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Smart Management Planning for Urban Development to Enhance Social Well-being: Cases of Ukrainian Cities During Wartime

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ABSTRACT

The article examines case studies of Ukrainian cities in developing smart city management concepts focused on sustainable development and the reintegration of veterans into civil society. It outlines the characteristics of smart cities based on indicators proposed by experts, including Smart Governance, Smart Communication and Decision-Making, Smart Administrative Services, Smart Utilities, Smart Transportation, Smart Urban Planning, Smart Healthcare and Education, Smart Energy, and Smart Tourism.

The budgets of urban territorial communities such as Vinnytsia UTC, Lutsk UTC, Kyiv, Lviv UTC, Dnipro UTC, Kharkiv UTC, and Chernivtsi UTC are presented. A step-by-step development plan for smart cities is provided, along with an assessment of city maturity levels in achieving "smartization." The article includes examples of sustainability criteria and indicators for Lutsk Urban Territorial Community based on ISO 37123. The use of blockchain technology is proposed to enhance urban smartization and foster development.

KEYWORDS: smart management, urban development, social well-being, veterans' reintegration, planning, blockchain.

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1. Introduction. The popularity of the SmartCity concept in Ukraine is growing. This trend emerges in response to decentralization, increased powers of local authorities, advancements in technology, and the rising number of IT professionals. Ukrainian society is becoming more open to change, and public administration employees are enhancing their innovation management skills.

The development of SmartCity initiatives during wartime and peacetime differs significantly. In times of danger, well-developed urban infrastructure can greatly benefit residents, serving as the foundation of the human-centered approach of a "smart city." This approach uses technology and data to improve the quality of life for citizens. On the other hand, the techno-centric approach emphasizes the functioning of cities through advanced information and communication technologies.

Projects aimed at enhancing security, such as the construction or modernization of shelters, gain particular importance during wartime. Additionally, with damage to the energy infrastructure, energy-saving measures become critical. The defining challenge for SmartCity initiatives during wartime is finding ways to balance the safety of residents with the efficient use of resources.

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2. Literature Review. The authors' research on smart management gains significant importance, especially in the context of ensuring social well-being and reintegrating veterans into civilian life.

R.V. Sevastianov notes that a "Smart City" is an innovative system utilizing technologies such as sensors, the Internet of Things (IoT), network solutions, and big data analytics to enhance the efficiency and competitiveness of urban services. To ensure the sustainable development of a "Smart City," it is essential to consider economic, social, and environmental factors while addressing the needs of both current and future generations.

The creation of "Smart Cities" involves the integration and coordination of urban services, as well as enabling opportunities for citizens to remotely participate in city management processes. The author has systematized electronic smart services in Zaporizhzhia, including "EasyWay," "Waze," and services in transportation, housing and utilities, healthcare and medicine, cultural and entertainment sectors, socio-economic activities, and administrative-social services (Sevastianov, 2021).

E. Jacques, A. N. Júnior, S. De Paris, M. Francescatto, and J. Siluk highlighted that poorly planned urbanization exacerbates the imbalance between the needs of the population and the organized development of urban spaces. Their studies emphasize the role of Smart Cities and the Internet of Things (IoT). IoT technologies are beneficial for human life, providing intelligent services essential for urban development. Technological innovations play a crucial role in advancing Smart Cities. The use of technological resources and the development of applied tools foster collaboration and communication among various Smart City stakeholders, driving innovation and enabling the creation of shared and creative applied solutions in sectors such as education, healthcare, energy, industry, the environment, and public safety. Smart Cities must design and implement innovative solutions and comprehensive approaches, leveraging advanced technologies and scientific knowledge to enhance sustainability, efficiency, resilience, equity, and citizens' quality of life. Managing Smart Cities requires adapting processes and implementing strategic planning while integrating technological advancements. This strategy should align with the collaborative efforts of educational institutions, researchers, companies, public agencies, and self-governance bodies (Jacques et al., 2024).

M. Zaman, N. Puryear, Sh. Abdelwahed, and N. Zohrabi emphasized that Smart City initiatives aim to enhance urban domains such as healthcare, transportation, energy, education, the environment, and logistics through the use of advanced information and communication technologies, particularly the Internet of Things (IoT). In a Smart City, technology acts as a facilitator rather than an end in itself. It is employed to collect and analyze data, which is then used for decision-making, optimizing resource

allocation, and improving service delivery. The primary goal of a Smart City is to promote an economically vibrant, socially inclusive, and environmentally sustainable environment. This involves a holistic approach in which smart technologies are intertwined with strategic urban planning. Key components include developing intelligent infrastructure, ensuring sustainable resource management, and delivering effective public services aimed at enhancing residents' quality of life. Smart Cities emerge as solutions to modern urban challenges, with technology at the forefront of their transformation. Three types of standards are associated with Smart Cities: strategic, procedural, and technical specifications, all of which play crucial roles in building a solid foundation for Smart Cities. Strategic standards are the most essential for city leadership, helping to design a comprehensive pathway toward achieving Smart City objectives. Procedural standards are highly beneficial for defining effective management strategies in established cities. Technical standards apply to all aspects of a Smart City, guiding governance and management decisions for creating a more connected urban environment. To assess the success of a Smart City, a comprehensive set of indicators should be developed to evaluate the effectiveness of policies and efforts implemented to achieve smart objectives (Zaman, et al., 2024).

A. F. Pashchenko explored the latest Smart City concepts. He presented the Integrated Operational Center — a new concept of operational intelligence capable of digitizing, controlling, forecasting, acting, making better and faster decisions, and interacting with its citizens. The proposed concept for managing a Smart City (or Smart Region, Smart Country) would, if implemented, bring breakthrough changes, improving the efficiency of city or regional management and operations (Pashchenko, 2021).

T.A. Pushkar, D.O. Seryohina, and K.V. Mykhailova determined that modern approaches to formulating Smart City strategies are based on a balanced combination of economic, social, and environmental factors of urban development. According to them, the main goal of implementing Smart City strategies is to ensure a comfortable living environment for all groups of urban residents, while combining sustainable development with innovation (Pushkar, 2021).

I.A. Ostrovskyi and H.V. Stadnyk analyzed the experiences of cities in EU countries (Ghent, Seville, Bologna, Poznan, Czech Republic) in the field of sustainable development management. They grouped typical policies identified by the Global Smart Cities Alliance G20 for effective management of Smart City development. They concluded that during the implementation of Smart City strategies, there was a gradual shift from individual digital tools to comprehensive urban digital systems that integrate various aspects of city life and their management (Ostrovsky & Stadnyk, 2023).

O.L. Yershova and L.I. Bazhan concluded that the development of Smart Cities in Ukraine is hindered by the lack of technical infrastructure for creating information technology platforms, as well as the absence of a roadmap for the digital transformation of the national economy. The main obstacles to the digital transformation of cities in Ukraine include barriers to the development of new technological solutions due to unresolved issues in the field of technology standardization and working with big data (Yershova & Bazhan, 2020).

O. Polinkevych, O. Kuzmak, and R. Kaminski noted that Smart Cities will help address issues of social well-being and social inequality in Ukraine, transform businesses in line with societal changes, and

assist in the reintegration of war veterans into civilian life (Polinkevych et al., 2023; Polinkevych, 2023,Polinkevych, 2024a,Polinkevych, 2024b;Glonti et al., 2024).

P. Pontrandolfo, O. Polinkevych, B. Scozzi, and O. Kuzmak described examples of Smart City development in Poland and Ukraine. They conducted an assessment of Smart City programs using the Benessere equo e sostenibile dei Territori (BESdT) methodology for the city of Lublin and cities in the Volyn region (Pontrandolfo et al., 2023).

3. Methodology. The study employs a descriptive-review approach, along with methods of analysis, synthesis, abstraction, and comparison, to investigate the planning of smart management for urban development in Ukraine. In examining the characteristics of Smart Cities based on indicators such as Smart Governance, Smart Communication and Decision-Making, Smart Administrative Services, Smart Utilities, Smart Transportation, Smart Urban Planning, Smart Healthcare and Education, Smart Energy, and Smart Tourism, the method of generalization was used.

Through the use of a tabular method, the main indicators for smart management in cities such as Vinnytsia, Dnipro, Kyiv, Lviv, Kharkiv, Chernivtsi, and Lutsk were identified, along with an analysis of the budgets of urban territorial communities, the cities' maturity levels in achieving "smartization," and the criteria and indicators for the sustainability of Lutsk Urban Territorial Community according to ISO 37122. The methodology for studying the communication interaction of smart cities is based on a scoring system in the following areas: Smart Government, Smart Communication and Solutions, Smart Administrative Services, Smart Utilities, Smart Transportation, Smart Landscaping, Smart Healthcare and Education, Smart Energy, and Smart Tourism. The city's maturity level in terms of achieving its "smartization" state was set based on the fulfillment of 50% of the indicators defined in ISO 37123.

4. Results. Conceptual approaches division into periods

The aim of this article is to examine case studies of Ukrainian cities in shaping the concept of Smart City governance, focusing on sustainable development and the reintegration of veterans into civilian society.

In Ukraine, the formation of smart cities is taking place in a time of war. Military operations cause cataclysms in society, instability of the internal and external environment. Military operations have led to the emergence of a new socially vulnerable population - war veterans. Smart cities should create conditions for the reintegration of veterans into society. As of July 25, 2024, there are 1 million 300 thousand veterans in Ukraine (Burtseva & Zolin, 2025). This number is constantly growing. War veterans are mostly young people, both with and without education. Therefore, their reintegration into society is extremely important. This can be achieved through the formation of the concept of smart cities, where the main role is given to creating a safe and inclusive space for interaction between the government, business, and the public sector.

Drawing on global experience, Ukraine began implementing the Smart City concept in 2015. Currently, the SmartCity system operates in various forms in cities such as Kyiv, Ivano-Frankivsk, Lviv, Mukachevo, Drohobych, Zaporizhzhia, Poltava, Ternopil, and Kharkiv. Additionally, the "Safe City" system has been implemented in Mariupol and Lutsk. According to 2021 data, Kyiv ranks 82nd in the global Smart City Index ("Smart City Ukraine").

Table 1 summarizes the characteristics of a Smart City based on indicators proposed by experts: Smart Governance, Smart Communication and Decision-Making, Smart Administrative Services, Smart Utilities, Smart Transportation, Smart Urban Development, Smart Healthcare and Education, Smart Energy, and Smart Tourism ("Smart innovations").

Table 1

Characteristics of smart cities by indicators

Indicator	Vinnytsia	Dnipro	Kyiv	Lviv	Kharkiv	Chernivtsi	Lutsk
Smart government							
Electronic document management	1	1	1	1	1	1	1
Electronic bidding	1	1	1	1	1	1	1
Property management system	1	1	1	2	1	2	1
Map of MAFs	3	1	1	3	1	2	2
Map of advertising structures	2	2	1	2	1	1	1
Smart communication and solutions							
Electronic communication on the mayor's website	1	1	1	1	1	1	1
Electronic appointment for government officials	1	1	2	1	1	1	1
Open budget	1	1	1	1	3	2	1
Participatory budget	1	1	1	1	1	1	1
Budget on the map	1	1	2	1	3	2	2
Smart admin services							
Electronic administrative services	1	1	1	1	1	1	1
Electronic record in the TsNAP	1	1	1	1	1	2	1
MVD center in the TsNAP	1	1	2	1	3	3	1
Resident's office on the city hall website	1	2	1	1	1	2	1
Resident's card	1	2	1	1	3	2	2
Smart utilities							
Unified call center	1	1	1	1	1	1	1
Road condition map	2	1	2	3	3	3	1

Smart utilities							
Housing and utilities application map	1	2	1	2	1	2	1
Online selection of utility contractors	1	3	2	3	3	3	2
Smart transport							
GPS monitoring of public transport	1	2	1	1	2	2	2
GPS monitoring of municipal transport	1	1	1	1	2	2	1
Transport and traffic light control center	1	2	2	1	2	2	1
Electronic ticket	2	2	2	2	2	2	1
Electronic traffic display at stops	1	2	2	1	3	3	2
Payment for parking spaces with contactless bank cards	3	3	1	1	3	3	1
Payment for public transport with contactless bank cards	3	3	1	3	3	3	1
Smart landscaping							
Street CCTV	1	1	1	1	1	1	1
Face Recognition CCTV	1	2	2	1	2	2	1
Online Police Call	1	2	2	3	3	3	2
Chargers on Streets or Bus Stops	1	2	1	2	3	3	2
Cycle Lanes	1	2	2	2	2	2	1
Disabled Paths	2	2	2	2	2	2	2
Garbage Bins with Fill Sensors	3	2	2	3	3	2	2
Smart medicine and education							
Electronic registration	1	1	1	1	1	1	1
Electronic patient card	2	1	2	3	3	3	1
Electronic queue for kindergarten	1	1	1	2	1	2	1
Innovations in education	1	3	2	3	3	3	2
Smart energy							
Energy monitoring	2	2	2	1	2	2	2
Automatic regulation of coolants	1	2	2	1	1	2	2
Smart tourism							
Electronic guides for tourists	1	2	2	1	2	1	2
QR codes for tourists	1	2	1	2	1	1	2

Notes: 1 – option available; 2 – option in progress; 3 – not available. From "Smart innovations of Ukrainian cities", 2025 (http://www.urbanua.org/dosvid/ukrayinski-pryklady/340) In the public domain. From "Smart cities in Ukraine: comparative assessment and trends", by L.I.Tsymbal, I.M. Uninets, 2022 (http://doi.org/10.32702/2307-2105.2022.9.2) In the public domain and own research

Table 1 provides a scoring assessment across various levels, including Smart Governance, Smart Communication and Decision-Making, Smart Administrative Services, Smart Utilities, Smart Transportation, Smart Urban Development, Smart Healthcare and Education, Smart Energy, and Smart Tourism. Each level comprises multiple indicators.

Overall, the leading positions in the rankings for Smart City development and smart urban management are held by Vinnytsia (1st place), Lutsk (2nd place), Kyiv (3rd place), Lviv (4th place), Dnipro (5th place), Kharkiv (6th place), and Chernivtsi (6th place).

Budgets of the urban communities of Lviv, Vinnytsia, Dnipro, Chernivtsi, Lutsk and Kyiv are analyzed in Figure 2.

Table 2

Budgets of urban territorial communities

Indicator	**Year**					**Deviation 2024/2020**	
	2020	**2021**	**2022**	**2023**	**2024**	**+ /-**	**%**
Lviv MTG							
Deficit/ surplus	7561348,6	9645378,9	958360,3	-2775216	756313,7	-6805034,9	-90,00
Revenue, thousand UAH	9070425,4	11649659,6	13432025,8	15277806,8	15258460,9	6188035,5	68,22
Expenses, thousand UAH	1509076,8	2004280,7	12473665,5	18053022,8	14502147,2	12993070,4	860,99
Kyiv							
Deficit/ surplus	272764	1859474,4	7822626,6	-2797419,5	-13480268	-13753031	-5042
Revenue, thousand UAH	58121754,1	71255170	68332257,5	80170891,5	71762709,4	13640955,6	23,47
Expenses, thousand UAH	57848990,1	69395695,6	60509630,9	82968311	85242977	27393986,9	47,35
Vinnytsia MTG							
Deficit/ surplus	-2002801	2775418,39	1472574,76	-6175984,8	-197054,29	1805746,7	-90,16

Vinnytsia MTG							
Revenue, thousand UAH	3016523,03	3623668,84	6497784,08	762638,943	6354678,04	3338155,0	110,66
Expenses, thousand UAH	5019324	848250,446	5025209,32	6938623,79	6551732,33	1532408,3	30,53
Dnipro MTG							
Deficit/ surplus	-1164114	1766711	7556475	-1997702	7235177	8399291	-721,5
Revenue, thousand UAH	45821703	61741492	58619859	68543900	64128041	18306338	39,95
Expenses, thousand UAH	46985817	59974781	51063384	70541602	56892864	9907047	21,09
Chernivtsi MTG							
Deficit/ surplus	-34343	-188642	200640	395864	776746	811089	-2361
Revenue, thousand UAH	2275303	2767205	3384412	3891517	4240383	1965080	86,37
Expenses, thousand UAH	2309646	2955847	3183772	3495653	3463637	1153991	49,96
Lutsk MTG							
Deficit/ surplus	-127669	8141	492607	-114709	228051	355720	-278,6
Revenue, thousand UAH	2229117	2858760	3121808	3588384	3741044	1511927	67,83
Expenses, thousand UAH	2356786	2850619	2629201	3703093	3512993	1156207	49,06

Note: From "*Lviv MTG budget*", 2025(*https://city-adm.lviv.ua/public-information/budget/lviv*) In the public domain. From "Official portal of Kyiv", 2025 (http://surl.li/seuipd) In the public domain. From "Budget of the Dnipropetrovsk Urban Territorial Community", 2025 (https://openbudget.gov.ua/local-budget/0400000000/info/) In the public domain. From "Budget of Chernivtsi urban territorial community", 2025 (https://openbudget.gov.ua/local-

budget/2455200000/info/indicators) In the public domain. From "Lutsk City Council", 2025 (https://www.lutskrada.gov.ua/digital-city) In the public domain. From "Open budget", 2025 (https://openbudget.gov.ua/local-budget/0355100000/info/indicators) In the public domain.

From Table 2, it can be concluded that both revenues and expenditures increased across all urban territorial communities and Kyiv in 2024 compared to 2020. This growth in revenues and expenditures indicates the development and capacity of these communities to implement Smart City management projects.

The revenues of the Vinnytsia Urban Territorial Community showed the highest growth, increasing by 110%, while Kyiv experienced the smallest growth. In terms of expenditures, the most significant increase was observed in the Lviv Urban Territorial Community, with the smallest growth recorded in the Dnipro Urban Territorial Community.

The smartification of cities is guided by ISO 37120, ISO 37122, and ISO 37123 standards [23; 24; 25]. These standards outline 18 components of smart development: city economy, energy, environment and climate change, finance, governance, healthcare, housing, population and social conditions, safety, waste management, sports and culture, telecommunications, transport, urban agriculture, urban planning, wastewater management, and drinking water. Each component is accompanied by specific indicators and criteria for urban sustainability.

The step-by-step plan for city development can be represented as a series of actions:

Step 1: Alignment of Vision and Conceptualization of Terms. At this stage, the concept of "smart city" is defined and clarified within the framework of a city's sustainable development strategy or specific smart city strategy.

Step 2: Adherence to Standards. Optimal city resource management is ensured through commonly accepted rules and methods based on established standards.

Step 3: Identification of Gaps. Achieved results are analyzed and compared against the vision and initial plan, with adjustments made to refine future actions.

Step 4: Efficiency Analysis. Needs are assessed from three perspectives: residents, local authorities, and the environmental context.

Step 5: The "Happy" District. Smart residential neighborhoods are developed as prototypes for future urban transformations.

Effectiveness is evaluated using 75 indicators grouped according to the standard. Notably, cities aiming to meet ISO 37122 must achieve at least 50% of the standard's indicators.

These proposed frameworks serve as valuable tools for assessing Ukrainian cities, regardless of their size or level of damage. Key indicators of smart development include the maturity of civil society and the quality and accessibility of public services.

The readiness of Ukrainian cities can be determined by monitoring outcomes and comparing them to the standard. The level of sustainable development ranges from 10% to 100%, progressing from an initial stage (10–20%) to the optimization of existing systems (90–100% compliance with the standard).

After the war ends, such an evaluation will become crucial, as any actions undertaken without a clear "diagnosis" may prove ineffective due to poorly defined priorities. In contrast, preliminary analysis enables the identification of weaknesses and potential imbalances.

At the next stage, it will be possible to develop a "smart city" strategy and create an action plan for its gradual implementation. This will be achieved through technological solutions and initiatives proposed by the community and local authorities.

Table 3

Levels of City Maturity in Achieving "Smartification"

Achieved level / % of implementation of ISO 37122	**Indicators**	**Description Positioning of large cities in Ukraine**
1. Initial 10 – 20%	At this stage, the processes of digital transformation within the city begin. Cities plan and develop information systems designed to integrate their "smart" management solutions.	All cities of Ukraine, except occupied ones
2. Quantitatively managed 30 – 40%	At this stage, the city's management systems reach a new level of efficiency. Local governments actively seek innovative solutions, implement information technologies, and place greater emphasis on collaborative decision-making processes with citizens. This is primarily achieved by leveraging data from diverse sources, rather than relying solely on official statistics.	Zhytomyr, Rivne, Sumy, Zaporizhia, Poltava, Chernivtsi
3. Established 50 – 60%	At this stage, the data has already been collected and is accessible to the public through information and communication technologies (ICT). They are effectively utilized, with cloud computing technologies integrated into the public service delivery system. This ensures access to information for both citizens and other stakeholders	Kharkiv, Chernihiv, Khmelnytskyi, Ternopil, Cherkasy, Odesa
4. Qualitatively managed 70 – 80%	At this stage, cities can combine resources to make public services accessible to citizens. The use of computing technology at this level focuses on ensuring universal access.	Kyiv, Lviv, Dnipro, Vinnytsia, Ivano-Frankivsk, Lutsk
5. In the process of optimization 90 – 100%	At this stage, cities are recognized as highly efficient, actively pursuing innovations and becoming leaders in implementing technological solutions	none

Notes: Lutsk is classified as Managed qualitatively due to the calculation of the indicator in Table 4. From *"Implementation of the "Smart City" concept in the management of large cities of Ukraine: monograph".* by *A.O. Andrienko*, 2023 *Vinnytsia, Ukraine: NGO "European Scientific Platform", 196 p.,* In the public domain.

Table 4

Criteria and indicators of sustainability of the Lutsk urban territorial community according to ISO 37123

Criteria	**Indicators**	**% of indicator fulfillment**
1) city economy:	1.1. Historical losses from disasters as a percentage of the city's product. 1.2. Average annual losses from disasters as a percentage of the city's product. 1.3. Share of objects that have insurance coverage for high-risk events. 1.4. Percentage of total insurance value to the total risk value for the city. 1.5. Employment concentration. 1.6. Percentage of the workforce in the informal employment sector. 1.7. Average available income of households.	1.1. 70% 1.2. 80% 1.3. 65% 1.4. 90% 1.5. 80% 1.6. 95% 1.7. 78% General 79 %
2) education:	2.1. Percentage of schools teaching emergency preparedness and disaster risk reduction. 2.2. Percentage of the population trained in emergency response and disaster risk reduction. 2.3. Percentage of publications on emergency behavior and disaster risk reduction in alternative languages. 2.4. Disruptions in education.	2.1. 70% 2.2. 80% 2.3. 65% 2.4. 90% General 76,25 %
3) energy:	3.1. Number of different energy sources that provide at least 5% of the total energy supply. 3.2. Power supply capacity as a percentage of peak energy demand. 3.3. Percentage of critical infrastructure served by off-grid energy services.	3.1. 70% 3.2. 80% 3.3. 90% General 80 %
4) environment and climate change:	4.1. Urban heat island effect magnitude. 4.2. Percentage of natural areas in the city that have undergone environmental assessment regarding their protective functions. 4.3. Area restored by ecosystems as a percentage of the total city area. 4.4. Annual frequency of extreme rainfall events. 4.5. Annual frequency of extremely hot days. 4.6. Annual frequency of extreme cold events. 4.7. Annual frequency of floods. 4.8. Percentage of urban land covered by tree canopy. 4.9. Percentage of city area covered by materials with high albedo that contribute to mitigating the effects of urban heat islands.	4.1. 74% 4.2. 83% 4.3. 69% 4.4. 91% 4.5. 83% 4.6. 92% 4.7. 88% 4.9. 83 % General 73,66 %

Criteria	Indicators	% of indicator fulfillment
5) finance:	5.1. Annual expenditures on modernization and maintenance of urban services as a percentage of the city budget. 5.2. Annual expenditures on maintaining stormwater infrastructure as a percentage of the city budget. 5.3. Expenditures on ecosystem restoration within the city as a percentage of the city budget. 5.4. Annual expenditures on green-blue infrastructure as a percentage of the city budget. 5.5. Annual expenditures on emergency management planning as a percentage of the city budget. 5.6. Annual expenditures on social and public services as a percentage of the city budget. 5.7. Total reserve funds allocated for disaster preparedness as a percentage of the city budget.	5.1. 56% 5.2. 70% 5.3. 69% 5.4. 70% 5.5. 60% 5.6. 75% 5.7. 71% General 67,3 %
6) governance:	6.1. Frequency of updates to disaster recovery plans. 6.2. Percentage of essential city services with a sustainable documented plan. 6.3. Percentage of city's electronic data with secure and remote backup storage. 6.4. Percentage of public meetings dedicated to city resilience. 6.5. Number of intergovernmental agreements focused on planning for "shocks" as a percentage of total intergovernmental agreements. 6.6. Percentage of essential service providers with a documented business continuity plan.	6.1. 63% 6.2. 68% 6.3. 65% 6.4. 80% 6.5. 70% 6.6. 95% General 73,5 %
7) health care:	7.1. Percentage of hospitals equipped with backup power supply. 7.2. Percentage of the population covered by basic health insurance. 7.3. Percentage of the population fully immunized. 7.4. Number of infectious disease outbreaks per year.	7.1. 50% 7.2. 70% 7.3. 65% 7.4. 60% General 61,25 %
8) housing:	8.1. Capacity of designated emergency shelters and refuges per 100,000 population. 8.2. Percentage of buildings structurally vulnerable to high-risk hazards. 8.3. Percentage of residential buildings not meeting building codes and standards. 8.4. Percentage of damaged infrastructure that has been better restored after a disaster/damage. 8.5. Annual number of flooded residential buildings as a percentage of the total residential real estate in the city. 8.6. Percentage of residential real estate located in high-risk areas.	8.1. 69% 8.2. 83% 8.3. 75% 8.4. 80% 8.5. 85% 8.6. 75% General 77,8 %

Criteria	Indicators	% of indicator fulfillment
9) population and social conditions:	9.1. Proportion of vulnerable population in the total population of the city. 9.2. Percentage of the population covered by social assistance programs. 9.3. Percentage of the population exposed to high natural hazard risks. 9.4. Percentage of neighborhoods with regular and open meetings for residents. 9.5. Annual percentage of the city's population directly affected by natural disasters.	1.1. 70% 1.2. 80% 1.3. 65% 1.4. 90% 1.5. 80% 1.6. 95% 1.7. 78% General 79 %
10) security:	10.1. Percentage of the city's population covered by the early warning system for various hazards. 10.2. Percentage of rescuers who have undergone disaster response training. 10.3. Percentage of local hazard warnings issued annually by national authorities that are received in a timely manner by the city. 10.4. Number of hospital beds in the city, destroyed or damaged by natural disasters, per 100,000 population.	10.1. 75% 10.2. 70% 10.3. 85% 10.4. 89% General 79,75 %
11) waste:	11.1. The number of active and temporary waste management sites available for garbage and rubble per square kilometer	11.1 95 %
12) sports and culture;	12.1. The proportion of the population of different age groups involved in sports activities. 12.2. The availability of sports infrastructure in neighborhoods.	12.1 89 % 12.2 91 % General 90 %
13) telecommunications:	13.1. The percentage of firefighters in the city equipped with specialized communication technologies capable of reliably functioning during natural disasters or emergencies.	13.1. 95 %
14) transport:	14.1. Available evacuation routes per 100,000 population..	14.1 89 %
15) urban agriculture and food security:	15.1. The percentage of the city's population that can be served by municipal food reserves for 72 hours. 15.2. The percentage of the city's population living within one kilometer of a grocery store	15.1 79 % 15.2 95 % General 87 %
16) urban planning:	16.1. The percentage of the city's area covered by publicly available hazard maps. 16.2. Land plots, public spaces, and sidewalks built with permeable drainage, as a percentage of the city's land area. 16.3. The percentage of city land in high-risk areas where risk reduction measures are being implemented. 16.4. The percentage of city administrations and public services conducting risk assessments in their planning and investment management. 16.5. The annual number of flooded critical infrastructure objects as a percentage of the city's critical infrastructure. 16.6. Annual expenditure on water retention	16.1. 73% 16.2. 84% 16.3. 69% 16.4. 92% 16.5. 88% 16.6. 91% General 82,8 %

Criteria	Indicators	% of indicator fulfillment
	measures as a percentage of the city's preventive measures budget.	
17) wastewater:	17.1. The availability and quality of drainage structures	17.1 72 %
18) drinking water:	18.1. The number of different sources that provide at least 5% of the total water supply capacity. 18.2. The percentage of the city's population that can be supplied with drinking water through alternative methods for 72 hours.	18.1 68 % 18.2 73 % General 70,5 %
General		79,38 %

Note: built by the author

When implementing smart city solutions in the context of active conflict (military and humanitarian), there are limitations that impede their implementation. Among them are the following risk groups:

1. Security risks. These are the risks of cyberattacks on infrastructure, destruction of physical objects, and compromise of public data.

2. Funding restrictions, which involve redirecting resources to defense, humanitarian needs and recovery, and an unstable investment environment. As a result, interest in Smart City projects is low.

3. Problems with energy supply and communication, including power outages, lack of stable functioning of smart devices and IT systems.

4. Irregular work of municipal authorities means loss of control over certain areas, evacuation of employees and loss of databases.

5. Decreased trust and participation of citizens arises from the fear of losing personal data, which leads to a decrease in interest in Smart City due to the focus on survival.

6. Population migration due to destructive impacts on infrastructure, changes in social structure, and loss of labor.

7. Legal and ethical barriers related to the dilemmas of using technology in conflict, lack of regulations governing crisis situations.

The smartification level of the Lutsk urban territorial community is quite high. In the future, the "SmartCity" concept aims to create an environment where technology is fully integrated into city life, uniting various aspects (social, economic, organizational) for efficient resource distribution, providing essential administrative services, and improving citizens' quality of life. Blockchain technology can be practically implemented in the Ukrainian context in various areas, including wartime challenges, the need for transparency, digitalization, and restoring trust in institutions. It is facilitate the rapid implementation of the "SmartCity" concept by ensuring high levels of interaction among various stakeholders and participants. The degree of "smartification" will depend on many factors. In particular, structural elements of the "SmartCity," such as infrastructure and services, should adhere to the principles of "smart" urban design. Blockchain technology is a concept that covers a broad range of issues related to modernizing key aspects of city development, from basic infrastructure (such as utility systems, roads, and transportation) to additional elements (public-private partnerships, quality public services, socially

responsible business, circular economy, and active communities). As mentioned earlier, all of these components work together to create conditions for integrating technology into all areas of "smart" urban management, aiming to better meet citizens' needs for a quality, safe, and productive space for living and working, all for the benefit of the city. Blockchain technology is considered an effective solution for this integration, as it is an evolutionary choice for a management system that can help cities overcome numerous challenges related to integrating infrastructure elements and improving the technological, social, and financial environment.

Blockchain technology is an excellent choice for the development of "SmartCity," as it helps cities address numerous issues related to the integration of infrastructure elements and improves technological, social, and financial conditions in urban communities. In the process of rebuilding Ukrainian cities after the war, the creation of such an environment with the involvement of a wide range of participants becomes especially important. Since blockchain technology was initially developed to ensure the security and integrity of documents, it holds particular value for Ukrainian document management systems and the organization of internal management processes in general. The approach proposed in this paper optimizes the data structure, enabling information to be stored in the form of a transaction list.

The resulting blockchain of data blocks is decentralized, distributed, permanent, chronologically ordered, and protected from tampering. Blocks will be created and added to the blockchain system in such a way that all valid network actions can be easily traced, starting from the initial block. One of the main advantages of using this technology is achieving the highest level of transparency.

The concept of "SmartCity" and blockchain technology share two main common characteristics. First, both concepts are broad and describe an ideal functional environment that provides more comfortable living conditions for people compared to traditional systems. Blockchain, in turn, is a technical platform capable of expanding the capabilities of government bodies and all participants in the urban development process. Both concepts are currently in the active development stage, promising significant practical progress in the near future. Regarding blockchain, there are numerous ideas that promote the implementation of more efficient solutions capable of ensuring the scalability of transactions without the need for energy-intensive mechanisms to reach consensus between parties. Thus, technological progress creates new opportunities for the realization of the "SmartCity" concept, with blockchain becoming an important component. This opens up prospects for further research and innovative solutions in traditional management issues.

In practical terms, blockchain makes it possible to create decentralized registers of utility use (water, electricity, transportation, living space), which allows residents and regulatory authorities to track consumption, optimize costs, and prevent corruption or abuse. Blockchain provides full transparency of the budget process: from budgeting to spending on specific projects. This allows citizens to control how their taxes are spent and increases government accountability. Smart contracts can automate the provision of public or municipal services, such as renting municipal property, paying fees, and applying for administrative services, without the involvement of intermediaries and with instant fulfillment of conditions. Blockchain can serve as a basis for creating decentralized digital identification systems for citizens who retain control over their personal data but can quickly and securely confirm their identity to receive services. In Smart Cities, blockchain can ensure that local elections or public polls are held online, guarantee the protection of votes from forgery and fraud, and reduce the cost of electoral processes. The

use of blockchain makes it possible to integrate all public transport services into one system, provide one-click fare payment, track movements and loads, and create a system of rewards for environmental behavior (for example, using bicycles or public transport). The use of blockchain technology makes it possible to create systems for accounting for waste collection, recycling, and disposal, where each step is recorded, and contractors are paid only for the confirmed scope of work. Blockchain allows for transparent distribution of social assistance, targeted subsidies, grants, and other resources for vulnerable groups, avoiding abuse and losses.

Thus, blockchain is the basis for creating an open and sustainable urban infrastructure that combines innovation, digital security, public trust, and effective governance in a smart city.

5. Conclusion . It has been noted that smart city development planning in Ukraine began to evolve in 2015. Currently, the Smart City system operates in various forms in cities such as Kyiv, Ivano-Frankivsk, Lviv, Mukachevo, Drohobych, Zaporizhzhia, Poltava, Ternopil, and Kharkiv. The "Safe City" system was also implemented in Mariupol and Lutsk.

Examples of smart city management development are provided for cities like Vinnytsia, Kyiv, Kharkiv, Lutsk, Dnipro, and Chernivtsi. The cities were assessed based on the following categories: Smart Government, Smart Communication and Decision Making, Smart Administrative Services, Smart Utilities, Smart Transport, Smart Urban Planning, Smart Healthcare and Education, Smart Energy, and Smart Tourism. Each category has a set of indicators. Overall, the leading positions in the smart city development and smart management rankings are held by Vinnytsia (1st place), Lutsk (2nd place), Kyiv (3rd place), Lviv (4th place), Dnipro (5th place), Kharkiv (6th place), and Chernivtsi (6th place).

It is noted that smart community development, according to the standards ISO 37120, ISO 37122, and ISO 37123, is assessed using 18 groups of indicators: city economy, energy, environment and climate change, finance, governance, healthcare, housing, population and social conditions, safety, waste management, sports and culture, telecommunications, transport, urban agriculture, urban planning, wastewater, and drinking water. Each of these components has its own indicators and criteria for city sustainability. A level of at least 50% must be achieved in each group. This methodology has allowed for the development of a step-by-step city development plan: Alignment of development vision and conceptualization of ideas – Following the standard – Identifying gaps – Analyzing effectiveness – Creating a "happy" district.

This plan can be implemented using blockchain technology. Blockchain is understood as a technical platform capable of expanding the capabilities of government bodies and all participants in the urban development process. It can generate numerous ideas that will help implement more efficient solutions and ensure scalability of transactions without the need for energy-intensive mechanisms to achieve consensus among parties.

In the future, it would be important to develop measures within the five steps of smart city development, identify the main challenges in their implementation, and propose indicators for monitoring results. Additionally, the author of the work has not addressed the issue of regulating smart city governance development in line with the concept of social equality and the adaptation of veterans to civilian life. This will be the subject of further research.

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