Studies in Systems, Decision and Control 601

Bahaa Awwad *Editor*

AI and IoT: Driving Business Success and Sustainability in the Digital Age

Volume 1

Springer

Studies in Systems, Decision and Control

Volume 601

The series "Studies in Systems, Decision and Control" (SSDC) covers both new developments and advances, as well as the state of the art, in the various areas of broadly perceived systems, decision making and control–quickly, up to date and with a high quality. The intent is to cover the theory, applications, and perspectives on the state of the art and future developments relevant to systems, decision making, control, complex processes and related areas, as embedded in the fields of engineering, computer science, physics, economics, social and life sciences, as well as the paradigms and methodologies behind them. The series contains monographs, textbooks, lecture notes and edited volumes in systems, decision making and control spanning the areas of Cyber-Physical Systems, Autonomous Systems, Sensor Networks, Control Systems, Energy Systems, Automotive Systems, Biological Systems, Vehicular Networking and Connected Vehicles, Aerospace Systems, Automation, Manufacturing, Smart Grids, Nonlinear Systems, Power Systems, Robotics, Social Systems, Economic Systems and other. Of particular value to both the contributors and the readership are the short publication timeframe and the worldwide distribution and exposure which enable both a wide and rapid dissemination of research output.

Indexed by SCOPUS, DBLP, WTI Frankfurt eG, zbMATH, SCImago.

All books published in the series are submitted for consideration in Web of Science.

Bahaa Awwad
Editor

AI and IoT: Driving Business Success and Sustainability in the Digital Age

Volume 1

Springer

Editor
Bahaa Awwad
Department of Computerized Banking
and Financial Sciences
Palestine Technical University—Kadoorie
Tulkarm, Palestine, State of

ISSN 2198-4182 ISSN 2198-4190 (electronic)
Studies in Systems, Decision and Control
ISBN 978-3-031-92239-8 ISBN 978-3-031-92240-4 (eBook)
https://doi.org/10.1007/978-3-031-92240-4

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Globalisation Trends in the Sustainable Development of Urban Agglomerations

Nadiia Reznik, Yuliia Havryliuk, Svitlana Kozhemiakina, Natalya Ushenko, Nataliia Vasiutkina, and Alla Kasych

Abstract The article is devoted to the study of globalization trends that affect the sustainable development of urban agglomerations, with a focus on Ukrainian realities. This work examines in detail the economic, social and environmental aspects of urbanization, which are key components of sustainable development in the context of globalization. The emphasis is on studying the impact of global processes on the functioning of such agglomerations important for Ukraine as Kyiv, Kharkiv, Lviv and Odesa. These urban entities act as platforms for Ukraine's integration into global markets, and not only as economic and cultural centers. In particular, the authors analyze the spread of digital technologies, the mission of infrastructure investments, the implementation of "green" initiatives and the development of an innovative economy. The article reveals how the urbanization boom enhances economic activity, while at the same time causing new challenges, such as uneven development of regions, increased environmental load and social imbalances. The analysis of the article focuses on the importance of maintaining environmental stability and forming effective management strategies to ensure the balanced development of urban agglomerations. The role of international organizations in

N. Reznik (✉) · Y. Havryliuk
National University of Life and Envinromental Sciences of Ukraine, Kyiv, Ukraine
e-mail: nadya-reznik@ukr.net

Y. Havryliuk
e-mail: havrulyuk1983@gmail.com

S. Kozhemiakina · N. Ushenko
Borys Grinchenko Kyiv Metropolitan University, Kyiv, Ukraine
e-mail: s.kozhemiakina@kubg.edu.ua

N. Ushenko
e-mail: n.ushenko@kubg.edu.ua

N. Vasiutkina
State University «Kyiv Aviation Institute», Kyiv, Ukraine
e-mail: vasyutkina@ukr.net

A. Kasych
Kyiv National University of Technologies and Design, Kyiv, Ukraine

B. Awwad (ed.), *AI and IoT: Driving Business Success and Sustainability in the Digital Age*, Studies in Systems, Decision and Control 601,
https://doi.org/10.1007/978-3-031-92240-4_91

promoting sustainable development initiatives and the importance of partnership between the public and private sectors are substantiated. The results of the study can be used in the preparation of comprehensive programs for the development of urban areas that contribute to the integration of Ukraine into the world community as a modern, environmentally conscious and economically competitive state and meet the goals of sustainable development.

Keywords Globalisation · Sustainable development · Urban agglomerations · Urbanisation · Ukraine · Innovations · Environmental sustainability · Socio-economic development · Integration · Urbanism

1 Introduction

One of the defining processes of modernity is globalization, which actively affects all spheres of social life, including the development of urban agglomerations. It is in this context that sustainable development becomes a key concept. This allows balancing economic growth, social progress and environmental stability. Urban agglomerations play an important role in ensuring the competitiveness of states in the global environment, becoming centers of economic activity and innovation.

A model of successful integration into global economic and social processes is provided by such European urban agglomerations as Paris, Berlin, London and Barcelona. These agglomerations show a high level of urbanization, economic development and the implementation of innovative solutions for sustainable development, in particular in the areas of ecology, infrastructure and digitalization. At the same time, such problems of European agglomerations as overpopulation, social inequality and environmental pollution require a constant search for harmonious solutions to ensure sustainable development.

Ukraine's gradual integration into global economic, cultural and environmental processes is facing numerous challenges in the development of its urban agglomerations. This is due to both external and internal factors, such as globalization and urbanization, uneven economic development of regions, outdated infrastructure and the need to introduce innovative technologies. The Russian invasion has a particular impact on the dynamics of the development of agglomerations in Ukraine. The destruction of infrastructure, reduction of investments, migration processes and changes in economic and social structures caused by the war pose new challenges for urban planners regarding restoration and sustainable development.

Thus, the purpose of the article is to identify key trends and challenges related to the development of urban agglomerations in the context of globalization and military conflict, as well as to develop recommendations for ensuring their sustainable development.

2 The Literature Review

An important direction of modern scientific thought is the study of globalization trends and sustainable development of urban agglomerations. The works of Ukrainian scientists who study the features of the development of urban systems in the context of globalization processes deserve special attention.

One of the most important studies is the work of V. M. Grechukha, who studies the socio-economic aspects of urbanization and the impact of globalization on the development of urban areas of Ukraine. Grechukha emphasizes the importance of integrating economic, environmental and social factors in the development of cities and agglomerations, and also emphasizes the need to create sustainable management mechanisms to maintain the competitiveness of urban areas in the context of global changes [1].

Gladka T. A., in her works, studies the environmental problems faced by urban agglomerations in Ukraine. The author notes that sustainable development of agglomerations is possible only if a balance is maintained between industrialization and the preservation of natural resources. Hladka emphasizes that in order to achieve sustainable development, it is necessary to implement "green" initiatives, develop environmental infrastructure and actively cooperate with international organizations [2].

Another important contribution was made by L. I. Shymchuk, who analyzed the economic development of urban agglomerations in the context of globalization. She focused on investment processes, infrastructure development and digitalization as important drivers of sustainable development. Shymchuk believes that integration is necessary to ensure the economic stability of urban agglomerations in global economic processes, but at the same time emphasizes the need to maintain internal economic balance and support social development [3].

In particular, I. M. Volkov studies the relationship between urbanization and changes in the social structure. He identifies social inequality and unemployment as key factors affecting the sustainability of urban agglomerations, and suggests ways to solve these problems through the development of social programs that provide equal opportunities for all segments of the population [4].

Of particular note is the study by O. S. Kramarenko, which analyzes the processes of urbanization in Ukraine and their impact on economic activity. Kramarenko notes that, despite significant progress in the development of infrastructure and technologies, urban agglomerations of Ukraine face problems arising from the rapid pace of urbanization and insufficient funding at the level of local authorities [5].

Finally, the work of O. M. Borovsky is devoted to the study of strategies for adapting Ukrainian cities to the conditions of globalization changes. Borovsky emphasizes the need to modernize urban systems and develop innovations, focusing on the adaptation of cities to new economic, social and environmental challenges [6].

Thus, the scientific achievements of Ukrainian scientists confirm the importance of an integrated approach to the development of urban agglomerations, combining

economic stability, social justice and ecological sustainable development. They also emphasize the need to integrate national agglomerations into global processes, adapt to new realities, and ensure sustainability in the face of globalization changes.

3 Materials and Methods

The method of comparative analysis is used to study the processes of development of urban agglomerations in Ukraine and Europe, which allows identifying common trends and differences in governance, economic development and environmental sustainability. The statistical method was used to collect and process quantitative data on economic, social and environmental indicators of cities, as well as to assess their dynamics.

For a deeper understanding of development processes, the method of situational analysis was used, which allows us to study specific cases of Ukrainian and European agglomerations, analysing individual management strategies and adaptation models. The forecasting method helps to assess future development trends, in particular in the context of globalisation trends, based on existing data. In addition, the content analysis method was used to study scientific publications, policy documents and urban agglomeration development strategies, which allows us to assess the application of international approaches in the context of Ukraine.

This combined approach, which combines both quantitative and qualitative methods, provides an in-depth understanding of the impact of globalisation on the sustainable development of urban agglomerations.

4 Results

Globalization is one of the main determinants of the modern development of urban agglomerations. It affects social, economic and environmental processes, thereby creating new opportunities and challenges for cities and agglomerations. From the perspective of sustainable development, globalization trends contribute to economic, cultural and technological integration, as well as increasing interdependence between regions and states.

Urbanisation, digitalisation, increased mobility, integration of economic systems, as well as changes in the environmental and social environment are the main globalisation trends that affect the development of urban agglomerations. Today, most agglomerations in the world face challenges associated with rapid infrastructure development, growing demand for resources, deteriorating environmental conditions and increasing social inequalities [7, 8].

A key aspect of the sustainable development of urban agglomerations is the balance between economic growth, social integration and environmental protection. Important indicators of sustainable development include:

Sustainable development index (**SDI**)—an indicator that reflects the ability of a city to ensure sustainable development in the social, economic and environmental spheres. For agglomerations, high values of the index are important in the context of economic stability, environmental safety and social equality [9].

Urbanization index—measures the degree of urbanization of a certain region, in particular the share of the urban population in the total population. In Ukraine, this index varies depending on the agglomeration, in particular the Kyiv agglomeration is the most urbanized, which increases its economic potential and at the same time exacerbates problems with infrastructure [10].

Environmental sustainability index—calculates the impact of agglomeration development on the environment, including CO2 emissions, water and air pollution, and the use of renewable energy sources. In large cities of Ukraine, this indicator remains low, which indicates the need for environmental reforms [11].

Economic activity index—measures the level of economic activity in agglomerations, taking into account GDP growth, employment levels and investment activity. Cities with high economic activity indicators are cities that are actively integrated into global economic processes [12].

Social inclusion index—shows the extent of social benefits for different segments of the population, such as the degree of social equality and access to education, healthcare and other social benefits. This index is important in urban agglomeration studies, as globalization can lead to easier access to resources and at the same time increase social inequality [13].

Digitalization is also an important part of globalization. It promotes the development of intelligent technologies, automation, and the management of urban infrastructure through smart systems, which in turn allows for more efficient use of resources, reduced energy consumption, lower costs for maintaining cities, and improved quality of life for residents [14].

Although globalization has many advantages, it is not without challenges. It can increase economic inequalities, put pressure on the environmental situation, and deepen social tensions due to insufficient attention to local needs and cultural characteristics. To overcome these problems, it is important to develop policies that ensure the integration of global and local interests while maintaining sustainable development at all levels of government [15].

Thus, globalization trends will have a significant impact on the development of urban agglomerations, but to achieve sustainable development, it is necessary to ensure a balance between economic, social, and environmental development at all stages of urbanization.

4.1 Trends In the Development Of Urban Agglomerations In the World

According to the UN, more than half of the world's population lives in cities, and this share is projected to increase to 68% by 2050. This rapid growth necessitates rethinking approaches to planning, management and development of urban agglomerations.

One of the main trends today is the rapid growth of the population in urban agglomerations, driven by the migration of rural people in search of better living conditions. Megacities such as Tokyo, New York, Shanghai and Mumbai are experiencing steady population growth due to internal migration, labour inflows and the concentration of living and working opportunities. Tokyo, for example, is the world's largest metropolitan area, with more than 37 million people and about 30% of Japan's total population.

This rapid population growth leads to the following challenges:

Housing shortage, rising property prices;
Overloading of infrastructure, including transport and energy systems;
Increasing levels of air and water pollution, etc. [16].

Hence, the development of technology has become a key driver of sustainable management of urban agglomerations. The idea of 'smart cities' introduces digital platforms to optimise traffic flows, energy systems and utilities. According to the McKinsey Global Institute, smart city technologies can reduce energy consumption by 10–15% and reduce travel time by 20–30%.

Examples of successful smart cities include:

Singapore, which has integrated a transport system that uses artificial intelligence to manage traffic.
Barcelona, which uses smart sensors to manage water supply and waste collection.
Dubai—the use of blockchain technologies for the provision of public services, allowing to increase transparency and efficiency of management [17].

In the current context of urban agglomerations, environmental aspects are central to globalisation. Accordingly, governments of developed countries are actively implementing policies aimed at reducing greenhouse gas emissions, transitioning to renewable energy sources and improving energy efficiency.

For example, London, which has significantly improved the environmental situation through the use of electric public transport (electric buses, subways), the creation of Low Emission Zones, and the development of green areas, which include more than 300 parks in the city, covering 18% of the territory [18].

Table 1 shows a comparative analysis of the environmental performance of global agglomerations.

Another important aspect of sustainable agglomeration development is the provision of convenient and affordable transport in the city. Ensuring sustainable mobility of residents is an important component of urban planning. For example,

Table 1 Comparison of environmental performance of global agglomerations [18]

Agglomeration	Population, million people	Environmental sustainability index	CO_2 emissions per capita, tonnes per year
New York	20,1	78	4,8
Tokyo	37,4	72	3,6
London	9,5	84	2,9

Los Angeles is successfully implementing a programme to develop infrastructure for electric vehicles, which will reduce CO_2 emissions by 12% over 5 years.

Cities such as Paris and Seoul are actively investing in expanding their metro networks and integrating different modes of transport, including bicycles, electric scooters, and buses. In France, in particular, the Paris rapid transit (RER) network provides connections to the suburbs. In Seoul, a single ticket system for public transportation has simplified city travel and reduced waiting times..

4.2 The Impact Of the Russian Invasion On Ukrainian Agglomerations

The invasion of Russian troops into Ukraine on February 24, 2022 seriously affected the development of Ukrainian urban agglomerations. The war has caused large-scale economic, social and infrastructural changes that have affected both large cities and regions with smaller agglomerations. Agglomerations located in the east and south of Ukraine, where the fighting is ongoing, have been most affected.

In particular, Kharkiv, Mariupol, Sievierodonetsk and other cities where active hostilities are taking place have felt the effects of the war the most, with some of them experiencing a sharp decline in population. As a result of the large number of refugees fleeing to safer regions, the cities have suffered significant demographic losses. This has led to a decline in the labour force and, consequently, an economic slowdown. According to the State Statistics Service, about 1 million IDPs were registered in Kyiv alone at the end of 2022 (Table 2).

The war has had a significant impact on the economy of urban agglomerations. One of the most important aspects is the extensive damage to infrastructure.

Table 2 Dynamics of population change in Ukrainian agglomerations, 2022 [10]

Agglomeration	Population change (%, 2022)
Kyiv	+ 2,5
Kharkiv	− 3,7
Odesa	+ 1,1
Lviv	+ 2,0
Mariupol	− 50,0

Table 3 Impact of damaged infrastructure on the economic performance of urban agglomerations, 2022 [19, 20]

Agglomeration	Number of damaged infrastructure facilities (pcs.)	Economic losses of GDP (%,)
Kyiv	250	– 1,5
Kharkiv	700	– 7,3
Odesa	100	– 3,0
Lviv	50	– 2,0
Mariupol	1200	– 95,0

This includes residential buildings, transport networks, communications, medical facilities and businesses. Many businesses were forced to suspend their operations, and some even ceased to exist due to damage or evacuation to safer areas. The majority of businesses have relocated to western Ukraine, where the business environment remains more stable.

In particular, Kharkiv, Mariupol and Sievierodonetsk were the cities where infrastructure was almost completely destroyed. Kyiv, Lviv, Odesa, and Dnipro suffered partial damage, but were mostly able to maintain basic functions through infrastructure repairs and restoration (Table 3).

This is particularly evident in cities such as Mariupol, where most of the metallurgical industry was destroyed and the city's economy is experiencing serious difficulties due to the lack of production capacity and occupation [19, 20].

The war has also had a negative impact on the environmental situation in urban agglomerations. Significant environmental degradation has resulted in an escalation of environmental problems due to numerous shelling and fires in industrial areas, as well as leaks of oil products and chemicals. Cities such as Kharkiv and Mariupol, and others near intense hostilities, have faced problems with water purification and restoration of energy networks after damage [21].

4.3 The Impact Of Globalisation Trends On the Economic, Social and Environmental Performance Of Ukrainian Agglomerations

As agglomerations in Ukraine face extraordinary challenges in the form of infrastructural destruction, economic losses and changing social dynamics in the context of the war, globalisation trends are taking on new features.

Prior to Russia's invasion of Ukraine, globalisation had a positive impact on the economy of Ukrainian agglomerations, in particular through the development of digital technologies, integration into the global economy and foreign trade. Major cities such as Kyiv, Lviv, and Odesa have been important economic hubs, attracting investment, developing infrastructure, and fostering business and small enterprise

development. However, the Russian invasion has changed the economic development picture.

According to the National Bank of Ukraine, there was a significant economic downturn in 2022, with large cities suffering the most due to the destruction of businesses and infrastructure. For example, Kyiv, Odesa and Kharkiv suffered significant economic losses in the form of production shutdowns, reduced investment and damage to transport infrastructure. In particular, Kharkiv, which is an important industrial centre, suffered losses of 30% of its gross domestic product (GDP) in 2022.

Nevertheless, globalisation is creating opportunities for agglomerations to recover their economies. E-commerce, online education, and remote work have become important drivers of economic growth, especially in times of war, and attracting international investment through international aid programmes and infrastructure rebuilding can help launch a new recovery. Another opportunity is international economic ties, i.e. active participation in international economic forums and trade agreements allows Ukrainian cities to establish cooperation and gain access to new markets.

In our opinion, globalisation processes have contributed to social changes in Ukraine's urban agglomerations, particularly in terms of access to education, healthcare, culture and employment. Cities have become more accessible to the implementation of international practices in various spheres of life, which has contributed to the development of human capital.

A significant flow of internally displaced persons (IDPs) to large cities has increased the burden on social services, housing stock and infrastructure. According to the UN, more than 7 million Ukrainians became internally displaced by the end of 2022, most of them settled in agglomerations [22].

In general, the war in Ukraine significantly complicated the social situation in agglomerations, increasing social risks and the need for state assistance to improve the living conditions of the population.

Environmental problems have also become an important aspect of urban development, especially in the context of globalization. In particular, Ukrainian cities such as Kyiv and Lviv have actively invested in environmentally friendly technologies, sustainable development and renewable energy sources, which was an important element of their integration into global ecological networks. However, the Russian invasion has significantly complicated the implementation of environmental programs.

The hostilities have damaged environmentally important facilities, such as sewage and water treatment facilities, and have also polluted the air and soil. This has become a serious problem for the sustainable development of large cities. According to the Ministry of Ecology and Natural Resources of Ukraine, more than 100 objects of environmental importance have been destroyed or damaged in Ukraine as a result of hostilities [21].

At the same time, globalization processes open up new opportunities for restoration and sustainable development. In particular, this is happening thanks to the involvement of international assistance, the use of the latest technologies, and integration into the global economy.

4.4 Policies and Strategies for Sustainable Development of Ukrainian Urban Agglomerations: Lessons From the European Experience

Given the impact of globalisation trends and the challenges of war, the use of European agglomerations' cases can be a source of effective solutions in recovery and sustainable development policies and strategies. Successful examples of sustainable development for Ukrainian agglomerations are recommendations based on the analysis of practices from such cities as Berlin (Germany), Copenhagen (Denmark), and Warsaw (Poland) [23–25].

These European cities demonstrate the importance of an integrated approach to urban planning. For example, Berlin is implementing a sustainable development strategy through the Berlin 2030 programme, which combines transport planning, green space development and digitalisation of urban management.

Taking into account Berlin's experience, Ukrainian agglomerations can take into account the following aspects:

Prioritise green technologies by increasing the development of eco-friendly transport projects, such as electric buses, and building cycling infrastructure in Kyiv, Lviv, and Kharkiv after the war;
Using the experience of Copenhagen, implement zoning of urban areas in the design of residential areas, taking into account green areas and public facilities;
When restoring damaged infrastructure by creating multifunctional residential and commercial areas, focus on energy efficiency.

European agglomerations such as Warsaw, even in times of crisis, are actively investing in the development of innovative economy clusters, which helps ensure sustainable growth. For Ukrainian cities, this may include:

Supporting start-ups and technology clusters by creating innovation centres, such as the IT hub in Lviv, and stimulating entrepreneurship through tax incentives;
Attracting international investors through business forums and presentations to attract foreign capital;
Developing the creative economy, namely stimulating cultural projects and tourism programmes to restore economic activity.

One of the main challenges is the integration of internally displaced persons (IDPs). Amsterdam, in particular, has successful integration programmes that could be adapted for Ukraine. They include:

- Housing programmes for IDPs, including the construction of modular housing and the provision of affordable housing in large cities;
- Educational and vocational programmes, including retraining courses for IDPs with a focus on integration into urban economies;
- Social inclusion, including the creation of public spaces for cultural and social life that promote social cohesion.

Copenhagen is a city that is a leader in the decarbonisation strategy among European cities. The following achievements in this area may serve as an example for Ukrainian agglomerations:

- Renewable energy sources are used in the development of district heating systems to reduce carbon dioxide emissions;
- Introduction of mandatory standards for building insulation and installation of solar panels, which helps to improve the energy efficiency of buildings;
- Introducing modern water treatment systems, similar to the practices of Warsaw.

European cities, such as Barcelona, are actively implementing digital technologies through the "CityOS" platform to improve urban governance, which allows citizens to participate in decision-making through mobile applications.

Kyiv is also a leader among Ukrainian cities in implementing innovative technologies for urban governance, which are aimed at digitalizing processes, improving transport and environmental initiatives. One of the largest digital governance projects is the "Kyiv Digital" platform, which combines city services in one mobile application. The city also participates in such global projects as the "Smart Cities" initiative. This allows it to exchange experience with other cities and attract foreign investments to improve urban infrastructure.

Thus, in Ukrainian realities, an important step to ensure the sustainable development of urban agglomerations is the adaptation of best European practices. Integrated urban planning, environmental initiatives, social support and digital management tools will create conditions for the restoration and strengthening of Ukrainian agglomerations.

5 Conclusions

In the process of studying globalisation trends in the sustainable development of urban agglomerations with a focus on Ukrainian cities, in particular in the context of the Russian military invasion, we have come to several important conclusions that are of both scientific and practical importance.

Currently, urban agglomerations form the centers of globalization processes, which is manifested in digitalization, the introduction of smart technologies, integration into international economic and social systems. In the context of local realities and challenges, Ukrainian agglomerations need to adapt best European practices. In particular, such Ukrainian cities as Kyiv, Lviv and Dnipro have made progress in using innovative technologies to improve urban space management, but these approaches need further integration into a comprehensive strategy for sustainable development.

However, the Russian invasion has significantly affected the development of Ukrainian urban agglomerations, causing significant damage to infrastructure and making access to basic services more difficult. There has also been a decline in economic activity due to the destruction of enterprises and logistics networks, as well

as significant demographic changes due to internal displacement, forced resettlement and loss of the working population.

However, the war also led to an active search for alternatives, such as obtaining international support, developing volunteer campaigns, and mobilizing resources for rapid reconstruction.

A comparison of Ukrainian urban agglomerations with European ones shows that Ukrainian cities have great potential for integration into the European urban space. However, the key barriers remain insufficient adaptation of infrastructure, limited funding, and the lack of long-term strategies. European examples, such as Barcelona, Berlin and Warsaw, show that sustainable development is based on investments in green technologies, digitalisation of governance and active involvement of citizens in decision-making processes.

Therefore, we can conclude that to ensure the sustainable development of Ukrainian urban agglomerations in the post-war period, a number of strategies and policies need to be implemented, i.e:

- Develop long-term development strategies that include infrastructure rehabilitation, integration of smart technologies and stimulation of economic activity;
- Strengthen the environmental orientation of urban management, in particular through the introduction of energy-efficient solutions and renewable energy sources;
- Ensure active participation of citizens in the development and implementation of local policies;
- Integrate Ukrainian cities into European initiatives, such as the European Smart Cities, to share experience and attract investment;

Thus, Ukrainian agglomerations have great potential for transformation into modern, innovative and environmentally sustainable spaces. However, this process requires coordinated efforts by the government, local authorities, academics and international partners. Therefore, the successful future of Ukrainian agglomerations depends on their ability to integrate global trends into the local context, while maintaining their uniqueness and responding to the challenges of today.

References

1. Grechukha, V.M.: Socio-economic aspects of urbanisation in Ukraine. Kyiv: Naukova Dumka. (2015)
2. Gladka, T.A.: Environmental challenges of urban agglomerations of Ukraine. Kharkiv: Ecol. Dev. (2017)
3. Shymchuk, L.I.: Economic development of urban agglomerations in the context of globalisation. Lviv: Bus. Inform. (2016)
4. Volkov, I.M.: Social transformations in the context of urbanisation. Kyiv: Soc. Thought. (2018)
5. Kramarenko, O.S.: Urbanisation and economic activity in Ukraine. Odesa: Econ. Reg. (2019)
6. Borovskyi, O.M.: Adaptation strategies of Ukrainian cities to globalisation changes. Kyiv: Inst. Strateg. Dev. (2020)

7. Castells, M.: The rise of the network society. Wiley-Blackwell, p. 594 (2010)
8. Sassen, S.: Globalization and its discontents. New Press, p. 240 (2005)
9. United Nations: World urbanization prospects. 2020. URL: https://population.un.org/wup. Accessed 14 Dec 2024
10. State Statistics Service of Ukraine: Statistical Yearbook of Ukraine for 2022—Kyiv: State Statistics Service, p. 400. (2023)
11. World Bank: Environmental Performance Index. (2021). URL: https://epi.yale.edu. Accessed 14 Dec 2024
12. European Commission: Urban Data Platform. (2023). URL: https://urban.jrc.ec.europa.eu. Accessed 14 Dec 2024
13. OECD: Social Inclusion Indicators in Urban Areas: Report. Paris: OECD Publishing, (2021). URL: https://www.oecd.org/. Accessed 14 Dec 2024
14. Schwab, K.: The Fourth Industrial Revolution. Crown Bus. 192. (2017)
15. Pylypchuk, V.: Globalisation and urbanisation: challenges for sustainable urban development. —Kyiv: Naukova Dumka, 256. (2020)
16. World Bank: Global Urbanization Prospects. (2021). URL: https://worldbank.org/urbanization-prospects. Accessed 14 Dec 2024
17. European Commission: Smart Cities and Communities Initiative. (2023). URL: https://ec.europa.eu/smart-cities. Accessed 14 Dec 2024
18. Circular Cities Coalition: Towards a Circular Economy in Cities. (2022). URL: https://circularcitiescoalition.org. Accessed 14 Dec 2024
19. Ministry of Infrastructure of Ukraine: Damage to infrastructure as a result of the war. (2023). URL: https://mtu.gov.ua. Accessed 14 Dec 2024
20. National Bank of Ukraine: Economic impact of the war on urban agglomerations of Ukraine. (2023). URL: https://bank.gov.ua. Accessed 14 Dec 2024
21. Environmental monitoring of Ukraine: The environmental state of large Ukrainian cities after the Russian invasion. (2022). URL: https://www.menr.gov.ua. Accessed 14 Dec 2024
22. United Nations: Statistics on internally displaced persons in Ukraine. (2022). URL: https://www.unhcr.org. Accessed 14 Dec 2024
23. Nadiia Reznik, P., Havryliuk, Y., Druzhynina, I., Anishchenko, H.Y., Omelianenko, M.V., Novykova, I.V.: The Impact of the War on Internet Trade in Ukraine and the World: Consumer Trends and Expectations. Intelligent Systems, Business, and Innovation Research. Studies in Systems, Decision and Control, vol. 489. Springer, Cham. (2024)
24. Nadiia, R., Havryliuk Y., Yakymovska A., Halahur Y., Klymenko L., Zhmudenko V., Ischenko, V.: Land market in ukraine: functioning during the military state and its development trends. In: Hamdan, A., Aldhaen, E.S. (eds.) Artificial Intelligence and Transforming Digital Marketing. Studies in Systems, Decision and Control, vol. 487. (2024)
25. Labenko, O, Sadauskis, A., Lymar, V.: The efficiency of financing environmental protection measures in the context of Ukraine's future membership in the EU. Sustainability **14**, 6090 (2024)
26. Kozhemiakina, S., Cherkasov, A., Reznik, N., Yazlyuk, B., Zhuravka, O., Mazurov, S.: New workplace forecasting in the industrial sector of the Ukrainian economy. Probl. Perspect. Manag. Perspect. Manag. **16**(4), 384–394 (2018)
27. Reznik, N.P., Gavrilyuk, Y.G., Muzychenko, A.S.: Regulators tools for stimulating the development of biofuel production by enterprises. Agric. Ind. Ukraine Herald. Econ. Transp. Industr. **69**, 101–113 (2020)
28. Mysyuk, M., Zakhodym, M., Ievstafieva, Y., Susharnyk, Y., Misko, A., Reznik, N.: Problems of food security in modern conditions of Ukraine. Int. J. Adv. Sci. Technol. 29(9s), 4606–4613 (2020). http://sersc.org/journals/index.php/IJAST/article/view/17171
29. Nataliia, M., Liudmyla, H., Nadiia, R.: Approaches to land zoning on the basis of sustainable territory development. Int. Conf. Bus. Technol. 784–796 (2022)
30. Serhii, C., Yuliia, C., Petro, T., Artem, S., Nadiia, R.: Areas of forensic methodology development in Ukraine. J. Adv. Res. Dyn. Control Syst. **12**(7), 419–427 (2020). https://doi.org/10.5373/JARDCS/V12SP7/20202124