REPUBLIC OF MOLDOVA ECONOMIC AND ECOLOGICAL COMPETITIVENESS OF URBAN AGGLOMERATIONS AND CLUSTERING POLICY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

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Abstract

The development of economic agglomerations is acknowledged as a key factor in enhancing national competitiveness. This article focuses on examining the distinctive features of economic and ecological competitiveness in urban agglomerations within the Republic of Moldova. It provides an analysis of the conceptual underpinnings of urban agglomerations, encompassing a range of theories and concepts related to the spatial organization of the economy, as well as the underlying logic governing the formation and growth of agglomerations. The study draws upon statistical data, with its methodological framework grounded in general scientific methods of theoretical and empirical inquiry. Findings from the assessment of economic and ecological competitiveness within Moldovan urban agglomerations, alongside an evaluation of sustainable development goals and associated indicators, reveal a lack of alignment with contemporary challenges and standards, posing significant implications for the efficient functioning of urbanized territories. The practical relevance of these findings lies in their potential application for the formulation of regional and national development strategies and programs.

Key words: *competitiveness; economic agglomerations; principles of agglomeration development; regional policy; regionalization; urbanization*

JEL Classification: *O18, O44, R11, R58*

INTRODUCTION

In the context of global transformations, accelerating the pace of sustainable economic growth is essential both for the competitiveness of national economies and for the well-being of a country's citizens.

The term "sustainable development" became widely used after the 1992 Conference on Sustainable Development (Rio de Janeiro). The main areas of public interest and global goals have become:

❖ health and well-being - the right of people to the highest attainable standard of health and to work productively in harmony with nature;

❖ sustainability - harmonious social and economic growth that adequately meets the development and environmental needs of present and future generations;

❖ environmental protection must be an integral part of the development process and cannot be considered in isolation.

Over several decades, sustainable development issues have been discussed at several international meetings, forums, conferences and congresses: Habitat - UN Conference on Human Settlements (Vancouver, 1976); Council of Europe - Permanent Conference of Local and Regional Authorities of Europe (European Charter of Cities. Strasbourg, March 17-18, 1992); UN Habitat II Conference on Human Settlements (Istanbul, 1996); UN Rio+20 Conference on Sustainable Development (Rio de Janeiro, 2012); UN Habitat III Conference, New Urban Agenda.

The methodological and conceptual aspects of sustainable development are also reflected in the following documents endorsed by the UN General Assembly: *the Millennium Declaration* (September 18, 2000); UN General Assembly, *Declaration on Cities and Other Human Settlements in the New Millennium* (2001); Strengthening the mandate and status of the Commission on Human Settlements and the status, role and activities of the UN Centre for Human Settlements (Habitat) (February 26, 2002); Transforming our World: The 2030 Agenda for Sustainable Development (2015).

One of the ways to ensure sustainable economic growth and competitiveness in the context of increasing globalization and regionalization of the world's countries and the growing number of risks and threats is an effective territorial policy, and one of its instruments is the creation and development of agglomerations (or urban settlements) (Drezner, 2001).

The purpose of this study is to explore and advance strategies that enhance the economic and ecological competitiveness of urban agglomerations in the Republic of Moldova through effective clustering policies within a sustainable development framework. This involves a comprehensive assessment of current policies and the formulation of development pathways that integrate economic growth with environmental stewardship, considering both local particularities and the potential of regional cooperation.

The objectives of this study are to analyze the structure and dynamics of urban agglomerations in the Republic of Moldova. It aims to evaluate the economic competitiveness of urban regions, focusing on factors such as economic composition, infrastructure, resource allocation, and human capital, while also assessing the environmental impacts of urban growth and identifying necessary measures to protect ecosystems. The study will examine the role of clustering policies and the competitive advantages they offer, particularly within environmentally responsible industries and priority sectors. By identifying sustainable development models and best practices from international contexts, it seeks to enhance Moldova's economic and ecological competitiveness. Finally, the study will formulate a policy framework with actionable recommendations for implementing clustering strategies adapted to local conditions, aiming to achieve both economic growth and environmental resilience.

To achieve these objectives, the study will begin with a review of the specialized literature, gathering comprehensive information on Moldova's urban agglomerations, economic competitiveness, ecological impacts etc. An evaluation of sustainability indicators will identify environmental risks and highlight necessary protective measures to maintain ecological balance amid urban expansion. International clustering models will be reviewed to assess successful policies from other countries and the feasibility of adapting similar strategies to Moldova's unique context. A strategic policy framework will then be developed, proposing supportive policies and tools to promote clustering in key sectors, particularly green and innovative industries that foster sustainable growth. The potential impact of these proposed policies on economic competitiveness and environmental sustainability will be assessed through modeling and simulation. The study will conclude with targeted recommendations for policymakers to support competitive and sustainable urban development across the Republic of Moldova.

I. ANALYSIS OF APPROACHES TO SUSTAINABLE DEVELOPMENT OF URBAN AGGLOMERATIONS

The factors that contribute to added value in today's economy, such as intellectual capital and innovation capacity, are largely concentrated in the largest economic agglomerations. Sectors of the national economy based on these factors are growing faster than others, even in times of crisis and great social, economic and political uncertainty (Sollaci, 2022).

In this context, it is important to distinguish the concept of agglomeration, commonly approached from a *mechanistic* perspective in our country, from the framework of *agglomeration in economics*, where growth is driven by innovative business networks (clusters) and the accumulation of creative capital (Melo et al., 2009; Fu et al., 2023). The first approach assumes the creation of agglomerations through the territorial unification of localities, the enlargement of existing cities and municipalities and the joint development of infrastructure, but it does not assume the use of the competitive advantages specific to the new economy and does not estimate the risks of territorial concentration of resources, economic activities and considerable discrepancy in income and living standards in the regions of the national economy. This approach is more simplistic and self-evident and involves strategies and policies with medium- and short-term effects. The second approach is more complex, but it offers the possibility of highlighting all the risks and threats associated with the agglomeration process in the short, medium and long term, which allows for a reduction in uncertainty and increased possibilities for management, maneuver and control at both local and national levels. The role of the central government according to this approach is very limited, while the role of regional, municipal and local authorities, on the contrary, is extremely important. However, we believe that the second approach, with all its complexity, can contribute to ensuring sustainable economic growth and economic competitiveness of the Republic of Moldova at global and regional level.

The theory of economic agglomeration distinguishes the following characteristics of agglomerations, which are considered by some specialists to be classic: territorial proximity of urban settlements; compact grouping (within a maximum two-hour accessibility zone) around the main nucleus; division of labor between localities; development of interlinked relations of production, distribution, exchange and consumption, the existence of socio-cultural links, etc. (Duranton & Puga, 2020; Cosmulese et al., 2021). However, the identification of these characteristics has not led to the emergence of a unanimously accepted definition of economic agglomeration. At the same time, it is important to note that almost all the definitions of economic agglomerations that exist today emphasize the following two essential characteristics of agglomerations: (1) the density and concentration of the urban environment and (2) the community of economic, social and infrastructural connections that create an integral spatial system (Rosenthal & Strange, 2004).

Thus, the most widely accepted characteristic of agglomeration is the *geographical concentration of people and industries*. Agglomerations differ considerably from the national average in terms of indicators such as (1) population density and population growth; (2) degree of spatial connectivity; (3) Gross Product per capita and labor

productivity; (4) per capita income; (5) real estate prices and cost of rented housing; (6) innovation production (Glaeser, 2010).

Ensuring the competitiveness of urban agglomerations requires, firstly, to develop a system of indicators characterizing different aspects of their environmental sustainability; secondly, to consider these indicators in dynamics over a long period of time; thirdly, to create criteria for determining critical indicators characterizing environmental sustainability provisions (threshold parameters).

Sustainable urban development is not possible if the balance between economic, environmental and social aspects is disturbed. Due to the complex structure of the taxonomy of urbanized territories, it is impossible to make a classification based on a single parameter. For these purposes, multi-criteria analysis can be used. The sustainable development of urban agglomerations has been the focus of numerous studies, including those by Bithas and Christofakis (2006), Dassen et al. (2013), Girardet (2004), Naess and Jensen (2002), and Hall and Falk (2013).

A review of international urban policies has identified several common approaches to the concept, the most common being *smart city*. The *smart city* concept is both comprehensive and technology-driven, focusing on the integration of digital solutions to enhance urban living. However, its application is often constrained by an emphasis on modernizing the infrastructure within economic agglomerations, which limits the broader potential of the concept to address diverse urban challenges beyond just infrastructure improvements. It has a number of disadvantages such as: possibility of application only in the construction of new cities, strict centralized control and a limited number of sustainable development possibilities taken into account. On the other hand, the initial integrity of the urban system, the absence of inherited problems and the integration and coordination of technological solutions are the undeniable advantages of this approach.

However, this model is not suitable for countries with cities that have their own history and culture. In such cases, an integrated approach and special attention to the transformation of the society in the urbanized territory, the integration of technological and social implementations in the urban environment and the harmonious interaction of subsystems are required. Mitigating the threat of inefficient allocation of resources in order to achieve outstanding results can be achieved only by identifying priority areas of development, giving the process a systemic character.

The implementation of the smart city model is only possible through the creation of innovative clusters of central and local government, business and academia to jointly develop and implement the agglomeration development roadmap (Baptista & Swann, 1998). This would enable the organization of a smart management structure involving specialists in urban planning, economics, process engineers, social sciences, psychology and system analysts.

The large-scale challenge is linked to the need to go beyond specialized and narrow thinking in the process of managing urban agglomerations and ensuring their environmental and economic competitiveness. In this context, the theory of sustainable development has practical applications: the developed countries of the world have expressed their sustainable development priorities. The long-term consequences of today's economic decisions are important, it is necessary to minimize negative environmental consequences as well as externalities for future generations (Dragomir, 2017). The economic and environmental competitiveness of urban agglomerations is based on the following principles:

1) amount of renewable natural resources should not decrease, but ensure a reproduction regime;

2) minimizing the use of non-renewable natural resources, replacing them in the future with other unlimited resources;

3) minimizing waste by introducing resource-saving and recycling technologies (Grosu et al., 2024);

4) environmental pollution should not exceed its present level, i.e. it is necessary to reduce pollution to a socially and economically acceptable level.

III. ENSURING THE ECONOMIC AND ECONOMIC COMPETITIVENESS OF URBAN AGGLOMERATIONS IN THE CONTEXT OF ACHIEVING THE STRATEGIC OBJECTIVES OF SUSTAINABLE DEVELOPMENT

The swift expansion of urban populations represents a considerable challenge in the pursuit of achieving sustainable development goals. Currently, more than half of the world's people live in cities, and by 2050, the UN Department of Economic and Social Affairs predicts that the 70% threshold will be exceeded. With ever-increasing urbanization and strains on infrastructure and resources, another challenging issue arises, driven by the need to manage effective, evidence-based planning policies.

Contemporary systems of public administration and state governance do not respond to the growing challenges that are gradually taking on global and interstate characteristics. Achieving quick objectives and short-term interests hinders sustainable development. There is a need for a systematic and long-term approach at the state level to strategies for ensuring the economic and ecological competitiveness of urban agglomerations in the context of achieving the strategic goals of sustainable development (Costanza, 1992).

The Global Cities Index uses a set of about 27 indicators distributed in six main categories to assess urban performance (see Figure 1).
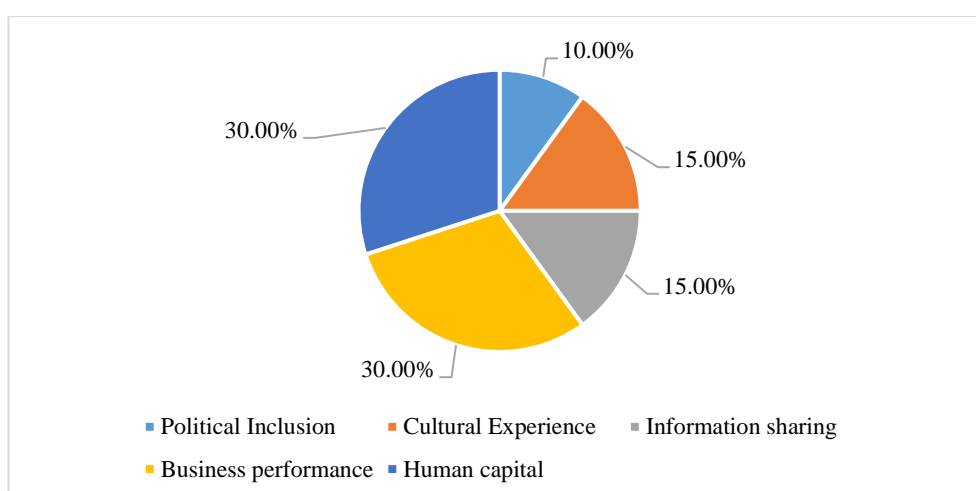
Figure 1. Global Cities Index: Category Weight Distribution

Source: Prepared by the author based on Kearney (2022).

The Global Cities Index applies a set of approximately 27 indicators, grouped into six core categories, to comprehensively evaluate urban performance and global competitiveness. *Human capital* evaluates the educational attainment of a city's population, a pivotal factor for fostering economic growth and driving innovation. Higher educational levels enhance a city's potential for talent development and economic resilience. *Business performance* focuses on economic assets, market dynamics, and the presence of major corporations, painting a picture of the city's economic health and business landscape. A strong economic foundation is indicative of a robust job market and sustained investment potential. *Information sharing* assesses the accessibility of the internet and other information resources, vital for enabling connectivity, knowledge exchange, and social advancement. This category reflects how well a city can support a modern, interconnected society. *Cultural experience* examines the availability of cultural infrastructure, including museums, theaters, and public events, which collectively improve the quality of life for residents and enhance the city's appeal to visitors. A thriving cultural scene is often associated with greater social inclusion and community pride. *Political inclusion* evaluates levels of civic and political activity, highlighting the importance of active citizen participation and inclusivity in governance. High engagement contributes to democratic resilience, ensuring social cohesion and greater transparency in decision-making processes (Dragomir & Alexandrescu, 2017).

Together, these categories provide a nuanced view of urban strengths and developmental needs, offering insights for strategic urban planning and enhancing cities' standing on the global stage. By comparing urban performance with these indicators, it becomes easier to identify areas where the city excels, set development priorities and monitor progress over time. This approach makes it easier to identify significant changes and adapt urban development strategies to emerging needs. Thus, sustainable development is conceptualized as a balanced form of economic and social development that meets the current needs of the present generation without compromising the ability of future generations to meet their needs, including ensuring a healthy and sustainable environment. Strengthening the ecological and economic competitiveness of urban agglomerations should be based on the principles of sustainable development, promoting an integrated and sustainable approach to the management of resources and environmental impacts.

IV. ECONOMIC AND ECONOLOGICAL COMPETITIVENESS OF URBAN AGGLOMERATIONS AND CLUSTERIZATION POLICY IN THE REPUBLIC OF MOLDOVA

The deviation from the Pareto optimality principle, which can be used in assessing and analyzing the distribution of population (of resources, goods, etc.) among the cities of a country, is a distinctive feature of the cities of the Republic of Moldova. This deviation suggests possible radical changes in the demographic structure of cities, highlighting specific inequalities and trends in population distribution.

According to data of the National Bureau of Statistics, on January 1, 2023 in the Republic of Moldova out of 1682 localities, 13 have the status of municipalities and 53 - cities. At the same time, according to the National Strategy for Regional Development of the Republic of Moldova 2022-2028, Moldova has the lowest degree of urbanization (43%, considered to be the lowest level on the European continent). Moldova's regional development continues to be dominated by the monopoly model, characterized in particular by the disproportionate concentration

of resources, economic activity and the considerable gap in living standards and income in the regions of the national economy.

Within the national economy there are 6 municipalities with the potential to become competitive economic agglomerations (regional development poles) - Ungheni, Orhei, Comrat, Cahul, Edineț and Soroca. However, they do not meet the minimum accepted criteria for a city to have the status of a municipality and face considerable challenges and risks of sustainable development. At the same time, mun. Chișinau is considered a "national pole of absorption" of resources and economic activities. Gross Regional Product/capita in mun. Chișinau is almost 4- 6 times higher than in the regions, and it will be 146204353 lei in 2021. In 2022 the share of national GDP produced outside mun. Chisinau constituted only 42% (see Table 1).

Table 1. Regional GDP in 2021   - current prices thousand lei

Development regions	Regional Gross Domestic Product	Gross Domestic Product regional per capita	Volume indices of Regional Gross Domestic Product*
Municipality of Chisinau	146,204,353	217,987	112.6
North	37,080,742	51,746	113.8
Center	36,389,568	49,617	116.1
South	16,838,038	47,546	120.4
UTA Gagauzia	5,565,927	46,012	116.6

Source: National Bureau of Statistics (NBS)

*Notes: * in % compared to previous year*

It is possible to claim that, in the conditions of the new economy, the creation and development of urban agglomerations can contribute to accelerating the sustainable economic growth of the Republic of Moldova and to ensuring national competitiveness.

As previously stated in the article, the benefits of creating and developing urban agglomerations considerably outweigh their costs and risks. However, in the context of accelerating sustainable economic growth and ensuring national economic competitiveness it is important to outline the following:

➢ First, conceptually, urban agglomerations are not just one big city/metropolis. Not every large city is an agglomeration, and many large cities do not provide economic growth. Glaeser (2010) called this phenomenon "urbanization of poor countries". In developing countries, agglomerations are formed as a result of urban explosion, uncontrolled rapid urban population growth

➢ Second, regional and local strategies and policies are more effective in creating and managing economic agglomerations. The task of central public policies in this respect is to determine the general spatial characteristics of large cities. In this context, for example, we can note the policies promoted by the countries of the European Union - of encouraging urban growth, later replaced by the strategy of suburbanization and, later, of encouraging the growth of inner urban areas, gentrification (Florida, 2015). These are examples of direct regulation (of policies and strategies at the central - national level), which lead to the creation of framework conditions that set the right incentives for business and population throughout the national economy.

The excessive concentration of population in the capital can be attributed to the absence of large developed cities, which leads to stagnation of regional development. Changes in the natural habitat of the population are associated with technogenic impacts on the environment, a phenomenon that is particularly noticeable in large cities such as Chișinau. The degradation of the quality of the environment is becoming a systematic problem, thus requiring the formulation and implementation of appropriate intervention measures (Socoliuc et al., 2020). Continued societal progress cannot be achieved without the development of the concept of sustainable development, which takes into account the need to preserve natural resources for future generations. The synergy between ecological and economic systems has led to the emergence of a new direction of development - the green economy (Glaeser, 2010).

Economic mechanisms for the optimal management of water and air resources and for ensuring a clean and sustainable environment are still at an early stage of development. Depending on the stages of forecasting, planning and development, as well as the capacities of the biosphere, it is imperative to develop an economic mechanism for regulating socio-economic relations of production. In the context of ensuring ecological and economic competitiveness for urbanized territories with large industrial centers, the main costs and efforts should be focused on maintaining living conditions and environmental quality. This can be achieved by developing a system of environmental values, expanding the economic management mechanism and optimizing the management of natural resources, as well as identifying organizational and technical-technological ways to save energy and resources.

The development of urban agglomerations involves significantly altering the natural environment, transforming it to support residential, industrial and social infrastructure. This process involves deforestation, the construction of reservoirs and changes to the natural landscape as well as to living conditions, which has a negative impact on the quality of human life. As intensive consumers of natural resources and energy, cities

contribute to environmental pollution, affecting areas beyond their administrative boundaries. Urban populations suffer from an acute shortage of clean air, water, green spaces and tranquility. Urbanized agglomerations become centres of anthropogenic disturbance to the integrity of the natural environment, making the tasks of improving and preserving the quality of life require economic solutions, integrated with economic-environmental assessments. This approach can contribute to the development of effective strategies to increase the economic and economic competitiveness of urban agglomerations.

The Aalborg Charter of European Municipalities and Cities for Sustainability, adopted in 1994, requires countries to develop long-term strategies for the transition to sustainable economic growth. Technological impacts on territories and the natural environment must be balanced in urban areas or regulated at regional or national level. A crucial aspect is the need to allocate financial resources to ensure the sustainability of natural resources. In this regard, it is important to assert the following, in the context of ensuring the ecological and economic competitiveness of urban agglomerations, the following priority directions of strategic development of urban territories in the Republic of Moldova can be highlighted: 1) conservation of natural resources, including water, soil and habitats for rare species; 2) reducing dependence on non-renewable energy sources; 3) development of recreational parks to alleviate pressure on natural forests; 4) optimizing the efficient use of natural resources.

The process of urbanization, which is gaining momentum globally, is characterized by the emergence of cities with distinct functions and features, determined by the processes of concentration of production and capital, industrialization and centralization. The expansion of large cities is due to the development of the service sector. Industrialized countries are experiencing the phenomena of *urban sprawl* and *exurbanization* (*ruralization*), followed by a transition to *neighborhood upgrading (gentrification)*, which involves the development of micro-districts with improved planning in place of demolished housing.

One of the most relevant 2030 Sustainable Development Goals (SDGs), adopted by the UN General Assembly on September 25, 2015, is to ensure that cities and human settlements are open, safe, resilient and environmentally sustainable. The significance of the formulated SDGs is underscored by the following provisions:

- translating the overall priorities for human development into a system of 17 objectives, 169 targets and 230 indicators for monitoring program implementation;
- the reference period is 15 years;
- structure and accessibility of the implementation of strategic decisions.

The efficiency of achieving the final outcome increases, as most of the objectives are interlinked. To ensure the environmental and economic competitiveness of urbanized territories we consider that the following *sustainable development objectives* can be identified:

❖   *No. 3 Ensuring healthy lifestyles and promoting well-being for all at all ages* aims to reduce morbidity and mortality caused by environmental pollution.

❖   *No. 9 Building resilient infrastructure, promoting inclusive and sustainable industrialization and innovation* provides for the introduction of clean and green industrial technologies and processes.

❖   *No. 11 Sustainable cities and communities* aims to create inclusive, safe, resilient and sustainable urban agglomerations and human settlements.

❖   *No. 12 Responsible Consumption and Production* provides for ensuring the transition towards sustainable consumption and production patterns and aims in particular to address the challenge of urban agglomerations related to waste treatment and recycling.

❖   *No. 13 Taking urgent action to combat climate change and its effects* aims to reduce greenhouse gas emissions.

❖   *No. 17 Partnerships for Goals* involves strengthening the means to achieve sustainable development, with a view to revitalizing global partnership mechanisms. They play a key role in addressing the challenges of urban agglomerations in an integrated way.

These six targets and the associated 12 indicators reflecting their implementation are particularly relevant for urban agglomerations in the Republic of Moldova (see *Table 2*).

To implement SDG 11 by 2030, it is necessary to: reduce the proportion of people living in substandard housing (target 11.1), reduce the negative environmental impacts of transport by increasing the share of public transport (target 11.2), implement environmental protection programs (target 11.3), implement measures to preserve and protect cultural heritage (target 11.4), reduce waste (target 11.5), and increase the amount of green areas and public spaces (target 11.6).

Table 2. SDG 11 targets and indicators adapted to the conditions of the Republic of Moldova

Target	Indicator
11.1 By 2030, to ensure access to adequate, safe and affordable housing and basic services for all citizens	11.1.1 Share of urban population living in unsatisfactory living conditions
11.2 By 2030, aim to ensure citizens' access to safe, affordable and sustainable transport	11.2.1 Public transport passenger numbers

systems by increasing road safety.	
11.3 By 2030, the aim is to expand inclusive and sustainable urbanization and to promote opportunities for integrated planning and management of agglomerations through a participatory approach to their management.	11.3.1. The ratio between the total volume of construction works and the population growth rate. 11.3.2. The number of urban agglomerations with regularly and democratically functioning structures ensuring the direct participation of civil society in urban planning and management reflects the level of involvement and transparency in the urban development process. 11.3.3. The level of public satisfaction with the measures taken to tackle environmental problems in cities indicates the degree of acceptance and perceived effectiveness of the actions taken by the authorities in this field. 11.3.4. Public satisfaction with air quality in cities reflects citizens' perception of the state of the atmospheric environment and the measures implemented to improve it.
11.4. Strengthen efforts to protect and preserve the world's cultural and natural heritage.	11.4.1. Total per capita expenditure (public and private) on the conservation and protection of cultural and natural heritage represents the financial resources allocated by central and local public authorities and the private sector for activities to protect, restore and manage cultural and natural resources. These expenditures include investments in conservation infrastructure, educational programs, research, monitoring and specific measures for the protection of heritage sites, reflecting the commitment to their long-term preservation.
11.5 By 2030, aim to reduce the negative environmental impacts of cities (per capita), with a particular focus on improving air quality and efficient management of urban and other waste.	11.5.1 Number of population living in cities with high and very high pollution levels. 11.5.2. The annual average levels of fine particulate matter (PM2.5 and PM10) in the urban atmosphere represent the concentrations of small particulate matter in the air from sources such as traffic, industry and fuel combustion. 11.5.3. The proportion of municipal solid waste regularly collected and properly managed is the percentage of waste that is treated by appropriate collection, disposal, recycling and landfilling methods according to environmental standards.
11.6. By 2030, aim to ensure universal access to safe, accessible and inclusive green spaces and public spaces to improve the quality of urban life.	11.6.1. The average percentage of the built-up urban area devoted to public spaces open to all reflects the ratio of their surface area to the total urban area, taking into account accessibility for different categories of population. 11.6.2. Share of green spaces in the urban area (area of green spaces and specially protected natural territories) per inhabitant (m^2/person)

Source: Prepared by the author based on Moldova Voluntary National Review on the Implementation of the 2030 Agenda (2020)

Currently, an active phase of adapting the concept and indicators of the SDGs to the particularities of the economic and economic competitiveness of urban agglomerations is underway. The implementation of SDG 11 on sustainable urban development depends significantly on the achievement of other SDGs. In this regard, the most urgent directions of implementation of SDG no. 11 in the Republic of Moldova include 1) building a system of urban development indicators based on the general structure and concept of the SDGs; 2) development of comprehensive indices (indicators) of sustainable development based on the SDGs or possible adaptation of existing comprehensive indices to the SDGs.

Work in these two areas is at an early stage in the Republic of Moldova, and the integration of international experience is becoming essential to ensure the adoption of best practices and effective implementation.

In recent years, a new concept of a smart, creative or harmonious city has emerged, which integrates a number of principles, including:

- *Population*. Ensuring equitable access to emerging educational knowledge and technologies is essential to promote an inclusive and accessible education system.

- *Quality of life*. Access to quality health care, social services.

- *Economy*. Expanding business opportunities through digitization.

- *Mobility*. Advanced intelligent transportation and logistics networks, designed to optimize the flow of goods and passengers using a mixed mode of transport, are an innovative solution (Naess & Jensen, 2002). One possible approach would be to relocate transportation infrastructure underground, freeing up space for the development of parks and recreational areas. However, in the Republic of Moldova, the opportunities for developing underground transport infrastructure are limited due to the constraints of available land and the high costs of implementation. In order to overcome these limitations, the following solutions can be considered:

  ➢ Develop alternative transport - Invest in green public transport solutions, such as electric buses or trams, to reduce reliance on underground infrastructure.

  ➢ Deploying advanced technologies - Using intelligent or autonomous transportation systems to improve the efficiency of traffic flows and reduce congestion.

  ➢ Optimize existing infrastructure - Adapt existing transport networks to increase efficiency by creating dedicated public transport corridors.

➢   Public-Private Partnerships - Collaboration between public authorities and the private sector to find economically viable solutions for underground or alternative infrastructure development.

➢   Coherent urban planning - Integrating underground transport into urban development, coordinating infrastructure projects with the expansion of cities, taking into account economic and environmental considerations.

These measures could help to improve transport infrastructure in the Republic of Moldova, even without significant development of underground transport.

- *Habitat*. Focus on green aesthetics. Zero greenhouse gas buildings equipped with smart sensors, solar panels and wind turbines to produce more energy than is consumed. Green spaces covering 40% of the site. A continuous monitoring system to ensure timely exchange of information to make decisions when the situation changes.

- *Governance*. The system of effective interaction between authorities at different levels that improves the quality of public services.

- *Preserving historical uniqueness and national characteristics*, which become an increasingly valuable resource over time.

In the following, Table 3 presents the challenges, objectives and results of smart urban systems deployment.

Table 3. Challenges, objectives and results of implementing smart urban systems

Challenges	Objectives	Results
Processing and analysis of big data streams for efficient management of urban activities and optimization of administrative decisions in real time	Crime reduction and prompt response to urban security threats based on real-time data analysis, rapid and informed interventions to optimize public security	Chicago (USA) has implemented an advanced security system that uses video monitoring to facilitate faster and more effective real-time responses to emergencies
Limited public access to information on healthcare, education, housing and utilities	Implementation of advanced analytical tools to process large volumes of data aimed at improving the efficiency of the respective sectors	Copenhagen (Denmark). Doctors' rapid access to medical records has allowed more accurate diagnosis of diseases, improving the quality of care.
Traffic congestion hits conurbations' budgets	Reducing congestion can be achieved by implementing integrated transport systems and expanding the number of interchanges	Stockholm (Sweden). The staircase dynamic pricing for different vehicle categories reduced traffic in the city center by 25% and emissions by 14%. At the same time, revenues to the city budget increased by 6%
Poor water quality	Implement an integrated water monitoring system to provide detailed data on water use at different levels.	Galway (Ireland). The systems for water monitoring, water quality management and hydrological forecasting provide essential operational information for all stakeholders.
Administrative barriers and weaknesses in the regulatory system constrain business development	Establishing a system that respect the highest standards for the deployment entrepreneurial activity and improving its efficiency	Dubai (UAE). The one-stop-shop system integrates around a hundred types of services, providing a centralized solution for various administrative needs.

Source: Prepared by the author based on United Nations Human Settlements Programme (UN-Habitat, 2022)

Smart cities offer a high standard of living through stability and smart economy, introducing high standards of services, transferring broad skills to local communities. High quality of life, social and economic dynamics increase the economic and environmental competitiveness of urban agglomerations in the age of digitalization.

The New Songdo project, also known as "ubiquitous city" (U-City), involves the development of a completely new city with an innovative design, integrating advanced technologies and modern architecture. In this project, all buildings, transport infrastructure and street networks are equipped with interconnected information systems and sensors, creating an integrated network that optimizes the efficiency of urban functioning. "The 'Electronic' City"will act as a laboratory for testing efficient management concepts, implementing smart communications and developing new urban ecosystems. The concept of smart cities is best implemented at the level of specific areas and individual components illustrates examples of the implementation of smart systems to solve current urban problems.

V. CONCLUSIONS

Both traditional and contemporary theories of economic growth underestimate the importance and the degree of influence of regional competitive advantages and regional drivers in ensuring sustainable development. The creation and development of urban agglomerations in the Republic of Moldova as engines of sustainable economic growth can contribute to help accelerate it and, consequently, to increase the country's level of economic and environmental competitiveness in the regional and global context. However, it is important to point out that the success of agglomerations as engines of sustainable economic growth is not guaranteed, since in this process there will be not only winners (efficient economic agglomerations), but also losers (devastated localities, regions). In this context, the role of central strategies and policies in the effective management of the process of creation and development of economic agglomerations is limited, while the role of regional and local ones is fundamental. Thus we can conclude that the final success of the agglomeration process cannot be guaranteed at the level of central public authorities, but some framework conditions can be formed and maintained that can stimulate sustainable economic development and national economic competitiveness rather than hinder them.

Thus, the following strategies for ensuring the economic and ecological competitiveness of urban agglomerations in the Republic of Moldova can be formulated:

❖ Synchronized growth of economic assets and specialized human capital;

❖ Implementation of processes of economic development of the urban environment and strengthening the social welfare of the population;

❖ Shaping urban infrastructure development processes, with the integration of public support and control mechanisms, to optimize their management and sustainability;

❖ To create a favorable framework for social and economic development by integrating ethnic diversity into the structure and configuration of the urban landscape;

❖ Etc.

So far, smart and green city strategies have proven their effectiveness. The evolution of the life cycle of an idea requires the development of new plans, which require appropriate decisions, becoming conventional until they no longer correspond to the new requirements and challenges, which then require continuous adaptation and transformation.

Understanding the life cycles of processes and assessing the relevance of ideas are fundamental for identifying the right time to implement innovations, allocating a new development budget, monitoring and benchmarking. Creating sustainable urban harmony is an iterative process, characterized by continuous improvement and dynamic adaptation to new challenges.

Not understanding the differences between the concepts of 'smart city' and 'city of the future' creates additional difficulties in addressing urban challenges. The digital technologies used in smart cities are geared towards solving environmental, economic and social challenges, thus contributing to building sustainable and efficient urban environments.

Not understanding the differences between the concepts of 'smart city' and 'city of the future' creates additional difficulties in addressing urban challenges. Advanced digital technologies are being developed for *smart cities*, designed to effectively address environmental, economic and social challenges. Promoting "smart" solutions to maximize benefits is impossible without deep reform of business processes and effective interconnection between economic entities. Smart technologies help to increase economic and environmental competitiveness, reduce resource consumption, improve quality of life and save money.

The steady reduction in the cost of digital technologies facilitates their promotion and efficiency gains in various sectors of urban agglomerations. Organizing a balanced market of smart solutions, capable of meeting consumer needs, is only possible through the implementation of formal support mechanisms and coordinated collaboration between economic and institutional actors. Sectors such as transportation, healthcare, infrastructure, construction and management are among the most important. Smart cities have become a key factor in the development of energy grids, integrating smart devices and diverse sources with energy storage systems.

At the same time, requirements for environmental standards of energy systems are becoming more stringent, and the ability to manage security, utilities, high-tech industries, transportation, buildings and access to information and data is becoming essential (Bores & Hlaciuc, 2016). In the Republic of Moldova, the challenge of attracting funding and developing sustainable business models remains a crucial priority in the context of insufficient resources. There are four business models that ensure optimal interaction between businesses and municipal authorities and their services:

1. Build - Own - Operate;
2. Build - Operate - Transfer;
3. Open Business Model.

The smart cities market is a catalyst for the development of advanced solutions to facilitate communication with users and improve interactions between the population and service providers. In this context, the use of digital

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technologies, appropriate infrastructure and specialized skills is essential. The development direction will target the deployment of automation technologies and wireless networks such as Insteon, Z-Wave, etc.

The development of new technologies and the accelerated process of urbanization require a profound transformation of the structure and functioning of urban agglomerations. They are becoming centers of new opportunities and their sustainable development requires the implementation of elaborate strategies supported by innovative urban governance methods. These approaches include, among others, specialized training programmes for urban managers and active collaboration with academic institutions and scientific research centres. The development trajectory of a city - whether in the context of dynamic transformation or gradual decline - depends on a multitude of interrelated factors. The optimal functioning of urban development mechanisms requires not only the application of advanced technical and theoretical knowledge, but also the development of specific skills among professionals in the field, enabling them to design coherent development programs and to identify internal sources of potential for increasing the economic and environmental competitiveness of urban agglomerations.

Managing the safety of ecological systems should be based on the ability to develop and simulate a variety of scenarios to ensure the economic and ecological competitiveness of urban agglomerations, taking into account a detailed analysis of the challenges and potential risks posed by inappropriate or inefficient solutions. Ecological balance can be defined as the optimal state of an ecological system in which human impact on the environment is minimized through active and informed management of risk factors, including the risks of pollution, habitat degradation or biodiversity loss. Achieving such a balance requires the integration of sustainability principles into all urban agglomeration development processes, involving the use of innovative technologies and adaptive ecological solutions. A deep understanding of the objectives and responsibilities involved in achieving a sustainable ecological balance will facilitate the transition from a strictly defensive approach, focused on the exclusive protection of the natural environment, to an integrated vision of symbiotic interaction between nature, economy and society. This approach will contribute not only to the protection of natural resources, but also to the creation of favorable conditions for the sustainable competitiveness of urban agglomerations, based on a balanced relationship between human needs and the capacity of ecosystems to sustainably support these needs.

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