SMART CITY 3.0 DIGITAL MANAGEMENT CONCEPT IN THE CONTEXT OF SUSTAINABLE GREEN DEVELOPMENT GOALS

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Abstract. The present study is relevant in the context of the formation of the digital management concept Smart City 3.0 in the context of sustainable green development goals. These goals are to be achieved by combining digitalisation technologies with the principles of environmental sustainability. The *purpose* of the study is to determine the conditions for the formation of a digital concept of city management 3.0 in the context of sustainable development goals. *Research objectives:* 1) to study the concept of the digital concept of city management or Smart City and the conditions for its implementation; 2) to reveal the concept of Smart City 3.0 development in the context of foreign experience; 3) to reveal the essence and significance of the concept of environmental sustainability of smart Smart City 3.0 and the promotion of sustainable green development. The *research methodology* is a systematic, cross-cultural, interdisciplinary approach to understanding the complex impact of digital technologies on all aspects of sustainable development in digital green smart cities 3.0, in particular on the economic, social and environmental dimensions. It allows for the interaction between digital innovations and the Sustainable Development Goals (SDGs) to be considered in a single structure. The Smart City 3.0 concept views the city as an integrated ecosystem. This approach ensures efficient infrastructure management and also helps to reduce environmental impact, improve the quality of life of citizens, and engage them in decision-making. The article examines the pivotal elements of the Smart City 3.0 concept, encompassing the deployment of artificial intelligence, the Internet of Things (IoT), big data and automated systems to enhance the urban environment. It has been demonstrated that the implementation of these technologies can result in a notable reduction in energy consumption, the optimisation of traffic flows, a reduction in greenhouse gas emissions, and an enhancement of the environmental sustainability of the city. The study analyses the global exemplars of digital urban management, identifies opportunities and challenges for the development of Ukrainian cities in the direction of smart and green management, and offers recommendations for their adaptation based on global experience.

Keywords: digital innovations, digital green Smart City 3.0, digital concept of city management 3.0, sustainable and green development, green capital.

JEL Classifications: O33, H76, R11, R58, Q55

1. Introduction

The study's relevance lies in its demonstration of the pivotal role creativity plays in the development of creative industries, which in turn contribute to the growth of creative cities and the generation of new ideas. The theoretical framework of the creative city emerged concurrently with the advent of the creative economy, which encompasses the economic aspects of digitalisation, urbanism, social well-being and innovation. Such factors include the changes brought about by digital technologies, their diffusion and impact on economic systems, including the concept of a Smart City and the application of digital solutions in urban management. A digital city should comprise

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public expenditures pertaining to local initiatives in urban management, including expenditures on digitalisation, infrastructure and services for residents in the context of a Smart City. Regional policy issues, including Smart City development policies and the introduction of digital tools to enhance the quality of life in cities, must also be considered. Furthermore, regional economic development, including urban growth and changes caused by digital transformation, must be taken into account to ensure the sustainability and development of urban regions (Peter Hall, 1997). The construction of a creative city has the potential to attract cultural and creative talents and groups, infuse the city with new vitality and competitiveness through the development of creative industries, and address significant urban development issues in innovative ways. In the context of digitalisation, the era of the creative economy based on the knowledge economy is emerging, and the construction of creative cities is an inevitable trend in the future development of urban areas. This necessitates the existence of a well-developed creative industry and the utilisation of the creative industry to support and promote innovation in the wider economic sphere. In a creative city, the creative industry represents a significant industrial grouping, and creative achievements frequently become inputs to other industries, providing consumers with new elements of value. Creative planning helps almost all traditional industries create a "blue ocean" and stimulate the development of a number of related industries. More importantly, the development of creative industries has significantly improved the cultural level of people, updated concepts, and increased creativity, leading to countless innovations in all areas of life. The concept of a Smart City is a model of a city based on the full-scale use of digital technologies to solve urgent problems of the city, its green sustainable development and improve the quality of life of citizens.

2. Analysis of Recent Research and Publications

In Cities in Civilisation (USA, Pantheon Books, 1998), Peter Hall presents a historical analysis of urban development and the role of innovation in urban prosperity. Although the term Smart City was not yet in common usage at the time of the book's publication, Hall offers ideas that later became the basis for its development, in particular in the context of creative, economic and social innovations to improve the quality of life. Hall observed that creative cities have existed since antiquity. They are the product of human civilisation, the cradle of cultural birth, and all creative achievements are inextricably linked to cities. Landry (2005), founder of Comedia, a UK-based creative city research institute, believes that a city

can only be revitalised through innovation, and that the key lies in the city's creative base, creative environment and cultural factors. In his work, The Creative City: A Toolkit for Urban Innovators (Earthscan Publications, 2000, UK), Charles Landry establishes the conceptual framework of the creative city, underscoring the significance of cultural capital and creative industries for the evolution of urban environments. His ideas have exerted considerable influence on the development of the Smart City, where digital innovations are integrated with a creative approach to urban governance and citizen engagement. Richard Florida posits that the key elements of building a creative city are the 3Ts: technology, talent and tolerance. In other words, the attraction of creative talent, the generation of ideas and the stimulation of the economy are essential components of this process. The region is characterised by a concentration of technology and high-tech industries, which exemplify the region's commitment to innovation. In contrast, tolerance can be defined as an openness to, and acceptance of, all minorities, races and attitudes. In his book The Rise of the Creative Class (USA Basic Books, 2003), Richard Florida concentrates on the development of the creative class as a driving force for urban economic growth. He demonstrates how creative and innovative professionals contribute to the enhancement of urban environments, which aligns with the principles of a Smart City and shapes the strategic development of innovative urban spaces. It can be argued that any city has the potential to become a creative city, which in turn can contribute to the promotion of both the cultural and the knowledge economy. The studies provide a comprehensive examination of the concept of the Smart City, offering insights into international experiences in this domain. These authors have established a theoretical foundation for the further development of Smart City concepts, underscoring the potential of urban spaces to become hubs of creativity, innovation, and technological advancement, thereby enriching the contemporary understanding of a Smart City. The authors pose questions regarding the equilibrium between technological advancement and environmental conservation, with a particular emphasis on the managerial and social implications of digital transformation. The authors examine the potential benefits and risks of using digital technologies in urban governance, and provide examples of cities that have already implemented these systems. They also present data-driven Smart City concepts that can be used to manage urban infrastructure, focusing on the principles of Smart City management and development, sustainability, and integration of environmental standards (Andrienko, 2018).

The concept of smart cities represents a pivotal paradigm for the advancement of urban areas in the

context of the digital transformation of the economy. The objective is to integrate digital technologies and innovations with a view to enhancing the quality of life, optimising resource management and facilitating sustainable urban development. A review of the literature reveals that considerable attention has been devoted to both the theoretical understanding of this concept and the methodological approaches to its implementation. The literature on the subject tends to focus on a number of key areas, including the definition of the concept, the technological tools that are available, the implementation models that can be used, as well as the barriers and challenges that need to be overcome. The scientific literature presents a number of definitions and approaches to understanding the concept of the Smart City. In general, a Smart City can be defined as an area that employs digital technologies to integrate infrastructure, enhance the management of urban processes, reduce environmental impact, and ensure a high quality of life (Kirimtat, Krejcar, Kertesz, & Tasgetiren, 2020).

Main approaches to the concept: Technological approach: emphasises the role of digital platforms, the Internet of Things (IoT), big data, artificial intelligence (AI) and automation in urban management (Pushkar and Seriogina, 2023; Holroyd, 2022). Socially oriented approach: focuses on citizen participation in decision making and improving the quality of life through technology. Sustainable development: focuses on balancing economic development, environmental sustainability and social inclusion (Allam and Newman, 2018). The literature emphasises the importance of integrated platforms (IoT, Big Data, blockchain) that provide management of various aspects of the city, including transport, energy consumption and waste management. The literature focuses on the use of autonomous vehicles, intelligent traffic control systems (ITS) and ride-sharing platforms (Muraiev, 2020). The study by Liu et al. (2017) provides evidence of the economic and environmental benefits associated with such systems. The extant literature emphasises that the development of smart cities is inextricably linked to the digital economy (Huang, Wang, Li, Zheng, Mourtzis, Wang, 2022).

A review of the literature on smart cities reveals that their development is a strategically important area in the context of the digital economy. The concept is designed to enhance the quality of life, efficiency of urban processes and sustainable development. However, the implementation of this concept requires a systemic strategy that takes into account both technological and social challenges (Senkevych and Voit, 2020; Sergiyenko, 2022). The following section outlines the objectives of the article, providing a clear statement of the task at hand. The objective of this study is to ascertain the prerequisites for the creation of a digital concept of urban governance in the context of sustainable development goals.

The objectives of the study are as follows: 1) to study the concept of the digital concept of city management or Smart City and the conditions for its implementation; 2) to reveal the concept of Smart City 3.0 development in the context of foreign experience; 3) to reveal the essence and significance of the concept of environmental sustainability of Smart City 3.0 and the promotion of sustainable green development.

3. Materials and Methods

Studying the concept of digital development in the context of the Sustainable Development Goals (SDGs) requires a multifaceted approach. Methods used to analyse the relationship between digital development and the SDGs: 1) Statistical data from international organisations such as the UN, the World Bank, the European Union, the International Monetary Fund and other international institutions. These data provide information on the level of digitisation, access to the internet and the use of digital technologies in different countries. The United Nations (UN) publishes reports on progress in achieving the Sustainable Development Goals (SDGs), which provide an analysis of the development of digital technologies in the context of sustainable development. The International Telecommunication Union (ITU) also publishes reports on this topic. In addition, the World Economic Forum (WEF) studies innovative digital solutions in the global context of sustainable development, while national digital development strategies and policy documents include strategic plans for digital transformation and sustainable development. Document analysis and content analysis are employed to examine official documents, strategies, programmes and reports on digital development and its alignment with the Sustainable Development Goals (SDGs) (Senkevych, Voit, 2020). Content analysis enables the identification of the principal approaches and priorities of digital development in diverse national contexts. Systemic analysis is employed to comprehend the intricate influence of digital technologies on all facets of sustainable development, encompassing the economic, social and environmental dimensions, and to examine the interplay between digital innovations and the SDGs within a unified framework. Econometric modelling to assess the impact of digital technologies on sustainable development. Big data analysis to identify trends and patterns in the development of digital infrastructure and its impact on different aspects of the SDGs, such as reducing inequality (SDG 10) or ensuring quality education (SDG 4).

Benchmarking is used to compare successful digital transformation practices in different countries working towards the SDGs. This provides an opportunity to identify the most effective strategies that can be adapted to other countries. Geographic information systems (GIS) analysis is a valuable tool for studying the territorial distribution of infrastructure resources, Internet access, and the impact of digital technologies on the environment. It is an essential instrument for analysing the spatial impact of digitalisation on sustainable development, as evidenced by its application in urban planning. By employing these methods, researchers can gain deeper insights into the relationship between digital technologies and sustainable development and identify strategies for optimising digital approaches to achieve the SDGs (Landry, 2005).

4. Results and Discussions

4.1. Digital Concept of City Management or Smart City and Conditions for its Implementation

The concept of Smart City represents a digital approach to urban resource and infrastructure management. It entails the utilisation of digital technologies, data, and artificial intelligence with the objective of enhancing the efficiency, sustainability, and quality of life of residents. The digital concept of urban governance establishes a novel framework for the interaction between the state, the private sector, and citizens, enhancing transparency in governance and the quality of life in cities (Table 1).

The advent of the Smart City concept represents a novel approach to urban management that integrates digital technologies with urban strategies, thereby facilitating a high level of integration and automation of urban functions. The utilisation of the Internet of Things (IoT), big data and artificial intelligence to optimise urban systems (energy supply, transport, security, etc.) represents a novel approach to urban infrastructure that facilitates enhanced data collection and analysis. The advent of the concept of "smart" solutions has enabled cities to utilise real-time data analysis in order to make informed management decisions. This represents a shift in traditional approaches to urbanism and enhances the city's capacity to adapt to the evolving needs of its population. The utilisation of digital platforms for civic participation and the implementation of digital services to engage citizens in city governance facilitate a novel level of interaction between authorities and residents, thereby engendering conditions conducive to decentralisation and the transparency of management processes (Li, 2022).

4.2. The Concept of Smart City 3.0 Development in the Context of Foreign Experience

The concept of Smart City development, as observed in the context of international experience, encompasses a diverse array of innovative approaches and solutions designed to optimise the urban environment and enhance the quality of life for urban residents. This encompasses the development of the Internet of Things (IoT) infrastructure, which includes the integration of IoT technologies for the monitoring and control of

Table 1

Key aspects of the digital concept of city management or Smart City 3.0

Concept aspects	Concept characteristics
Intelligent infrastructure management systems	Use of digital technologies to monitor and optimise urban infrastructure, such as transport networks, water and electricity supply, and energy systems. This helps to reduce costs, improve system reliability and prevent accidents.
Digital platforms for traffic and transport management	Real-time traffic management systems that analyse traffic flows and optimise routes, reducing congestion and pollution. Such platforms also support the safe movement of pedestrians and cyclists.
Internet of Things (IoT) and sensors for environmental monitoring	A network of sensors that collects data on air quality, noise, water pollution and other environmental indicators. This helps to quickly respond to threats and implement environmental initiatives.
Platforms for citizen engagement and digital self-governance	Digital platforms for discussing city projects, collecting proposals and voting that increase transparency and encourage citizen participation in city management processes. This contributes to the formation of a digital society where citizens can quickly communicate with the authorities.
Artificial intelligence for urban planning and resource management	The use of artificial intelligence algorithms to analyse large amounts of data on the population, mobility and needs of the city. This allows for forecasting, modelling the efficient use of resources, and making informed decisions.
Innovative solutions for digital security	Protecting municipal systems and personal data from cyber threats is a critical task. This includes encryption technologies, data privacy protection and cybersecurity systems to maintain the stability of digital networks.
Energy management system and sustainable development	Implementation of smart energy management systems to save resources, stimulate the use of renewable energy sources and implement green energy policies.

Source: compiled by the authors

urban systems, including transport, energy, water, and public safety (Allam, Newman, 2018). The utilisation of sensors and connected devices for the purpose of real-time data collection facilitates the optimisation of resources and the reduction of environmental impact. The implementation of intelligent transport systems, based on automation, facilitates the digitalisation of transport, the introduction of smart traffic lights, motion sensors, electronic information boards for public transport and electric transport infrastructure. Such systems assist in the reduction of congestion, the enhancement of safety and the optimisation of transport efficiency. Foreign smart cities are actively utilising renewable energy sources and energy management systems, including smart grids (Muraiev, 2020). Cities such as Amsterdam and Barcelona are implementing programmes designed to reduce emissions and encourage the construction of energy-efficient housing and buildings. The implementation of electronic government platforms that facilitate the convenient receipt of administrative services, the payment of utilities, and the submission of complaints or suggestions by residents. The objective is to guarantee equal access to digital resources, networks, educational and medical services for all segments of the population, irrespective of age, social status or geographic location. The development of cybersecurity measures to safeguard urban infrastructure and private data is also a priority. The application of big data analytics and artificial intelligence can facilitate the prediction of demand for a range of services, the optimisation of resource utilisation and the analysis of resident behaviour (Andrienko, 2018). By way of illustration, Singapore is engaged in a programme of experimentation with the use of AI in the fields of healthcare, traffic management and security. The evidence from international experience indicates that the active engagement of citizens through digital platforms and mobile applications to discuss city initiatives has the effect of promoting responsible governance and improving trust in city authorities. Cities such as Barcelona, Amsterdam, Singapore and Stockholm illustrate the significance of an integrated approach, wherein disparate elements of urban governance interact through digital platforms and shared networks, thereby establishing a genuine smart ecosystem. The creative industry represents an optimal synthesis of cultural, technological, industrial, and market elements. To illustrate, Berlin offers an exemplary infrastructure and event space conducive to creative pursuits. A multitude of creative professionals, including designers, photographers, and architects, can readily access the resources necessary to flourish, including opportunities for growth, networking, public communication, and a competitive environment. Berlin attaches great importance to the development of design talent. In creative cities, creative people can enjoy a good cultural atmosphere that is not only free and inclusive, allowing different cultures to exist and develop, but also has a certain number and level of audiences so that creative activities can be carried out without interruption. The importance of inclusivity for creative cities is that they can attract creative talent, and diverse cultural exchanges are more conducive to innovation (Voitko, Skorobogatova, Konovalova, 2023). Such a cultural atmosphere can attract more creative talent and companies, and thus generate more innovation. On the other hand, every industry needs a market of a certain size to develop, and for the creative industries, the audience is not only consumers, but their interaction with producers not only drives innovation, but also participates in the development of ideas. Therefore, the presence of a certain number and quality of audiences is also an important force for the growth and development of creative cities. Under the influence of economic globalisation, cities have become the main competition (Huang, Wang, Li, Zheng, Mourtzis, Wang, 2022). Cities are competing to attract investment and competition between cities is intensifying. In the context of competition for productive factors such as talent, knowledge, technology, information and investment, it is possible to attract these factors, which are the main direction of gaining new competitive advantages. In order to resolve the "globalisation-localisation contradiction", cities should rely on their own unique characteristics in the process of globalisation. The development of creative cities has the potential to enhance the competitiveness and adaptability of the national economy, while also improving the quality of life for citizens. Landry (2000) posits that modern metropolises are confronted with significant structural challenges, including the decline of traditional economic sectors, the deterioration of the quality of life, and the threats posed by globalisation. These issues necessitate the implementation of innovative solutions to address them effectively.

The digital concept of city management is a means of creating sustainable, environmentally responsible and socially integrated urban environments in which technology plays an important role in every aspect of life. The implementation of such solutions enhances the quality of life in urban areas, promoting sustainable development and economic growth (Zharova, 2019). The concept of the digital city encompasses innovative technologies for solving environmental problems, including the management of urban environments through digital solutions such as air monitoring, resource management, and green energy. These technologies will facilitate the economic analysis of digital city management in terms of innovation, regional policy, sustainable development, and urban economic growth (Sergiyenko, 2022). Solutions and projects are being implemented under the Smart City banner

Table 2

Areas of development of the digital concept of city management or Smart City 3.0

Development direction	Description of the direction
Smart management of buildings and infrastructure	The use of digital systems in public buildings to automate energy, heating, ventilation, cooling and security management. These solutions help to save resources, optimise costs and create a comfortable environment for residents and employees, while reducing environmental impact.
Digital healthcare services and healthcare systems	Implementation of telemedicine, mobile medical applications and digital patient records, which allow for fast and efficient service delivery. This ensures accessibility of medical services, simplifies health monitoring and speeds up response to medical needs.
Educational platforms and digital learning	Integration of digital education platforms that allow schools, universities and training centres to deliver distance learning, provide access to a variety of learning materials and support lifelong learning. This helps to adapt educational processes to the requirements of the modern labour market.
Analysing and using big data for decision-making	Data from various city systems are analysed to gain a deeper understanding of the city's needs. The use of big data helps to identify patterns, predict future trends and make strategic decisions to improve the quality of life in the city.
Supporting the digital ecosystem for the development of small and medium-sized businesses	Creation of digital infrastructure that supports the business environment by providing access to online platforms for e-commerce, logistics, financial transactions and interaction with the authorities. This stimulates the development of local businesses, creates new jobs and contributes to the economic development of the city.
Digital emergency response systems	Implementation of digital solutions that allow for effective coordination of rescue services and informing the public during emergencies such as fires, floods or man-made accidents. Early warning systems and rapid response tools increase the level of safety in the city.
Digital infrastructure for public space and recreation	Implementation of smart solutions for monitoring the condition of public areas such as parks, sports complexes and pedestrian zones. This allows tracking environmental indicators, ensuring cleanliness and safety, and analysing demand for infrastructure for further improvement.
Developing digital systems for cultural and social initiatives	Digital platforms for organising cultural events, social projects and community activities that allow cities to offer residents and tourists a variety of opportunities to interact with the cultural environment. Such systems help preserve local culture, stimulate social initiatives, and support cultural diversity.

Source: compiled by the authors

that only automate current processes in the city, but do not ensure the transformation of the management system, the improvement of the quality of services and the quality of life in accordance with the standards of the 21st century (ISO-37120, 37101). Risks of disintegration of the national digital model – through the creation of autonomous ICT architectures – own data centres, identification systems, data collection and exchange, cybersecurity approaches; creation of start-up initiatives in cities to increase the efficiency and speed of solving urban problems; innovation as a key factor in smart cities (innovation economy and development of urban innovations to solve urban problems); use of the sharing economy in the development of Smart City 3.0 (Holroyd, 2022).

4.3. The Concept of Environmental Sustainability Smart City 3.0 and the Promotion of Sustainable Green Development

The implementation of the concept of environmental sustainability of digital cities Smart City 3.0 revolves around improving the quality of life of the population, optimising resources and reducing costs; economic development and promoting sustainable development. This encompasses the implementation of intelligent traffic management systems, environmental monitoring, intelligent lighting and other innovative solutions that enhance the comfort, safety and environmental sustainability of urban environments. The deployment of digital technologies facilitates the optimal distribution of resources, thereby reducing the expenditure associated with utilities and infrastructure. This outcome is mutually beneficial for city authorities and residents alike (Kirimtat, Krejcar, Kertesz, Tasgetiren, 2020).

The European Green Capital Award was established by the European Commission in 2010 with the objective of recognising the efforts of cities to improve the environment and the quality of life of residents and visitors. To be eligible for this award, a city must demonstrate outstanding performance in terms of environmental standards and have a population of more than 10 million people. Furthermore, the city must have demonstrated an unwavering commitment to environmental protection. The Green Capital title is awarded annually to a city in Europe that is a role model for environmental protection and sustainable green development. The European Commission awards the winner 600,000 EUR (656,000 USD) to fund more sustainable green programmes. But the real prize is the marketing boost that comes with the city's certified green credentials. Previous winners include Tallinn (Estonia) and Oslo (Norway). Valencia is

home to the City of Arts and Sciences, a futuristic masterpiece by Valencian architect Santiago Calatrava that is now one of the city's biggest attractions. Its gleaming white curves and design give it a space-age feel, making it a favourite location for sci-fi films and TV series from Star Wars to Wild West World. The Spanish city of Valencia also places a premium on the creation of an environment conducive to the wellbeing of its citizens, evidenced by the transformation of streets and squares into pedestrian-friendly spaces. The city boasts a network of over 160 kilometres of bicycle paths and 95 square kilometres of pedestrian zones, which contribute to the advancement of environmentally sustainable transport (Pushkar, Seriogina, 2022).

The transition to the Smart City 3.0 concept necessitates the active involvement of citizens in the process of developing a Smart City through collaboration with private corporations and the public sector. It is anticipated that citizens will not only utilise existing applications that facilitate their involvement in the decision-making process, but will also contribute to the development of smart solutions (co-creation design) and become more integrated into the dynamics of business-public sector relations, which is crucial for the effective resolution of urban issues and the advancement of the city (Pozdnyakova, 2019).

5. Conclusions

The concept of environmental sustainability of the Smart City 3.0 and the promotion of sustainable green development, modernisation of urban infrastructure and implementation of effective resource green management (using IoT, green technologies, smart grids, new technical standards) are key elements of this proposal. The improvement of the urban management system (in fact, a request for transformation) is based on the integration of systems and data, while the determination of economic models of urban development takes into account not only natural, industrial, but also human potential (in fact, cities as centres of innovation and development). The concept includes the development of a national roadmap and a digital information framework for Smart City 3.0 as a basis for the development of relevant city roadmaps and support for urban digitalisation policies; the creation of a national platform – a catalogue of Smart City solutions (based on the principles of testing and certification) in accordance with the experience of the EPIC/European Smart Cities Platform. This is necessary to create an effective resource-based green management in the development and implementation of relevant projects, to equalise the capabilities of different cities in the country; to harmonise policies and legislation with EU

Table 3
Key advantages and disadvantages of environmental sustainability of digital cities

Direction content	Environmental sustainability advantages	Environmental sustainability disadvantages
Biodiversity conservation	Ecological sustainability contributes to the conservation of species and genetic diversity, which is important for the provision of ecosystem services and ecosystem resilience.	Building sustainable ecological systems can take time, especially when restoring depleted ecosystems.
Reduced environmental impact	Environmental sustainability helps to reduce the negative impact of human activity on nature, such as air, water and soil pollution.	The high costs of environmental sustainability can be costly, especially in the initial phase of implementation.
Ecosystem sustainability	Environmental sustainability ensures the stability of ecosystems, which is important for the provision of vital services such as water, climate regulation and food supply.	The application of strict environmental standards may lead to restrictions on the development of certain sectors, such as industry or agriculture.
Sustainable development in a changing climate	Environmental resilience helps ecosystems adapt to climate change and ensures the survival of diverse species in new conditions.	Some measures to achieve environmental sustainability can have unpredictable consequences in the long term, especially when it comes to global changes in ecosystems.
Economic benefits	In the long run, investments in environmental sustainability measures can lead to a reduction in the costs associated with climate change, pollution and biodiversity loss.	Achieving environmental sustainability requires cooperation between different sectors of society and government agencies, which can be difficult to achieve.
Social stability	Maintaining environmental sustainability helps to improve the quality of life and health of the population, which ensures social stability and promotes the development of society.	Unsustainable or inadequate activities can lead to the loss of valuable ecosystems and the services they provide, with serious consequences for human well-being and health.
Long-term benefits	Investing in environmental sustainability measures can have a long-term positive impact on ecosystems and human well-being, contributing to sustainable development.	Building an environmentally sustainable society requires a balanced approach that takes into account the needs of ecosystems, the economy and society.

Source: compiled by the authors

requirements (as stipulated in the EU-Ukraine Association Agreement) related to the development of the digital economy, innovation and urban governance (Connectivity and Regional Cooperation Policy 2014-2020); to implement international standards for Smart City management (ISO-37120, ISO-37101, etc.); to ensure not only technical interoperability, but also big data serve as a basis for improving city management – creating an intelligent city management system. The majority of creative cities included in the Smart City 3.0 project are characterised by a high level of cultural diversity, attracting individuals from a range of geographical backgrounds. These cities are often at the forefront of social and ideological change, and their urban policies attract highly skilled immigrants and entrepreneurs. The development of the creative industry is contingent upon financial support, as the creative industry itself requires financial backing to flourish.

References:

Allam, Z., & Newman, P. (2018). Redefining the smart city: Culture, metabolism and governance. *Smart Cities*, Vol. 1, p. 2–15.

Andrienko, A. O. (2018). Smart approaches to the development of large cities: prospects for implementation in Ukraine. Public Administration and Local Self-Government, p. 100–106.

Voitko, S. V., Skorobogatova, N. E., & Konovalova, N. S. (2023). Evolutionary prerequisites for the development of smart city on the basis of society 5.0. *Economic Bulletin of NTUU "Kyiv Polytechnic Institute"*, Vol. 26, p. 31–36.

Charles Landry (2000). The Creative City: A Toolkit for Urban Innovators (UK: Earthscan Publications, 2000).

Huang, I., Wang, B., Li, X., Zheng, P., Mourtzis, D., & Wang, L. (2022). Industry 5.0 and Society 5.0 – Comparison, complementation and coevolution. *Journal of Manufacturing System,* Vol. 64, p. 424–428.

Holroyd, C. (2022). Technological innovation and building a "super smart" society: Japan's vision of Society 5.0. *Journal of Asian Public Policy*, vol. 11, p. 18–31.

Zharova, L. V. (2019). Sustainable development in the concepts of smart urban initiatives. *Economics and law,* Vol. 3 (54), p. 107–114.

Kirimtat, A., Krejcar, O., Kertesz, A., & Tasgetiren, M. F. (2020). Future trends and current state of smart city concepts: A survey. *IEEE access*, Vol. 8, p. 86448–86467.

Li X. (2022). Big data analysis of the Internet of Things in the digital twins of smart city based on deep learning. *Future Generation Computer Systems*, Vol. 128, p. 167–177.

Peter Hall (1998). Cities in Civilisation. USA, Pantheon Books.

Pozdnyakova, A. M. (2019). Implementation of the smart cities concept in Ukraine: features and recommendations. *Problems of a systematic approach in the economy*, Vol. 2 (70), p. 49–57.

Pushkar, T. A., & Seriogina, D. O. (2022). Development of 'smart cities' in the context of digital transformation. *State and regions. Series: Economics and entrepreneurship,* Vol. 1 (124), p. 116–121.

Sergienko, L. V. (2022). Modern strategies of urban development in ensuring the security of urbanised territories. *Scientific notes of Vernadsky TSU. Series: Public management and administration*, Vol. 33 (72), No. 1, p. 123–129.

Muraiev, E. V. (2020). Development of cities based on the concept of "Smart Cities" in the digital economy: theoretical and methodological principles of implementation. *The current state of scientific research and technology in industry*, Vol. 2 (12), p. 109–119.

Senkevych, O. F., & Voit, D. S. (2020). Digital transformation of territorial management systems: directions and prospects for development. *Black Sea Economic Studies*, Vol. 52-2, p. 81–85.

Florida, Richard (2018). Homo creatives. How a new class is conquering the world / translated from English by Maxim Yakovlev. Kyiv: Nash format, 432 p.

Florida, Richard (2019). The crisis of urbanism. Why cities make us unhappy / translated from English by Iryna Bondarenko. Kyiv: Nash format, 320 p.