Sustainable cities: major challenges and trends

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Abstract. The world community begins realizing that human activity in urban systems has led to a socio-ecological crisis over the course of the development of civilization. The way out of this crisis is possible only through the formation of a new approach to the development of a sustainable habitat for existing population groups, excluding the possibility of large-scale destruction of the natural environment as a result of meeting human needs. In this regard, the term "sustainable city (eco-city)" appears in scientific circulation, which currently does not have a clear agreed definition. Generally, development experts agree that a sustainable city must meet the needs of the population without sacrificing the ability of future generations to meet their own needs. The ambiguity in this idea leads to large variations in how cities perform in their attempts to become sustainable. In these conditions, the task of creating an effective mechanism for managing urban sustainability becomes complex, including work on creating a concept, strategy and program for sustainable development of all subsystems of the city. Thus, the idea of sustainable eco-city development can and should become our national idea and play an important role in determining state priorities and prospects for further economic growth.

Keywords: urban sustainability, development, management, socio-economic system, concept of sustainable development, eco-city.

1 Introduction

The concept of sustainable development is a long-term and multi-dimensional process of achieving an equilibrium interaction between man and the biosphere. The transition affects the entire range of internal problems of long-term development of society, including structural and investment policies, changes in approaches to consumption, protection, rational use and reproduction of natural resources, economic and environmental security, social, scientific and technical policies.

Until now, there have been no approaches to measuring the degree and probability of survival and safe existence of mankind. However, now, in connection with the formation of the concept and strategy of sustainable development, it can be assumed that to the extent that civilization will move from the modern model of its unstable development to the model of sustainable development, the probability of its survival and continued safe existence increases to the same extent. If we assume that such a global transition will fully ensure the survival of mankind, then the probability (coefficient) of survival is associated with a decrease in human anthropogenic pressure on the biosphere, which many researchers have noticed: Javier Collado-Ruano considered the principles of ecosystem cooperation to reduce the impact on the environment and achieve sustainable development goals [1], Amin A. A. M. studied the impact of geotechnical objects located near the city on the environment and human health as a factor of sustainable development [2]. Thus, the sustainable development of the territories studied by the authors: Sergazin E., Esimova Z., Kozhakhmetova A., Mukasheva M. examined the relationship of sustainable development of the state security [3], Camagni R., Capello R., Nijkamp P. suggested an analytical framework for "sustainable cities" [4], Hawkes D. showed how projects in the field of low-energy design can be read in accordance with low power consumption, as steps towards the idea of sustainable cities [5].

There are also other approaches to measuring the degree of transition to sustainable development, reflected in the works of the following researchers: Boyer B. presented a study of the impact of institutional mechanisms on sustainable development [6], Hecht A. considered a triad of factors and offered recommendations for the development of positive relations between them in the perspective of sustainable development [7], Wheeler S. studied the issues of sustainable development of Neil E. Harrison [8], Zadorsky W. he studied the integration of sustainable development into the education...
system and solutions to the problems of the engineering industry [9], Carvajal-Arango D., Bahamón-Jaramillo S., Aristizábal-Monsalve P., Vásquez-Hernández A., Botero B. L. tried to establish a link between the philosophy of lean and sustainable construction, as well as to determine how lean construction practices contribute to each dimension of sustainability at the design stage of construction [10], Mhangara P., Lamba A., Mapurisa W., Mudau N. we have shown the use of a geographical information system (GIS) as a tool for monitoring and evaluating information about the effectiveness of the implementation of the concept of sustainable development [11].

The realization of the immanent relationship between development and security and, in the future, the "security – development" system led to the formulation of the provision on the possibility of ensuring security through development, or more precisely, through sustainable development.

There is no doubt that cities play an important role in implementing the sustainable development strategy.

Cities are the largest centers not only of economic and socio-cultural life, but also sources of enormous pressure on the environment. They are even compared to small but constantly active volcanoes that emit many tons of waste and other pollutants. Environmentalists consider cities, and especially large ones, to be unstable systems in terms of ecology and natural resources.

This stable (but not sustainable) urban development is thus provided by external ecosystems. Almost all major cities have already gone beyond the economic and ecological capacity of their territorial ecosystems and cannot ensure the growth of their productive forces and improve the quality of life of people within these limits. In large cities in the near future (at least in many existing cities), it is impossible to reduce anthropogenic pressure on the natural environment within the economic (carrier) capacity of the ecosystem.

Although environmental security issues are very important for the transition to sustainable development, however, this managed transition is possible only when the economic, social and other aspects of the real process of urban development are integrated. Cities that fail to become environmentally sustainable are doomed to economic depression, rising unemployment, pollution, and social tension. Therefore, the criteria for progress towards sustainable urban development should be of an integrated socio-economic and environmental nature, ensuring the stable development of urban processes on the way to a "sustainable city" of the future.

The purpose of this article is to study the problems of eco-cities development, since they can make a significant contribution to the global, regional and local transition to sustainable development, if they take drastic measures to significantly reduce their impact on the environment and ensure the safe existence of the urban population, which is the vast majority of the world's population.

2 Methods

This article uses two main methods: modeling and analysis. Modeling allowed us to identify and evaluate the desired socio-economic patterns of eco-cities development. The models were built through the analysis and taking into account that they were adequate to the domestic experience. For qualitative specification of the elements of the urban sustainability model, scientific modeling and systematic generalization of its results were used, confirmed by foreign experience.

The main theoretical basis is reflected in a number of scientific studies, such as: Rahma H., Fauzi A., Juanda B., Widjojanto B. investigated how economic, social and environmental factors can be integrated into regional indicators of sustainable development using a new composite index [12], Gibbs D. considered integrated planning for a sustainable urban environment [13], Klunder G. conducted a study in search of the most eco-efficient strategies for sustainable housing [14], Williams J., Lannon S. considered planning a sustainable city by developing a model for predicting energy and the environment [15], Lurie S. presented city design through forms of urban sustainability [16].

However, the practical aspects of the development of a sustainable city in modern conditions in relation to Russia have not been actively applied. The need for this type of research is primarily due to the fact that sustainable urban development is a socially significant problem.
3 Results and Discussion

Ideally, a sustainable city creates a sustainable way of life in the four areas of ecology, economy, politics, and culture. However, a minimally sustainable city must, first, be able to feed itself with a sustainable reliance on the surrounding countryside. Second, it should be able to own renewable energy sources. The essence of this is to create the smallest possible ecological footprint, while achieving the minimum amount of pollutants. All with efficient use of land resources, recycling of used materials, or converting waste into energy. All these contributions will ensure that the overall impact of the city on climate change is minimal and with minimal impact. The Adelaide city Council states (City of Adelaide [17]) that socially sustainable cities should be fair, diverse, connected and democratic and provide a good quality of life.

Understanding and evaluating the prospects for the development of eco-cities in reality, in our country, a number of long-standing problems prevent the full and accelerated development of such systems. The first and most striking reason for the slowdown in the development of sustainable cities in Russia is the relatively low level of the national economy and the ability to purchase housing, which is confirmed by the authors Guseinova A., Afanasyeva A. in their study [18]. Many technologies that are widely used in economically developed countries have not yet been mastered in our country. The government of the country directs its main forces to regulate problems that have long been solved in developed economies, so it does not yet see the main threat in the field of ecology.

The next problem that hinders the rapid and full-fledged development of eco-cities is the acute shortage of qualified specialists in this field. Due to the lack of a professional training system for developing sustainable cities, there is an incomplete understanding of the importance of environmental regulation, the use of energy-saving technologies and environmental certification systems in our country. It should also be noted that the problem of lack of highly qualified personnel is observed at all levels, from engineers to government officials.

High prices for special technologies and environmental construction materials significantly slow down the process of implementing sustainable cities. The high cost of future infrastructure construction requires significant initial investment, which is practically impossible in Russia with its current economic situation (growth of tax deductions, problems with the use of credit resources, high cost of financing), which is reflected by the authors Romanova A., Zagidullina G., Afanasyeva A., and Hkaretdinova R. in their study [19].

The Russian government's position on sustainable cities also creates obstacles to its full development. This problem is a derivative of the Russian economy's dependence on energy resources. As a result, the state is the owner of shares in the majority of national enterprises in the energy sector, so the country's authorities, as owners and suppliers of resources, should not be interested in reducing the demand for energy consumption. On the other hand, the global level of socio-economic development of society requires the state to solve problems of ecology and resource conservation.

Thus, there is a certain paradox: the state needs to reduce the volume of energy consumption, but in this case it will lose the benefits as an energy supplier. According to many experts, this factor is at the heart of the stagnation of sustainable cities. While the governments of developed countries take strict, mandatory measures to control the environmental aspect of all urban subsystems, the Russian legal framework is rather prescriptive, which significantly hinders the achievement of the goals of sustainable cities.

The peculiarities of the Russian mentality also affect the development of sustainable cities in the country. Since our country is rich in natural resources due to its favorable geographical location, the consumer does not face problems of acute energy shortage and its rise in price. However, further inevitable increases in energy prices and tighter regulation of urban systems in terms of environmental sustainability will soon change this situation.

Russia's transition to the development of sustainable cities has a number of features. First of all, it is the continuing high intellectual potential and the presence of large areas that are not affected by economic activity in the regions that make up more than 60% of the country. Thanks to these factors,
Russia can become a leader in the transition to a new model of eco-city development. However, at the present time in Russia, it is important to get out of the systemic crisis, to find a relatively stable and safe state, from which it is possible to start moving towards urban sustainability in the least painful way.

One of the conditions for the country's transition to a sustainable development trajectory is to increase the efficiency of energy potential use, which implies ensuring economic growth with less specific energy consumption.

In addition, incentives that facilitate the transition to the urban ecosystem should be created: preferential lending and taxation of modernization projects, subsidies for energy producers obtained from alternative sources, certification systems, etc.

Among the main directions for the development of sustainable cities that need to be paid attention to, first of all in the regional context, can be presented in the form of a diagram (Figure 1).

Further state decisions on the formation of socio-economic policy should be based on the concepts of sustainable urban development. This gives us a real chance to move away from catching up strategies that lead us to the world's periphery, and will allow us to move to advanced and balanced actions by making complex decisions.

Figure 1. Directions for developing sustainable cities.

Ensuring the environmental sustainability of cities involves solving two tasks:

1) include the principles of sustainable development of all urban subsystems in the strategies of the country's development programs, as well as prevent the loss of natural resources;

2) ensure the improvement of the quality of life of the population.

These tasks are primarily related to the development of human potential and ensuring its health, which means that they are environmentally and economically profitable.

4 Conclusions

Thus, it can be concluded that rapid urbanization has a negative impact on natural resources, especially freshwater, sewage systems, habitat and public health systems. Accordingly, the introduction of elements of sustainable development in urban systems is a priority for most countries of the world.
In Russia, the potential for improving approaches to the development of sustainable cities is huge. High urban density can help improve economic efficiency and introduce technological innovations, while cities can consume significantly less resources and energy than they do today.

However, considering the prospects for implementing sustainable development in modern cities, it is necessary to develop an organizational and economic mechanism for assessing sustainability that is applicable to all urban infrastructure objects, including using modern building methods presented in Afanasyeva A., Guseinova A. [20]. For its development, it is proposed to simultaneously consider environmental, economic and social criteria for sustainable development in order to achieve the common goal of reducing the consumption of natural resources and improving the environmental situation in the world.

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