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ORGANIZATIONAL AND LEGAL FRAMEWORKS FOR SMART CITIES IN UKRAINE: A COMPREHENSIVE OVERVIEW

This scientific article provides an in-depth examination of the organizational and legal underpinnings shaping the emergence of smart cities in Ukraine. As the global trend towards urban digitization gains prominence, the study investigates the key elements driving smart city initiatives, encompassing organizational strategies, legal frameworks, and the challenges faced in this transformative process. The research commences by elucidating the concept of smart cities, delineating their fundamental characteristics, and exploring how advanced technologies, data-driven decision-making, and citizen engagement converge to enhance urban sustainability and efficiency. Moving to the Ukrainian context, the article meticulously analyzes the role of the government in promoting smart city development, detailing national strategies and initiatives that underscore the importance of digital technology in economic growth and environmental resilience. The study accentuates challenges encountered in the course of smart city development in Ukraine, including funding constraints, limited civil society engagement, and technological and infrastructural hurdles. It underscores the need for a multifaceted approach to address these challenges effectively. International exemplars from cities such as Barcelona, Singapore, Seoul, and Dubai are presented to glean insights into successful smart city projects and draw lessons applicable to the Ukrainian context. In conclusion, the research posits a future outlook for smart cities in Ukraine, projecting a landscape where private sector collaboration, robust government support, and a focus on environmental sustainability foster a technologically advanced and inclusive urban environment. The article concludes by emphasizing the transformative potential of smart city initiatives in Ukraine and calls for ongoing research and active participation to shape a smarter and more resilient urban future.
Key words: *Smart Cities, Legal Framework, Development Strategies, Urban Digitization, Advanced Technologies, Digital Transformation, Infrastructure*

Т. П. Паламарчук. Організаційно-правові засади смарт-міст в Україні: комплексний огляд
У статті поглиблено розглядаються організаційні та правові засади формування смарт міст в Україні. У міру того, як глобальна тенденція до цифровізації міст набуває популярності, в статті досліджуються ключові елементи, що рушійно впливають на ініціативи смарт міста, охоплюючи організаційні стратегії, правові рамки та виклики, з якими стикаються в цьому трансформаційному процесі. Детальну увагу приділяється роз'ясненню концепції розумних міст, окреслення їхніх фундаментальних характеристик і вивчення того, як передові технології, процес прийняття рішень на основі даних і залучення громадян об'єднуються для підвищення стійкості та ефективності міст. Переходячи до українського контексту у статті прискіпливо аналізується роль уряду в просуванні розвитку смарт міста, деталізуючи національні стратегії та ініціативи, які підкреслюють важливість цифрових технологій для економічного зростання та екологічної стійкості. Дослідження акцентує увагу на викликах, які виникають під час розвитку смарт міст в Україні, включаючи обмеження фінансування, обмежене залучення громадянського суспільства, технологічні та інфраструктурні перешкоди. Це підкреслює необхідність багатогранного підходу для ефективного вирішення цих проблем. Зарубіжний досвід таких міст, як Барселона, Сінгапур, Сеул і Дубай, представлені, щоб отримати уявлення про успішні проекти смарт міста та отримати досвід, який можна імплементувати в Україні. Підсумовуючи, дослідження визначає майбутні перспективи розвитку смарт міст в Україні, проектуючи ландшафт, де співпраця приватного сектору, потужна державна підтримка та зосередженість на екологічній стійкості сприяють розвитку технологічно передового та інклюзивного міського середовища.
Ключові слова: *смарт-міста, правові засади, стратегії розвитку, цифровізація міст, передові технології, цифрова трансформація, інфраструктура*

Formulation of the problem. The problem addressed in this article revolves around the multifaceted development of smart cities in Ukraine, encompassing both organizational and legal aspects. As global urbanization trends increasingly lean towards digital transformation, the study identifies and examines the challenges and opportunities inherent in the establishment of smart cities within the Ukrainian context. The research delves into the intricate organizational strategies required for effective implementation, exploring the collaborative efforts among government bodies, local authorities, and the private sect or. Simultaneously, it scrutinizes the legal framework governing smart city initiatives, emphasizing the regulatory measures and legislative landscape influencing their successful execution. The article seeks to address issues such as funding constraints, limited civil society engagement,

and technological hurdles that impede progress, while also highlighting the transformative potential of smart cities in Ukraine for economic growth, environmental sustainability, and enhanced urban living. The overarching problem is to comprehensively analyze and present a roadmap for the development of smart cities in Ukraine, considering the intricate interplay between organizational strategies and regulatory measures.

Analysis of recent research and publications. Among scientists, such scientists as Bohun L.V., Dmytrenko V.I., Muzhanova T.M., Polishchuk B.G., Chukut C.A. studied the problems of "smart" cities. [1–3]. To improve the quality of life, safety, energy saving and economic growth, cities in Ukraine and the world are implementing various projects, which have received the general name "Smart City". The topic of the development of Smart cities in scientific publications is related to the study of modern trends in the development and implementation of "smart cities" projects. Analyzing recent research and publications on the topic of smart cities in Ukraine reveals several notable trends and areas of focus within the academic and professional discourse.

The article aims to comprehensively explore and analyze the organizational and legal framework for the development of smart cities in Ukraine. The overarching goal is to provide readers, including urban planners, technology enthusiasts, and those interested in the future of urban living, with valuable insights and information on the key aspects influencing the establishment of smart cities in the Ukrainian context.

Presenting main material. Smart Cities aim to create sustainable and efficient urban environments through the integration of advanced technologies, data analytics, and connectivity. Ukraine has a burgeoning Smart City initiative, with a focus on developing the organizational and legal framework to support these innovative cities. The organizational framework encompasses key elements such as urban planning, infrastructure development, and stakeholder collaboration. The legal framework in Ukraine includes regulatory measures and legislation to facilitate the implementation of Smart City projects. For a detailed understanding of the concept, it is important to define the conceptual and categorical apparatus and the meaning of the Smart City.

The Concept of Smart Cities

In recent years, the concept of smart cities has gained significant attention worldwide, with governments, urban planners, and tech enthusiasts alike recognizing its potential to transform urban areas into more efficient, sustainable, and livable spaces. Smart cities leverage digital technology and data-driven solutions to improve various aspects of urban life, including infrastructure, transportation, energy, public services, and citizen engagement.

Smart cities can be broadly defined as urban areas that utilize advanced technologies and data analytics to enhance the quality of life for residents while efficiently managing resources. These cities are characterized by their integration of digital infrastructure, Internet of Things (IoT) devices, and data analytics to optimize various systems and improve overall city operations.

The function of the Smart City is to some extent to restructure the basic conditions of communities and related social organizations, and this is probably a possible way to achieve good social governance. This is more important than the settlement of social contradictions. It is for this part of the project and this part that the trends of such projects, funds or policies are relatively high [4].

Smart cities prioritize citizen engagement and participation, recognizing that residents play a crucial role in shaping the urban environment. Through participatory platforms, mobile applications, and civic engagement initiatives, residents can actively contribute their ideas, feedback, and concerns. This fosters a sense of ownership and collaboration, ultimately resulting in the co-creation of urban solutions that truly meet the needs of the community.

The Smart City Initiative in Ukraine

The concept of smart cities has gained significant attention worldwide, and Ukraine has also been actively pursuing the development of smart city projects. The Ukrainian government recognizes the importance of digital technology and sustainable urban development in driving economic growth, improving the overall quality of life, and addressing environmental challenges. This section will provide a comprehensive overview of the smart city initiative in Ukraine, highlighting key aspects such as the role of the government, private sector participation, and specific projects being undertaken.

Regarding the situation in Ukraine, it should be noted the significant damage caused to infrastructure objects during 2022–2023. As of February 2023, the total amount of damage caused to the infrastructure of Ukraine due to the full-scale invasion of Russia has increased by another $6 billion and is $143.8 billion (according to replacement cost). In second place in terms of the amount of damage caused is the sphere of infrastructure. According to the results of a year of full-scale war, losses in this area are estimated at $36.2 billion. During this time, more than 25 thousand kilometers of state and local roads and 344 bridges and overpasses were destroyed or damaged due to the war [5].

The Ukrainian government plays a critical role in promoting and fostering the development of smart cities. It has established a national-level strategy to guide the implementation of smart city projects across the country. This strategy emphasizes the use of digital technology, data-driven decision-making, and citizen engagement to create smarter, more efficient urban areas. The government has also established regulatory frameworks and incentives to attract private sector investment in smart city infrastructure projects.

The private sector plays an important role in financing and implementing smart city projects in Ukraine. The government encourages collaboration between the public and private sectors to leverage the expertise and resources of different stakeholders. Several cities in Ukraine have embraced smart city initiatives and are undertaking projects to transform their urban areas. One notable example is the city of Dnipro, which has launched a large-scale project focused on enhancing urban resilience and promoting environmental sustainability. Through the implementation of smart infrastructure and the use of digital technologies, the city aims to reduce greenhouse gas emissions and improve overall energy efficiency.

Another noteworthy project is the Participatory Lab Positive Energy District in Lviv. This project, which is supported by civil society organizations and the Ukrainian government, aims to create an innovative and sustainable urban area that generates more energy than it consumes. By combining renewable energy sources, energy-efficient buildings, and smart city systems, the district serves as a model for future development and showcases the potential of smart cities in Ukraine.

Organizational Framework for Smart Cities in Ukraine

Smart cities are quickly becoming a global phenomenon, with countries worldwide embracing the concept and implementing initiatives to transform urban areas into technologically advanced and sustainable hubs. Ukraine, too, recognizes the importance of smart cities in its future economic reconstruction and has made significant strides in developing its own smart city infrastructure. In this section, we will delve into the organizational framework for smart cities in Ukraine, exploring the key players, partnerships, and policies that drive the country's smart city initiatives.

It is important to identify the Ukrainian Government's Role in its development. The Ukrainian government plays a critical role in promoting and facilitating the development of smart cities in the country. It has formulated a comprehensive strategy that outlines the steps and measures necessary to transition Ukrainian cities into smart and sustainable entities. This strategy focuses on leveraging digital technology, improving urban resilience, and fostering environmental sustainability. To achieve these objectives, the government collaborates closely with various stakeholders, including local authorities, civil society organizations, and the private sector.

At the local level, Ukrainian cities are actively involved in the smart city building process. Each specific city develops its own smart city project tailored to its unique needs and challenges. Local authorities work closely with the national government to align their initiatives with the broader goals outlined in the national strategy. Notably, public participation and engagement are crucial elements in the planning and implementation of smart city projects. Collaboration with the private sector is a vital component of smart city initiatives in Ukraine. The private sector brings in essential expertise, resources, and innovative technologies to implement and finance infrastructure projects. The Ukrainian government actively encourages private sector investment in smart city projects through various incentives and partnerships. This partnership helps drive innovation, accelerate the deployment of smart technologies, and ensures the long-term sustainability of the smart city ecosystem.

Ukraine recognizes the importance of international collaboration for the successful development of smart cities. The country actively cooperates with international organizations, institutes, and smart city experts from around the world. Through knowledge exchange, best practices sharing, and joint projects, Ukraine leverages the global experience to establish a robust smart city framework. Additionally, Ukraine actively participates in international events and initiatives focused on smart cities, enabling the country to position itself as an innovative and attractive destination for investment and collaboration.

Legal Framework for Smart Cities in Ukraine

The development of smart cities in Ukraine is driven by a robust legal framework that aims to provide a clear roadmap for the implementation and regulation of smart city initiatives. The Ukrainian government recognizes the important role that smart cities play in enhancing the quality of life for citizens and promoting sustainable development. Consequently, they have implemented various laws and regulations that govern the planning, implementation, and operation of smart city projects.

1. The Law on Urban Development: This law sets out the legal basis for urban development, including the establishment of smart cities. It regulates the process of creating urban areas with advanced infrastructure and digital technology integration. The law ensures that smart cities are developed in a systematic and sustainable manner, taking into account the long-term needs and priorities of the Ukrainian cities.

2. The Law on Smart Cities: Enacted in 2018, this law defines the concept of a smart city and outlines the principles and objectives of smart city development. It emphasizes the use of digital technology and data-driven solutions to enhance the quality of life, improve public services, and promote environmental sustainability. The law also encourages collaboration among various stakeholders, including the government, private sector, and civil society organizations, to drive smart city initiatives.

3. The Law on Public-Private Partnership (PPP): Recognizing the significance of private sector investment in smart city projects, the Ukrainian government has established a legal framework for PPPs. This law provides

guidelines for public-private collaboration in financing and implementing infrastructure projects, including those related to smart city development. It aims to attract private investments and expertise to accelerate the implementation of smart city initiatives and ensure their long-term sustainability.

4. The Law on Energy Efficiency: Smart cities prioritize energy efficiency and strive to reduce greenhouse gas emissions. The Ukrainian government has enacted the Law on Energy Efficiency to promote energy-saving measures and encourage the adoption of smart grid technologies. This law provides a regulatory framework for energy management and the integration of renewable energy sources into smart city systems, thereby contributing to environmental sustainability.

5. The Law on Digital Transformation: The digital transformation of cities is at the core of smart city development. The Ukrainian government has introduced the Law on Digital Transformation to create a conducive environment for the implementation of digital technologies in various sectors, including healthcare, education, transportation, and governance. This law facilitates the integration of digital solutions into smart city projects and promotes the use of data-driven decision-making processes.

Challenges and Opportunities for Smart City Development in Ukraine

As the Ukrainian government strives to modernize its economy and build a sustainable future, the concept of smart cities has emerged as a key strategy. However, the development of smart cities in Ukraine comes with its own set of challenges and opportunities. In this section, we will explore some of the main obstacles that need to be overcome, as well as the potential for growth and innovation.

One of the major challenges for smart city development in Ukraine is the limited availability of funding from the government and private sector. Smart city projects require significant investments in digital infrastructure, smart grids, and other technological advancements. Without adequate financial resources, it becomes difficult to implement large-scale projects that can truly transform urban areas. Therefore, attracting private sector investment becomes crucial in order to secure the necessary funding for smart city initiatives.

Securing funding from the government and private sector is crucial for the successful implementation of smart city projects in Ukraine. Limited Awareness and Engagement of Civil Society Organizations another challenge is the limited awareness and engagement of civil society organizations in the development of smart cities. For smart city initiatives to be successful, it is important to involve various stakeholders and engage the community in decision-making processes.

International Examples of Successful Smart City Projects

Smart cities have been rapidly emerging across the globe, showcasing innovative solutions for urban development and sustainable living. Let's explore some noteworthy examples that demonstrate the potential of smart city initiatives in improving the quality of life for citizens.

A smart concept is an urban design principle and practice that promotes effective integrated real-time information and communication technology (ICT) infrastructure facilities and services to achieve sustainable development. The concept of smart infrastructure comes from the concept of a Smart City, which is a complex system with various elements such as people, governance, environment, economy, mobility and living conditions in a certain geographical space with effective ICT that contribute to a smart sustainable environment [6].

Barcelona has gained international recognition for its smart city efforts. Through their comprehensive implementation of digital technology and data-driven solutions, Barcelona has transformed various aspects of urban life. One remarkable project is the implementation of a smart parking system, which uses sensors to detect available parking spaces, helping drivers find parking quickly and reducing traffic congestion. This initiative not only improves transportation efficiency but also contributes to reducing greenhouse gas emissions.

Singapore has established itself as a leader in smart city development with its "Smart Nation" initiative. The country has leveraged advanced technologies, such as the Internet of Things (IoT) and data analytics, to create a seamlessly connected city. One impressive example is their intelligent traffic management system, which utilizes real-time data to optimize traffic flow and reduce commuting time. This initiative has significantly improved transportation efficiency and enhanced the overall quality of life for Singaporeans.

Dubai has embraced the concept of smart cities through its "Smart Dubai" initiative. One outstanding project under this initiative is the implementation of a smart transportation system. This system integrates various modes of transportation and provides commuters with real-time information, enabling them to choose the most efficient routes and modes of travel. This initiative has significantly improved transportation accessibility and efficiency, ultimately enhancing the overall urban experience for residents and visitors alike.

These international examples highlight the immense potential of smart city projects in transforming urban areas and improving the quality of life for residents. By leveraging digital technology and data-driven solutions, cities can enhance transportation systems, reduce environmental impact, and create more sustainable and resilient communities.

Future Outlook for Smart Cities in Ukraine

As the concept of smart cities gains momentum globally, there is a tremendous opportunity for Ukraine to harness the benefits of digital technology and transform its urban areas. The future outlook for smart cities in Ukraine is promising, with various initiatives and policies in place to pave the way for a more sustainable and technologically advanced urban landscape.

The private sector will play a crucial role in driving the smart city initiative in Ukraine. By collaborating with the government and other stakeholders, private companies can bring in innovative solutions, expertise, and investments to accelerate the development of smart city projects. This partnership will ensure that the implementation of smart infrastructure is efficient and tailored to the specific needs of Ukrainian cities.

One of the critical roles that smart cities can play is in promoting environmental sustainability. By leveraging digital technology and smart grid systems, Ukrainian cities can optimize energy consumption, reduce greenhouse gas emissions, and improve overall environmental performance. The integration of renewable energy sources and the implementation of energy-efficient solutions will contribute to creating greener and more livable urban areas.

The future of smart cities in Ukraine also involves enhancing public transportation management and improving the overall urban infrastructure. By integrating smart transportation systems, such as intelligent traffic management and real-time public transportation tracking, Ukrainian cities can alleviate congestion, enhance mobility, and provide seamless connectivity for residents and visitors.

Conclusions. In conclusion, understanding the organizational and legal framework for smart cities in Ukraine is crucial for the country's development and progression in the digital era. By analyzing the current state of smart-city infrastructure globally and in Ukraine, we have identified priority directions for improvement and highlighted the tools of state policy for modernization. It is evident that a comprehensive approach is needed to effectively implement smart city solutions and overcome challenges. The future of smart cities in Ukraine looks promising, with the private sector playing a vital role in driving innovation and investments. The government's support, collaborative approach, and focus on environmental sustainability will pave the way for a more technologically advanced and inclusive urban landscape.

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