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EVOLUTION OF URBAN SPACES: THE GLOBAL DEVELOPMENT MODELS

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Romanovska Y. A. Evolution of Urban Spaces: The Global Development Models

The aim of the article is to explore and systematize contemporary trends in the development of urban spaces: from «digital» to «smart» city. Special attention is given to the analysis of a new approach to urban progress – the conception of «wise city», which focuses on the individual human being as the primary priority. The article analyzes the main differences between the conceptions of digital, smart, and wise cities. It is substantiated that the digital city is concentrated on the implementation of technology for the automation of processes and the improvement of infrastructure, the smart city uses data and innovations to optimize resources and enhance quality of life, while the wise city emphasizes harmonious development, taking into account the social, cultural, and ethical aspects of citizens' lives. Thus, the evolution of the urban environment is directed from technological solutions to a comprehensive, human-centered approach. The research materials provide examples of «digital» cities (in Tallinn, the e-Estonia system has been implemented, which ensures online access to public services, reducing bureaucracy and accelerating administrative processes); further on, «smart» cities (in Barcelona, a smart lighting system has been introduced that automatically adjusts the brightness of streetlights, reducing electricity consumption and the city's expenses), and «wise» cities (in Vienna, a social housing program operates that ensures the availability of quality housing for citizens, combining technological innovations with social justice). Thus, the development of cities occurs through three stages: from digitalization (digital city) to optimization of urban processes (smart city) and integration of social and environmental aspects (wise city). The wise city is an evolutionary extension of the smart city, as it not only utilizes technologies but also considers humanitarian, social, and environmental factors. Successful cities of the future must combine technological innovations, sustainable development, and active community participation, creating a comfortable environment for all residents.

Keywords: digital city, smart city, wise city, city.

Tabl.: 1. Bibl.: 21.

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Романовська Ю. А. Еволюція міських просторів: світові моделі розвитку

Метою статті є дослідити та впорядкувати сучасні тенденції розвитку міських просторів: від «цифрового» до «розумного» міста. Особливу увагу приділено аналізу нового підходу до урбаністичного прогресу – концепції «wise city», що зосереджується на людині як головному пріоритеті. У статті проаналізовано основні відмінності між концепціями цифрового, розумного та мудрого міста. Обґрунтовано, що «цифрове місто» зосереджене на впровадженні технологій для автоматизації процесів та покращення інфраструктури, «розумне місто» використовує дані та інновації для оптимізації ресурсів і підвищення якості життя, а «мудре місто» робить акцент на гармонійному розвитку, враховуючи соціальні, культурні та етичні аспекти життя громадян. Таким чином, еволюція міського середовища спрямована від технологічних рішень до комплексного, людиноорієнтованого підходу. В матеріалах дослідження наведено приклади «цифрових» міст (у Таллінні реалізована система e-Estonia, яка забезпечує онлайн-доступ до державних послуг, зменшуючи бюрократію та прискорюючи адміністративні процеси), «розумного» міста (у Барселоні впроваджена система розумного освітлення, яка автоматично регулює яскравість вуличних ліхтарів, зменшуючи споживання електроенергії та витрати міста) та «мудрого» міста (у Відні діє програма соціального житла, яка забезпечує доступність якісного житла для громадян, поєднуючи технологічні інновації з соціальною справедливістю). Таким чином, розвиток міст відбувається через три етапи: від цифровізації (digital city) до оптимізації міських процесів (smart city) та інтеграції соціальних і екологічних аспектів (wise city). Мудре місто є еволюційним продовженням розумного міста, адже не лише використовує технології, а й враховує гуманітарні, соціальні та екологічні фактори. Успішні міста майбутнього мають поєднувати технологічні інновації, сталий розвиток та активну громадську участь, створюючи комфортне середовище для всіх мешканців.

Ключові слова: digital city, smart city, wise city, місто.

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In the modern world, the concepts of a smart city and a digital city are becoming increasingly widespread, ensuring efficient urban infrastructure management through digital technologies, big data, artificial intelligence, and the Internet of Things (IoT). However, as cities develop, it becomes evident that technological solutions alone are not sufficient to create a sustainable, safe, and comfortable urban environment. Key factors driving the development of smart cities and digital cities include technological, demographic, environmental, economic, and political challenges. The rapid spread of innovations creates opportunities for cities to optimize infrastructure, reduce management costs, improve service quality, and expand business opportunities.

However, the development of smart cities requires not only technological changes but also social responsibility, environmental sustainability, and public engagement in urban governance. This has led to the emergence of a new paradigm—the wise city, which complements technological progress with a humanitarian approach, inclusivity, and sustainable development. Unlike the widely recognized concepts of smart city and digital city, the term wise city is not yet universally accepted in urban development discourse. Nevertheless, this approach is actively evolving in both the United States and Europe, aiming to enhance residents' quality of life through the implementation of advanced technologies and innovations. The shift from a smart city to a wise city signifies a change in priorities: from a focus solely on digitalization to the integration of human factors, social inclusion, and intelligent governance.

Global experience demonstrates that the most successful cities do not merely automate processes but create an ecosystem of interaction among residents, government, businesses, and technologies. Metropolises such as Copenhagen, Amsterdam, Vienna, Singapore, and Barcelona already showcase effective approaches to building wise cities, considering citizens' needs, cultural characteristics, and environmental aspects of development. At the same time, active government support and public participation can be key success factors, ensuring funding, necessary resources, and regulatory frameworks for innovation.

The phenomenon of the emergence and evolution of smart cities has attracted significant attention from the scientific community. Academic literature actively explores the features of smart cities, the factors that contributed to their emergence, and the key drivers of their successful development. Researchers such as Ushenko N., Tupika A. [1], Krysovatiy I. A. [2], Yershova O. L., Bazhan L. I. [3], Bityuk I., and Pascal L. [4] have studied this issue. Meanwhile, the development of digital cities has been analyzed by Nikitenko V., Va-

sylchuk H. [5], Mykhailova K. [6], Tormakhova A. [7], and others. Recently, international experts have identified a new innovative direction in smart city development – the wise city, which is increasingly being studied by American and European researchers [8–11]. Unfortunately, there are relatively few corresponding studies by Ukrainian experts, highlighting the importance of a detailed analysis of the multidimensional and fascinating process of urban evolution. In particular, the transformation of a smart city into a wise city remains a highly relevant area of research.

The purpose of the article is to explore and systematize modern urban development trends, from the “digital city” to the “wise city,” and to determine the characteristics of this new direction in urban progress, known as “wise city,” which is human-centered.

Quite often, the terms “digital city” and “smart city” are used interchangeably. However, they have significant differences. A digital city focuses on the implementation of information technologies in various aspects of life, while a smart city uses data and innovations to enhance the efficiency of urban processes, sustainability, and the quality of life of residents. A digital city is a model of urban development that actively employs information and communication technologies (ICT) to create an integrated digital infrastructure. The main goal of a digital city is to ensure uninterrupted access for citizens to digital services, improve communication between the government, business, and citizens, and establish digital platforms for city management. The main characteristics of a digital city are:

- ✦ e-Government: provision of administrative services through digital platforms;
- ✦ open data: cities publish data in open access, promoting transparency and public oversight;
- ✦ information platforms: use of big data (Big Data) for analyzing urban processes;
- ✦ development of the digital economy: support for innovative startups, e-commerce, and online services;
- ✦ digital access: ensuring high-speed internet and digital services for city residents.

One of the best examples of a digital city is Tallinn, Estonia [12]. This city has become a pioneer in implementing digital technologies in public administration. As part of the e-Estonia program, a unique e-government ecosystem was created, allowing citizens to access administrative services online. Residents can register businesses, vote in elections, receive medical services, and sign documents using an electronic signature. Thanks to the digitalization of processes, bureaucracy has been significantly reduced, and public services have become faster and

more efficient. Estonia is one of the leaders in Europe in terms of digital urban governance.

Another example of a digital city is Singapore, a city-state that actively utilizes digital technologies to manage infrastructure and improve the quality of life of its citizens [13]. The Smart Nation program involves the extensive application of artificial intelligence, big data, and automated systems in various fields, such as transportation, healthcare, and administrative services. Citizens can access government services through a unified digital platform, simplifying interaction with the government. Additionally, Singapore is actively developing a system of contactless payments, digital identification cards, and smart solutions in the healthcare sector. Thanks to these technologies, the city ensures a high level of efficiency and comfort for its residents.

A smart city is a concept aimed at increasing the efficiency of urban services through the use of advanced technologies, including artificial intelligence (AI), IoT, and automated management systems. The main difference from a digital city lies in its focus on sustainable development, resource optimization, and innovative urban governance. The main characteristics of a smart city are:

- ✦ Intelligent Transport System (ITS): optimization of traffic flow using sensors and AI;
- ✦ Energy efficiency: implementation of smart grids, energy-saving technologies, and renewable energy sources;
- ✦ Automation of public utilities: optimization of water supply and waste management through smart systems;
- ✦ Smart buildings and infrastructure: use of IoT for managing lighting, ventilation, and security;
- ✦ Environmental sustainability: reduction of CO₂ emissions, development of green areas, and introduction of environmental standards.

Barcelona, Spain, is one of the leaders in implementing the smart city concept [14; 15]. The city authorities actively use modern technologies to improve residents' comfort and optimize urban processes. Notably, a smart lighting system has been introduced, automatically adjusting streetlight brightness based on the time of day and pedestrian movement, significantly reducing electricity consumption. To combat air pollution, air quality monitoring sensors have been installed, transmitting real-time data and helping regulate traffic flow. Additionally, Barcelona has developed an intelligent waste management system, including garbage containers with fill-level sensors that optimize waste collection routes. These technologies help the

city reduce resource consumption and improve citizens' quality of life.

Amsterdam, Netherlands, is also one of the leading smart cities, actively utilizing the Internet of Things (IoT) and innovative energy solutions for efficient urban infrastructure management [16]. One of the city's key achievements is its smart grids, which help optimize electricity distribution and facilitate the transition to renewable energy sources. Buildings in the city are equipped with energy-saving systems that automatically regulate electricity and heat consumption. Amsterdam also actively implements smart transport solutions, such as traffic monitoring sensors and an intelligent traffic management system, helping to reduce congestion and CO₂ emissions. Moreover, the city supports green building initiatives and the expansion of cycling infrastructure, making it one of the most environmentally friendly cities in the world.

The concept of a smart city is evolving, and certain limitations in its sustainable development are emerging. Smart cities focus on technology but do not always take ethical, social, and humanistic aspects of urban development into account. The transformation of urban development concepts has led to the emergence of the wise city approach. A wise city does not merely use technology—it does so responsibly, considering the interests of the community, environment, and city culture. Unlike a smart city, where technology and data play a central role, a wise city focuses on people, harmony with nature, and a long-term strategy for sustainable development.

Thus, a wise city is an evolution of the smart city, which is not only technologically advanced but also guided by the principles of environmental sustainability, social equality, and harmonious coexistence of all residents. It focuses on:

- ✦ harmonious urban development – balancing technological progress with human needs;
- ✦ social responsibility – emphasizing the ethical use of technology and inclusivity;
- ✦ environmental sustainability – developing the city while considering climate change, ecosystems, and adaptation to natural conditions;
- ✦ public participation – engaging citizens in decision-making through digital platforms and urban initiatives;
- ✦ cultural aspect – preserving historical and cultural heritage in the urbanization process.

Wise City is considered the next stage in the development of Smart City, where priority is given not only to technology but also to wise urban governance for a sustainable future. Thus, the wise city concept is seen as the evolution of the smart city approach, fo-

cusing not only on technological aspects but also on social, cultural, and environmental factors to ensure sustainable development and improve the quality of life for citizens.

The research conducted by the Center for International Relations and Development (CIDOB), “Wise Cities: Modelling the Local Contribution to Sustainable Development Goals,” analyzes the evolution of the smart city concept and proposes a new approach to urban development – wise cities [17]. Experts note that despite technological advancements, smart cities often fail to consider cultural, social, and humanistic aspects, which can lead to inequality and citizen alienation. In response, the wise city concept places people at the center, integrating universal values such as justice, democracy, and environmental sustainability into the urban transformation process. Wise cities strive to improve the quality of life for residents, focusing on their well-being and happiness, with technology serving as a tool to achieve these goals rather than an end in itself. The research highlights the importance of adapting urban policies to the cultural and social characteristics of each city, avoiding one-size-fits-all approaches. Thus, wise cities combine technological innovations with a deep understanding of human needs and cultural contexts, promoting sustainable and inclusive development.

In the study “Beyond Smart Cities: It’s Time for Urban Sustainable Development,” the authors emphasize that modern cities face a range of global challenges, such as climate change, pollution, energy issues, unemployment, economic inequality, and security threats [18]. The traditional concept of Smart Cities, which focuses on implementing technology to optimize urban processes, has proven insufficient in addressing these complex problems. Researchers propose a shift to the model of Urban Sustainable Development, which integrates technological innovations with social justice, environmental sustainability, and economic growth [17; 18]. This approach requires active participation from local communities in decision-making, transparent governance, and a focus on long-term results. In particular, it is crucial to consider the needs of vulnerable population groups and ensure equal access to resources and opportunities. Experts stress that only a comprehensive and inclusive approach to urban development will allow cities to effectively address contemporary challenges and provide a decent quality of life for all residents.

These studies highlight the need to transition from a purely technological approach to a more comprehensive and inclusive vision of urban development, where technology serves as a means to achieve a higher quality of life and urban community sustainability.

Vienna is considered one of the leading cities in the wise city concept, as it combines technological development with high social standards and environmental sustainability. The city follows the Smart City Wien strategy, which emphasizes affordable housing, social equality, public participation, and environmental policies. One of the most important aspects is the social housing model, which provides residents with high-quality and affordable housing at controlled prices. Vienna is also actively integrating renewable energy sources, such as geothermal plants and solar panels, to supply energy to urban buildings. Additionally, the city is expanding cycling infrastructure and public transportation, promoting environmentally friendly modes of mobility. Vienna serves as an example of a balanced approach between technology, ecology, and social well-being, which is the core principle of a wise city.

Freiburg is known as Germany’s “green city” and one of the best examples of sustainable urban development [19]. The city’s main priority is environmental sustainability and public participation in decision-making. One of the most striking examples is the Vauban district, an ecological neighborhood characterized by passive housing, the use of solar energy, and restrictions on car usage. Freiburg also invests in the development of a circular economy, which includes waste recycling, pollution minimization, and efficient resource utilization. Bicycles are the primary mode of transportation in the city, and public transport mainly operates on renewable energy sources. Thus, Freiburg is an example of a city that harmoniously combines technology, ecological principles, and active citizen participation in shaping the urban environment.

Copenhagen is one of the most environmentally friendly cities in the world and an example of a wise city that integrates technological solutions and sustainable practices to improve quality of life [20]. The city’s main goal is to become carbon-neutral by 2025, making it the most ambitious climate strategy among European capitals. To achieve this, Copenhagen actively develops green energy, particularly through wind power plants, smart energy grids, and resource reuse systems. The city has implemented an extensive cycling infrastructure, allowing residents to travel comfortably without using cars. Additionally, the city government actively engages citizens in the urban planning process, creating interactive platforms for discussing urban projects. Thus, Copenhagen exemplifies a wise approach to urban development, where technology is combined with environmental responsibility, social inclusion, and a high quality of life.

This table illustrates the evolution of urban development concepts from digital to smart and wise cities. The wise city concept is a logical continuation

Table 1

Key Differences Between Digital, Smart, and Wise Cities

Criterion	Digital City	Smart City	Wise City
Main idea	Integration of digital technologies for city management	Use of technology for sustainable development and improving quality of life	Balance between technology, ecology, social justice, and human values
Focus	Access to electronic services, digital governance, open data	Optimization of energy, transport, infrastructure, environmental sustainability	Emphasis on human capital, harmonious development, community participation in decision-making
Key technologies	Internet, mobile applications, cloud services, open data	Internet of Things (IoT), Artificial Intelligence (AI), Big Data, automated systems	Digital technologies + social innovations, ethical AI, ecological design, democratic governance
Applied areas	Online administration, digital economy, cybersecurity	Infrastructure, transport, ecology, urban planning	Social justice, cultural identity, education, inclusive development
Environmental aspect	Not a key priority	Focus on energy efficiency and ecological balance	Deep integration of environmental principles, nature conservation, and circular economy
Role of citizens	Primarily users of digital services	Consumers and users of urban services, integration through participation platforms	Active participants in urban development, co-creators of policies, democratic self-governance
Example cities	Tallinn (Estonia), Singapore	Barcelona (Spain), Amsterdam (Netherlands)	Vienna (Austria), Freiburg (Germany), Copenhagen (Denmark)

Source: compiled by the author.

of digital and smart cities, as it integrates technological advancements with environmental sustainability, social responsibility, and active community participation.

One of the main trends in the development of Wise City is its human-centered approach. Unlike Smart City, which focuses on technology, the wise city uses innovation not as an end goal but as a means to enhance residents' comfort. This includes the development of public transportation, affordable housing, and convenient infrastructure for all population groups.

Another important trend is environmental sustainability. Wise City implements solutions that contribute to reducing CO₂ emissions, expanding green spaces, and transitioning to a circular economy. For example, in Copenhagen, wind power plants and smart energy grids are actively developing, promoting carbon neutrality.

A further key direction is democratic governance and public participation. The authorities of wise cities create interactive platforms where residents can express their ideas regarding urban planning and participate in decision-making. In Vienna, for instance, the social housing model is actively implemented, ensuring equal access to a comfortable living environment [21].

Balanced technology usage also plays a crucial role. Unlike Smart City, which is dominated by artificial intelligence and automated systems, Wise City applies technology with ethical considerations. This includes algorithm transparency, personal data protection, and reducing digital inequality.

Thus, a wise city is not only technologically advanced but also socially responsible, environmentally sustainable, and democratic. This urban development model fosters not only economic growth but also the creation of a harmonious environment for all residents. ■

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