through a literature review. For this research, we considered a selection of articles published in the recent years.

Results and discussion

Many scholars have divided the idea of a "smart city" into several characteristics and dimensions in an effort to better define it, citing the difficulty of managing the smart city idea holistically as justification (Albino et al., 2015).

From the articles researched, we developed a diagram that presents the key important dimensions of a smart city:

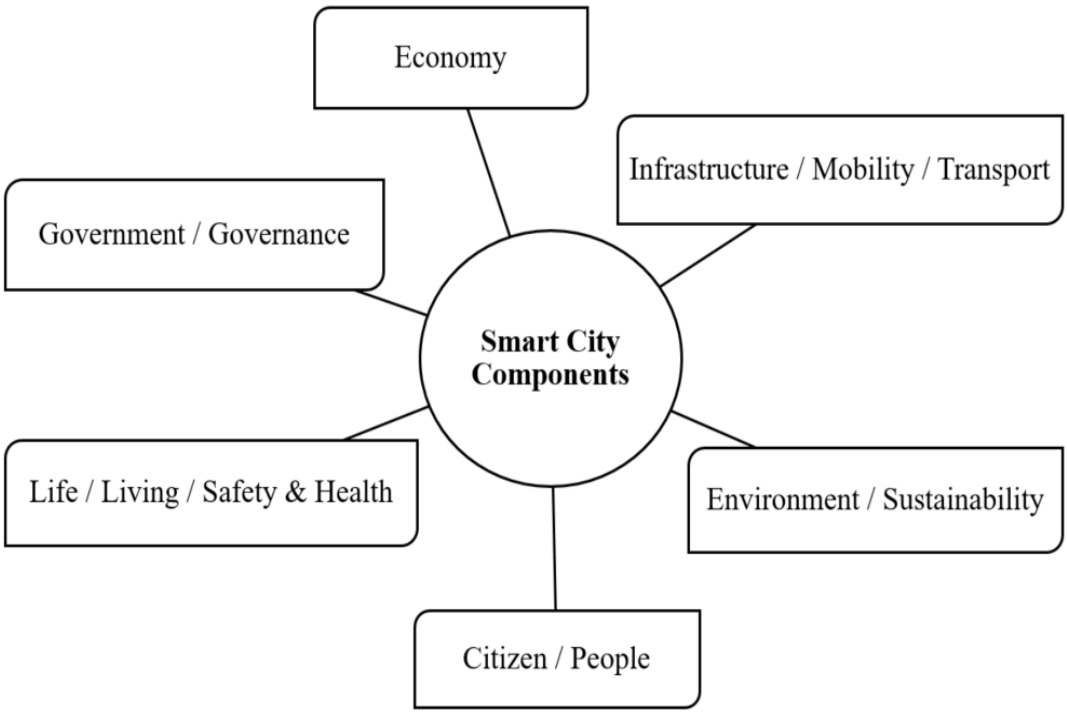

Figure 1. Smart City Components
Source: adapted from (Arroub et al., 2016), (Winkowska et al, 2019) and (Bokolo Jnr, 2021)

Six major areas have been established to unite the idea of a smart city; cities seeking to be smart ought to pay attention to these areas, develop them, and use them as the primary networking activities (Kinelski, 2022). The author indicates these key areas as being the ones integrated into (fig. no. 1). Some components are more important for the citizens than the others, people living in smart cities being more interested about Smart Mobility and Infrastructure. Smart Environment and Smart Governance have a medium degree of relevance for the citizens, according to (Wirtz et al., 2021).

Smart Economy

Numerous studies have shown that there is no single definition of this concept and that diverse interpretations exist (Arroub et al., 2016). The authors state that it consists of clever businesses that develop novel concepts and raise the price-quality ratio using the notion of resource optimization, yet this description does not encompass all of the distinctive features of the Smart Economy component. According to (Sadiku et al., 2021), this notion relates to e-business and e-commerce, as well as economic potential. Smart Economy is connected to economic development and competitiveness as an outcome of "innovation, productivity, entrepreneurship, and a flexible labor market". This synergy results in an economy with efficient, long-term manufacturing methods. Another effect is a flexible labor market that offers a range of economic opportunities to devise innovative approaches for addressing difficulties operations maintenance, leading to resource and cost savings. (Sadiku et al., 2021). (Stübinger et al., 2020) underline that the adoption of information and communication technologies (ICT) within company operations, innovative operations in businesses, and innovative technology sectors are all examples of what is meant by the term "smart economy." The expansion of businesses, the creation of jobs, an increase of personnel skills, and increases in productivity define this economy.

(Ristvej et al., 2020) state that the usage of economic models that emphasize sustainable practices, resource efficiency, and reduced carbon emissions, virtual and augmented reality technologies, innovative production technologies, the application of artificial intelligence, intelligent infrastructures and energy systems, the digitalization of industries and collaborative partnerships between academia and industry all contribute to the smart layer of the economy". According to other researchers, the component is predominantly influenced by the process of connecting and engaging with international economic systems, enabling the city to participate in global trade, investment, and exchange of goods and services. integration with global markets. This aspect can improve the town's capacity to compete with other regions and attract business investments, foster innovation, and create employment opportunities. Furthermore, the municipality's capacity to draw tourists and travelers from various locations, commerce, cash, and talented individuals contribute to the overall growth of the economy.. However, data from the literature showed that economic progress has frequently been connected with resource depletion, with negative ramifications for future development. As a result, smart cities must manage natural resources (Bokolo Jnr, 2021).

Research findings in the available literature address numerous aspects of the financial advantages connected to smart economy component and its relationship with the inhabitants. By helping businesses attract additional clients, online shopping solutions can be effective in the digital municipality. It remains difficult to strike a balance regarding innovation and client satisfaction in the light of a smart economy that considers people' worries about their personal information (Kirimtat et al., 2020).

Smart Government / Governance

(Arroub et al., 2016) state that Smart Government comprises various elements, including a set of individuals, technology, regulations, procedures, assets, cultural standards, and information all working together to facilitate and enhance the municipality's governance operations. Because of the vast range of partners, governance is critical to the achievement of the smart town ecosystem. To achieve their objectives, these ecosystems must allow all stakeholders, including residents, to participate and create smart city solutions (Ooms et al., 2020). Information systems and related services need to be endorsed through collaboration between stakeholders and governing bodies to encourage public input and involvement. Achieving this aspect would strengthen the effectiveness of the principles of smart governance in any setting (Kirimtat et al., 2020).

Smart government integrates ICT in aiding lawmakers to make choices and create plans. It requires modifying how public services are distributed and enhances self-government procedures. Furthermore, it is focused on the public's leadership and services for higher efficiency and ongoing development using information and communications technology advancement, such as electronic democracy or electronic government (Bokolo Jnr, 2021). (Stegerean et al., 2022) suggest a solution that is effectively applied by many cities in terms of smart governance: the integration of all public services into a single digital platform that helps citizens in accessing these services without the need of being present at the city hall. Other researchers, such as (Ristvej et al., 2020) state that smart government is characterized by transparent governance, high-quality services, and easy access to relevant information. In order to enhance services, bureaucratic red tape should be reduced, bidirectional contacts should be more effective, and visitor demands and preferences should also be considered. E-Democracy is used in smart cities to improve development results for all citizens (Kumar and Dahiya, 2017).

Smart city administration necessitates tackling significant socioeconomic issues, such as assuring digital inclusion through new forms of public involvement. Even in the digital age, physical "third places" that are neither home nor the workplace are nevertheless essential to fostering knowledge sharing and the development of new skills. Engagement requires more than

just listening to individuals; it also entails working with them to co-create public policy (OECD, 2020).

Local administrations that offer direct access to databases, develop, integrate and promote digital applications are taking the right steps to ensure the prompt and efficient provision of information and services to the public. One of the main goals of any municipality is the one of increasing the efficiency of urban management. Many cities improved this aspect by the integration of smart government solutions.

Smart Citizen / People

This component's description differs from the others in that it concentrates on attitudes, behavior, knowledge, information exchange, and citizens' capacity to use accessible information rather than employing technology and tools to build something novel (Ristvej et al., 2020).

Inhabitants of these cities are smart when it comes to their ability and academic attainment, in addition to the importance of community cooperation with regard to integrating life in society and communicating with one another. Other characteristics that may be considered include socioeconomic and cultural diversity, degree of qualification, inclination for lifelong learning, and open-mindedness (Bokolo Jnr, 2021).

The planning and development of a smart city should consider citizens' quality of life from their perspective, paying particular consideration for the privacy problem if private and family home-level information is concerned. All of these elements must be carefully considered and implemented because people may wary of or find innovative technologies obtrusive when they are introduced (Kirimtat et al., 2020). Another key issue is equity, which means that every citizen has the right to profit from the smart city technology advancements and there should be no disenfranchisement of any metropolitan area, with the goal of closing the discrepancy among urban and rural regions (Belli et al., 2020).

The process of integrating of digital technologies provides new tools for residents and other stakeholders to participate in the formulation of major urban concerns and possible solutions. Public and stakeholder involvement may occur on several levels across an array of channels for participation. Digital technologies have the potential to increase public engagement at all levels. Smart cities that prioritize residents might therefore act as an instrument for social transformation and sustainability (OECD, 2020).

Citizen engagement is playing a meaningful role within the integration of a smart city framework. Municipalities that organize consultative bodies and involve the members of the community in policy elaboration, are more likely to achieve notable milestones in a shorter timeframe, as citizens will be already familiar with the solutions proposed and more open to use them.

Smart Infrastructure / Mobility / Transport

Certainly among the most debated components is the smart transportation one (Biswas et al., 2023). It has various effects on all people as well as governmental and business entities inside the city. Pollution, traffic jams, and travel delays across the city are just a few examples. The significance of smart transportation can be observed as well in the case of insufficient transportation networks that hinder a city's economic well-being and dynamism and might result in the loss of precious space over time. As a result, dealing with transportation must be linked to regulation of both land use and housing (Ristvej et al., 2020).

Between the main cornerstones of the smart city framework we can recognise Smart Mobility. It is centered on improving urban transportation. Mobility may be optimized by delivering novel options for citizens using supporting technological advances in communication and information. (Savastano et al., 2023)

Mobility constitutes one of the areas that has consistently driven crucial factors for growth and success in cities as it allows individuals to travel between places and fosters knowledge growth by integrating modern technological advancements in a variety of contexts (Belli et al., 2020). Smart mobility's mission is to link all of the municipality's resources: citizens, commodities, and information. The progress of self-driving and electric cars has an influence on transportation (Sadiku et al., 2021).

Key components of urban digitalization, including the Internet of Things and information and communications technologies, are now being explored to take advantage of the innovative Traffic Management Systems and Urban Traffic Control and, while maintaining their primary objective of maximizing throughput and ensuring a high-quality service (Arroub et al., 2016). In compliance with traffic management regulations, these digital services enhance efficiency of traffic and positively impact the urban transportation infrastructure (Kirimtat et al., 2020). As a result, cities should use information and communications technology to improve mobility as a means of developing a digitized and interconnected transportation system (Bokolo Jnr, 2021).

(Jayasena et al., 2020) underline that Public-Private Partnerships (PPP) are important contributors to a municipality's smart infrastructure development. The authors identify a so-called "lack of resources" as a major issue in the development of smart infrastructure. Limited funds and outdated facilities are creating problems for governments across the globe. Municipalities can overcome this by collaborating with the private sector. Furthermore, smart city initiatives typically include a high degree of innovation, environmental goals, and technical collaboration with nearby higher education institutions or research institutes (Liu et al., 2020).

Smart cities encourage citizens to minimize the use of automobiles in the town's center by developing a sustainable public transportation alternative that includes intelligent systems, dedicated lanes, smart parking, bike-sharing stations and an excellent internet connection. The mobility plans of these municipalities should integrate the latest innovations as the conservation of resources and the low environmental impact can be addressed with the adoption of these modern technologies.

The promotion of public-private cooperation is essential in a smart city, as many projects can be developed through Public-Private Partnerships (PPP). The financial burden of these projects is then supported by both the public and the private pillars and the joint expertise will bring a more practical approach. The sustainable growth of the local economy is visible in municipalities that are encouraging and supporting the innovation industry, digital startups and private investments in civic innovation.

Smart Life / Living / Safety & Health

This component integrates many elements of citizen's quality of life (Stegerean et al., 2022) and manages to improve it by transforming their homes, neighborhoods, workplaces, energy, and transportation systems into environmentally friendly surroundings. Smart living increases individuals' understanding of how society and technological advances interact for their advantage. As a result, smart living is about adopting aspects that contribute to a meaningful and joyful existence (Bokolo Jnr, 2021). Existing cultural amenities, living circumstances, educational institutions, tourism, and cohesiveness in society are all considered indicators of smart living (Winkowska et al, 2019). Citizens employ technology to construct smarter ways of life. Everything is linked in gadgets, making many chores easier, safer, and less expensive. The creative solutions produced in recent years have been designed to make people's lives more effective and environmentally friendly (Arroub et al., 2016). Another concept that started to be more encountered in recent years is the one of smart buildings, centered on the life of the inhabitant, helping in personalized shopping, and other daily chores (Kirimtat et al., 2020).

Regarding the health perspective, the use of smart technology positively impacted the citizens during the pandemic, and helped them monitor their health, stay in touch with both family

and medical personnel and gave them a sense of independence, protection and safety. A greater interest has been shown in creating smart communities that are financially and ecologically resistant to natural catastrophes and problems caused by humans. COVID-19 appears to be an amplifier for guaranteeing resilience in intelligent towns (Umair et al., 2021). Healthcare professionals may treat patients more effectively, prevent diseases from occurring, and minimize their incidence with the use of smart health and telemedicine, as presented by (Lai et al., 2020) and (Sharifi et al., 2021). Additionally, smart health lowers healthcare costs for the elderly population that is expanding (Lai et al., 2020). Although using intelligent technology effectively enables seniors to integrate into everyday life and gain access to a practical and comfortable technologically advanced life, they may feel helpless in light of new technology (von Humboldt et al., 2020). The aforementioned issue is vital and local governments should start to address it as there are not that many services dedicated to the aging population (Karanasios et al., 2020). Some solutions can be represented by partnerships with non-governmental organizations that provide smart equipment to senior citizens in need, and also through special programs dedicated to familiarize seniors with technology and e-government (Ciesielska et al., 2022).

From digital tools integrated in the local health system to the meaningful impact that Artificial Intelligence (AI) and security cameras can have on the personal safety, this component of the smart city framework is one of the most visible ones and can have a profound impact in the way citizens perceive that municipality. Many towns around the world that successfully implemented the Smart Life / Living / Safety & Health component are positioned among the first places in global livability rankings, thus attracting more tourists, businesses and people willing to work from there or even settle.

Smart Environment / Sustainability

This component refers to the safeguarding of natural resources, for instance water, land, or clean air. It entails using natural resources in a more environmentally friendly manner, protecting the natural habitat, reducing pollution, and managing resources in a more sustainable manner (Bokolo Jnr, 2021). In the twenty-first century, the focus has shifted from sustainability evaluation to smart city objectives. In contrast to urban sustainability models, smart city concepts place a far greater emphasis on contemporary technology and intelligence (Stübinger et al., 2020).

People commonly associate green spaces and parks in cities with the environment when referring to the Smart City idea. These are undoubtedly crucial, but they do not make up the entire system. The environment, whether green or gray, is set to be integrated with smart technology that will enable people to successfully interact with it (Ristvej et al., 2020). This smart technology can help municipalities with waste management, by integrating facilities that are equipped with sensors and are solar powered. Air quality control and smart lighting are two other areas in which the use of technology enables a reduced negative impact on the environment (Shah et al., 2019).

To improve sustainability, a smart city must address environmental infrastructures such as sources of water, sewage systems and green areas. Additionally, it needs to be focused on the use of renewable sources of energy (Arroub et al., 2016). (Pandey et al., 2022) centered their research on the United Nations' Sustainable Goals for 2030, with eleven of the seventeen Sustainable Goals connected to water. The authors conclude that smart cities should include technologies like Artificial Intelligence (AI) or Internet of Things (IoT) innovations, along with Big Data tools and Machine Learning solutions, as well as integrations of Blockchain and Cloud Computing in wastewater treatment. According to (World Health Organization, 2022), one of the most serious environmental threats to human health is represented by the pollution in the air, as 99% of the inhabitants of the globe reside in areas where the World Health Organization air quality requirements are not reached. (Kirimtat et al., 2020) suggest that a decision-assisting system powered by IoT technology that keeps track of air pollution while employing efficient pollution control techniques could offer a solution to this problem.

The Environment / Sustainability dimension will have a key part in the future of smart cities, as many states worldwide currently offer subsidies and incentives for local projects based on renewable energy, smart energy management systems and grids, clean air and water initiatives or waste management systems that are environmentally friendly.

Conclusions

The paper presents which are the key elements of a smart city, according to the published literature related to this topic in the last eight years, especially focusing on the analysis of articles published from 2020 onward. As the pandemic accelerated the adoption of many technological advances in municipalities, contributing to the improvement in living quality and resource management that is more sustainable, this research offers an outline of the six key important dimensions of a smart city and considerations about their implementation by local governments. One of the main managerial challenges for local authorities will be the one of integrating appropriate policies that are adapted to the specific needs of that community, prioritizing the areas that are the most important for all stakeholders.

We can affirm that potential limitations of this paper exist, which could be overcome in future studies. One of them may be seen in the fact that it examined a number of articles referring to the key components of a smart city from a substantial amount of literature that was published on the smart city subject. We may affirm that this restriction may also have a benefit because the article provides a useful perspective on the subject at hand.

The article is intended for both researchers focused on this subject and stakeholders of towns that intend to achieve a high standard of the smart city framework implementation. The topic will probably continue to be studied extensively in the following years, as ambitious environmental legislation has been adopted, budgetary and resource constraints will tend to intensify and citizens tend to become more familiarized with digital tools and the benefits brought by them. As a direction for future research, a systematic review of the literature is considered, to underline the theoretical notions and specific cases of cities that successfully integrated the smart city components in the public services offered.

References

1. Albino, V., Berardi, U. and Dengelico, R.M, 2015. *Smart cities: Definitions, Dimensions, Performance, and Initiatives*, Journal of Urban Technology, 22(1), pp. 3-21.
2. Angelidou, M., 2015. *Smart cities: A conjuncture of four forces*, Cities, 47, pp.95–106.
3. Arroub, A. Zahi, B., Sabir, E. and Sadik, M., 2016. *A literature review on Smart Cities: Paradigms, opportunities and open problems*, 2016 International Conference on Wireless Networks and Mobile Communications (WINCOM), pp. 180–186.
4. Belli, L., Cilfone, A., Davoli, L., Ferrari, G., Adorni, P., Di Nocera, F., Dall'Olio, A., Pellegrini, C., Mordacci, M. and Bertolotti, E., 2020. *IOT-enabled Smart Sustainable Cities: Challenges and approaches*, Smart Cities, 3(3), pp.1039–1071.
5. Biswas, S., Nath, A. and Pal, A., 2023. *Smart Cities and Associated Solid Waste, Biomedical Waste, E-Waste Issues, and Management*. In Chatterjee, U., Antipova, A., Ghosh, S., Majumdar, S. and Setiawati, M.D. (Eds.), *Urban Environment and Smart Cities in Asian Countries, Human Dynamics in Smart Cities*, Switzerland, Springer Cham
6. Bokolo Jnr, A., 2021. *A case-based reasoning recommender system for Sustainable Smart City Development*, AI & SOCIETY, 36(1), pp.159–183.
7. Ciesielska, M., Rizun, N. and Chabik, J., 2022. *Assessment of E-government inclusion policies toward seniors: A framework and case study*, Telecommunications Policy, 46(7), p. 102316.

8. European Commission, 2023. *Smart cities*, Available at: https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en (Accessed: April 10, 2023).
9. Jayasena, N.S., Chan, D.W.M. and Kumaraswamy, M., 2020. *A systematic literature review and analysis towards developing PPP models for delivering smart infrastructure*, Built Environment Project and Asset Management, 11(1), pp. 121–137.
10. Karanasios, S., Cooper, V., Adrot, A. and Mercieca, B., 2020. *Gatekeepers rather than helpless: An exploratory investigation of seniors' use of information and communication technology in critical settings*, Proceedings of the 53rd Hawaii International Conference on System Sciences, pp. 3770–3379.
11. Khatoun, R. and Zeadally, S., 2016. *Smart Cities: Concepts, Architectures, Research Opportunities*, Communications of the ACM, 59(8), pp. 46-57.
12. Kinelski, G., 2022. *Smart City 4.0 as a Set of Social Synergies*, Polish Journal of Management Studies, 26(1), pp. 92-106.
13. Kirimtat, A., Krejcar, O., Kertesz, A. and Tasgetiren , M. F. 2020. *Future trends and current state of Smart City Concepts: A survey*, IEEE Access, 8, pp. 86448–86467.
14. Kumar, V. and Dahiya, B., 2017. *Smart economy in smart cities*. In Vinod Kuma, T. M. (Eds.), *Smart economy in smart cities, Advances in 21st Century Human Settlements*, Singapore, Springer
15. Lai, C.S., Jia, Y., Dong, Z., Wang, D., Tao, Y., Lai, Q.H., Wong, R.T.K., Zobaa, A.F., Wu, R. and Lai, L.L., 2020. *A Review of Technical Standards for Smart Cities*, Clean Technologies, 2(3), pp.290–310.
16. Liu, T., Mostafa, S., Mohamed, S. and Nguyen, T., 2020. *Emerging themes of public-private partnership application in developing Smart City Projects: A Conceptual Framework*, Built Environment Project and Asset Management, 11(1), pp. 138–156.
17. OECD, 2020. *Smart Cities and Inclusive Growth*, Available at: oecd.org/cfe/cities/OECD_Policy_Paper_Smart_Cities_and_Inclusive_Growth.pdf (Accessed: April 11, 2023).
18. Ooms, W., Caniëls, M, Roijakkers, N. and Cobben, D., 2020. *Ecosystems for smart cities: Tracing the evolution of governance structures in a Dutch smart city initiative*, International Entrepreneurship and Management Journal, 16(4), pp.1225–1258.
19. Pandey, S., Twala, B., Singh, R., Gehlot, A., Singh, A., Montero, E. C. and Priyadarshi, N., 2022. *Wastewater treatment with technical intervention inclination towards Smart Cities*, Sustainability, 14(18), p. 11563.
20. Ristvej, J., Lacinák, M. and Ondrejka, R., 2020. *On smart city and safe city concepts*, Mobile Networks and Applications, 25(3), pp.836–845.
21. Sadiku, M., Ashaolu, T., Ajayi-Majebi, A. and Musa, S., 2021. *Smart cities*, International Journal of Scientific Advances, 2(5), pp. 777–781.
22. Savastano, M., Suciu, M., Gorelova, I. and Stativă, G., 2023. *How smart is mobility in smart cities? An analysis of citizens' value perceptions through ICT applications*, Cities, 132, p. 104071.
23. Shah, J., Kothari, J. and Doshi, N., 2019. *A survey of Smart City Infrastructure via case study on New York*, Procedia Computer Science, 160, pp.702–705.
24. Sharifi, A., Khavarian-Garmsir, A.R. and Kummitha, R.K.R., 2021. *Contributions of Smart City Solutions and Technologies to Resilience against the COVID-19 Pandemic: A Literature Review*, Sustainability, 13(14), p.8018.
25. Stegerean, R., Trincă, V., Tămaș, A. and Nistor, R., 2022. *The Smart City Concept – Focusing on the Perception of Cluj-Napoca Residents*, Proceedings of the 16th International Management Conference, pp. 158-172.

26. Stübinger, J. and Schneider, L., 2020. *Understanding Smart City—A Data-Driven Literature Review*, Sustainability, 12(20), p.8460.
27. Toli, A.M. and Murtagh, N., 2020. *The concept of sustainability in Smart City definitions*, Frontiers in Built Environment, 6, pp. 1–10.
28. Trincă, V., Nistor, R. and Stegerean, R., 2021. *Digitalization in a post pandemic era*, Managerial Challenges of the Contemporary Society, 14(1), pp. 66-75.
29. Umair, M., Cheema, M.A., Cheema, O., Li, H. and Lu, H., 2021. *Impact of COVID-19 on IoT Adoption in Healthcare, Smart Homes, Smart Buildings, Smart Cities, Transportation and Industrial IoT*. Sensors, 21(11), p.3838.
30. van Twist, A., Ruijer, E. and Meijer, A., 2023. *Smart Cities & Citizen Discontent: A systematic review of the literature*, Government Information Quarterly, 40(2), p. 101799.
31. von Humboldt, S., Mendoza-Ruvalcaba, N., Arias-Merino, E., Costa, A., Cabras, E. Low, G. and Leal, I., 2020. *Smart technology and the meaning in life of older adults during the COVID-19 public health emergency period: A cross-cultural Qualitative Study*, International Review of Psychiatry, 32(7-8), pp. 713–722.
32. Winkowska, J., Szpilko, D. and Pejić, S., 2019. *Smart city concept in the light of the Literature Review*, Engineering Management in Production and Services, 11(2), pp. 70–86.
33. Wirtz, B.W., Becker, M. and Schmidt, F.W., 2021. *Smart City Services: An empirical analysis of citizen preferences*, Public Organization Review, 22(4), pp. 1063–1080.
34. World Bank, 2022. *Urban Development*, Available at: https://www.worldbank.org/en/topic/urbandevelopment/overview (Accessed: April 8, 2023).
35. World Health Organization, 2022. *Ambient (outdoor) Air Pollution*, Available at: https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health (Accessed: April 15, 2023).