

# To the issue of the environmental development of housing construction in the integrated land use management

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**Abstract.** The paper considers environmental problems arising during the implementation of housing programs for the integrated development of territories by high-rise buildings. The need to assess the quality of the environment in the functional zoning of territories is identified and a calculation of the index of the ecological potential of the territories is proposed. The main stages of organization of construction of environmental real estate and the introduction of energy-saving and resource-saving technologies at the regional level are formulated.

## 1 Introduction

Currently, in accordance with the concepts of development and general organization of urban and rural settlements, the territory for the development of cities must be chosen taking into account the possibility of its rational functional use. The basis for the choice of the functional use of the territory is comparison of various options for architectural and planning solutions and the assessment of technical and economic, and sanitary and hygienic indicators, accounting for fuel, energy, water and all territorial resources. In addition, it is necessary to assess the state of the environment taking into account the forecast of future changes in natural and other conditions, while considering the state of the environment and its impact on the living and health conditions of the population [1].

## 2 Materials and methods

The emergence of environmental problems is associated with the intensification of anthropogenic processes, which do not take into account the natural potential to compensate for the negative consequences of the results of the activities of all mankind. Also, in part, the emergence of environmental problems is associated with the orientation to social and economic priorities of the habitat of the population of urban and rural areas. In addition, people began to forget that they are part of the natural system, and influencing their habitat, they directly influence their health. This has become the reason for special attention to the problems of environmental and economic nature and to formation of the so-called "green" economy, which allows to significantly reduce risks to the environment and prevent its degradation [2]. The emergence of industrial zones, polluting the environment was the result of such an uncontrolled human impact on nature. Reorganization of such zones by

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turning it into a safe residential area is a new task for both state authorities and large business.

Unfortunately, with the functional zoning of the planned development site, the only criterion for safety for the health of the population today is to ensure that all factors outside the sanitary protection zone are reduced to the required hygienic standards, which are the maximum one-time MPCs. Special studies are needed to assess the health risk [3] to determine the possibilities of using the territories for specific purposes.

The theory and practice of urban development solves problems associated with the elaboration of territorial development plans. They include both architectural and artistic, construction and engineering, economic issues, as well as sanitary and hygienic issues. However, proper attention is not given to the latter. Even at the pre-project stages of the investment study, with integrated development of the territory, it is necessary to pay attention to the study of all sources of pollution, assessment of the current state of atmospheric air, taking into account the aeration mode, the terrain and microclimatic conditions of the territory.

The application of the concept of functional zoning of the industrial territory to be reorganized, using the methodology for assessing the health risk to the population, will allow allocating only a part of the territory for perspective residential development; the rest of the territory, depending on its characteristics, was divided into functional zones of a different purpose: public-business, and communal. As part of traditional approaches to modeling and decision-making on the basis of compliance with MPC of pollutants, the entire territory would be adopted to accommodate a promising residential development [4]. Particular attention should be paid to territories with existing buildings, especially those located in the zone of negative impact of industrial facilities.

### 3 Results

When assessing the quality of the environment, with integrated development of the territory, an environmental risk indicator that estimates the probability of occurrence of ecologically caused diseases in the population may be chosen as the determining criterion [6]. The *US EPA* methodology (*developed by the Erisman Center for Hygiene*) makes it possible to determine the quantitative values of this risk. Using the values of the total environmental risk of this methodology, it is possible to determine the overall environmental risk:

$$ER = \frac{HI}{N}, \quad (1)$$

where  $ER$  - is the environmental risk;  $HI$  - is the total risk;  $N$  - is the number of pollutants (chemical pollution of anthropogenic origin).

Depending on the value of  $ER$ , you we can introduce the index of the environmental potential of the territory, taking into account the number of points depending on the magnitude of the risk component (Table 1).

**Table 1.** The value of the index of the environmental potential of urban territory

Total environmental risk (ER)	Level of the territorial potential (Ip)	Points
Over 10	<i>Catastrophic potential</i>	1,0
7 – 8	<i>Critical potential</i>	2,0
4 – 6	<i>Minimum permissible potential</i>	3,5
1 – 3	<i>Average potential</i>	5,0
0,6 – 1,0	<i>Increased potential</i>	7,0
0,4 – 0,6	<i>High potential</i>	9,0
Less than 0,4	<i>Optimum potential</i>	10,0

Studies show that a new high-yield segment of the housing market has been established in Russia related to the complex development of new urban areas. This segment accounts for an average of 45% of all construction work in the residential real estate market performed by large developer companies. It should be noted that there is a tendency for increasing this share.

Based on the analysis of the practice of developing new territories, it should be noted that the investment and construction complex, showing high rates of growth in housing construction, has accumulated sufficient experience in the construction of "spot" development in residential neighborhoods, and block development in the territories of former industrial zones, borders of the city, on the outskirts (the peripheral belt of the city) [5]. This led to urbanization of a residential zone of urban territories, namely, to an increase in the density of residence, and, consequently, to a decrease in the comfort of the habitat (Table 1). The higher the concentration of real estate per unit area of the urbanized zone, the more diverse and complex the problems that arise in different fields, (see Table 2).

**Table 2.** Consequences of spot and block development of the territory in the residential and former industrial districts of the city

Pos. No.	Factor name	Result of the change
1	Technical and technological factors	Increase of the load on engineering networks (power networks, water supply, water disposal)
		The emergence of waste disposal and pollution problems; problems with cleaning of the areas
		Increasing infrasound sources in the urban environment
		Increasing sources of low-frequency electromagnetic fields
2	Socio-cultural factors	Pollution of the socio-cultural environment
		Acoustic (noise) pollution
		Visual (aesthetic) pollution
		Decrease in the degree of insolation of residential premises
		No parking spaces, places for walking and rest; places for sports
3	Environmental factors of the city [5, 6]	Increased burden on schools and kindergartens
		Increasing content of anthropogenic pollutants in the city's natural environment (atmosphere, soil, drinking water)
		The presence of geochemical soil cover anomalies
		Environmental hazards and environmental risks (in Moscow): - occurrence of karst danger (local subsidence and dips of the earth's surface); - erosion and landslide hazards on the banks of the rivers Moscow and Skhodnya; - suffosion hazard and suffosion risk; - hazard and risk from frost heaving leading to a rise in the earth's surface, squeezing out of piles, pillars and foundations.
		Decreasing area of green plantations
		Pollution of atmosphere by gas exhausts of motor transport
		Negative technological impact on the subsoil, underground and subsurface
4.	Result: deterioration of quality of life and psychosomatic state of the population	

For example, according to the town planning SNIiP, the following is supposed to account for 1 resident of the house: 6 sq.m. of green plantations; 0,1 sq.m. for the rest of the adult population; 0,7 sq.m. for children's playgrounds; 2 sq.m. for sports; 0,3 sq.m. for economic purposes; 0.8 sq.m. for parking of motor vehicles. Therefore, the area of the adjacent territory per 1 resident should be 9.9 sq.m. However, the house under construction is not provided with these norms [5].

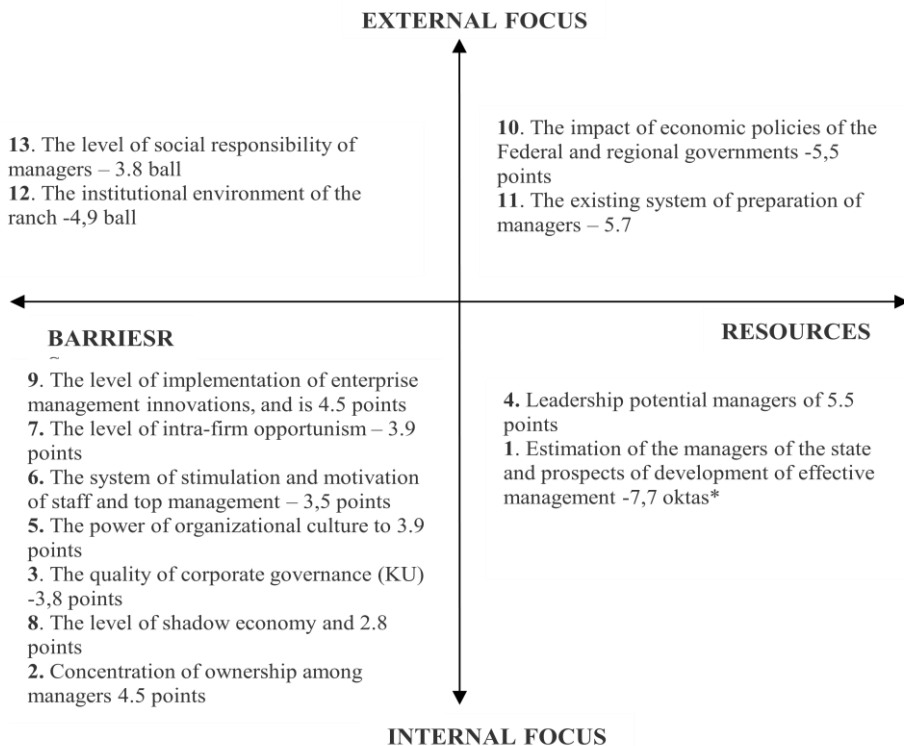
In addition, spot development leads to oversaturation of the residential area with personal vehicles, and, consequently, to deterioration in the environmental quality of the human habitat, including increased burden on public transport, worn out engineering networks of the city, and educational institutions. Even with the development of large areas of former industrial zones, the investor-developer does not burden himself with the obligation to erect public and social facilities - schools and kindergartens [6].

Solution of these problems is in the scope of the interests of professional development. There are such new activities in the traditional schemes of development as the development of individual land plots, land-development for integrated land use management. It is the development of land plots for integrated use of territories is an innovative form of professional development.

It should be noted that land development in Russia is of a one-sided investment nature. However, adopting the experience and the mechanism for implementing investment and construction projects implemented in Western countries, the Russian land development, according to experts, will take new innovative forms that will successfully implement large-scale projects. Over the past 5 years, regulatory acts have been developed that make it possible to implement the activities of land developers on a qualitatively new level. Modern forms of development can allow changing the habitat of people in accordance with modern requirements of environmental development. Namely, instead of a quantitative growth of the urban environment, including spot and block development of the territory, land development is able to implement large-scale projects for the integrated development of the territory, combining the necessary set of residential and social facilities that meet the requirements of "green construction" [7].

To promote environmental development in the construction sector it is necessary to change the current Russian model of management. Without developing appropriate concepts of effective management, which should be offered specific scientific and practical approaches to real overcoming the inconsistencies of the existing Russian model of governance requirements of the new economy, it is impossible to solve this problem.

The results of the study of organizational culture at the enterprises of the construction industry confirms the conclusion about the significant influence of authoritarian style leaders of regional businesses because of the dominance of "vertical culture" with a strong cult of unity of command. A multidimensional empirical analysis of the level of implementation of effective management tool in enterprises of the construction sector of the economy indicates a significant excess number of barriers to development of effective management over its resources (Fig. 1).



**Fig. 1.** Matrix resources and barriers to the development of effective management in the construction enterprises (\*internal factors: 1-9, external: 10-13)

In recent years, the main regulatory acts have been adopted that allow implementation of activities related to land development, in accordance with established market relations. In particular, modern forms of development are aimed both at a complex, but also in a qualitatively different change in the human habitat. This implies the rejection of the quantitative growth of the city, block, and even more spot construction, and the creation of modern complex buildings that combine residential, public and social real estate, and that comply with the requirements for the environmentally friendly habitat, that is, the requirements of "green" standards of construction and operation of facilities. Land development is intended to ensure a proportional and balanced development of built-up, including residential, public and industrial areas, and undeveloped territories, including natural, green areas and territories of the street and road network [8].

## 4 Discussion

Land development is intended to choose the types of use of land plots and architectural and town-planning solutions within the framework of town-planning requirements and restrictions established by law. The solution of this task is directly related to the ecologization of the economy, which implies the introduction of innovative safe technologies, resource-saving and energy-saving industries, including in the investment and construction sector and the housing and communal services that make it possible to create an environment for human life activities. Organization of construction of eco-real estate and the introduction of energy-efficient and resource-saving technologies is implemented through the introduction of standards regulating green construction, the development of

innovative solutions for the introduction of saving technologies, and other necessary measures (Table 3).

**Table 3.** Stages of organization of construction of eco-real estate and introduction of energy- and resource-saving technologies at the regional level

<b>STAGE 1.</b>	Ecological support of construction facilities that ensure compliance with the requirements for urban territory
<b>STAGE 2.</b>	The introduction of international standards (ISO-14000, ISO-4001) and the standards regulating the construction of "green buildings" to the construction sector companies
<b>STAGE 3.</b>	Designing of the construction of eco-real estate facilities creating a comfortable internal living environment
<b>STAGE 4.</b>	Development of innovative organizational and technological solutions for the implementation of energy- and resource-saving technologies

The investment attractiveness of territorial entities is determined by a set of interrelated indicators, among which we can single out the pace of housing construction, the level of development of regional real estate markets, improving the comfort of the population and safety of business functioning.

## 5 Conclusions

At present, sufficient scientific and practical potential has been created in assessing the resource efficiency and energy efficiency of residential real estate, as well as some experience was accumulated in analyzing the mutual influence of the level of development of the regional economy and the pace of housing construction. At the same time, the environmental component and its assessment remain aside. A systematic approach to the solution of this issue is at the stage of formation, and the existing regulatory framework is fragmentary. In connection with the above issue, it is necessary to highlight the leading conceptual approaches to the solution of the problem of improving the ecology of residential real estate.

The first direction was created by the system of normative documents in the field of compliance with the requirements for the ecology of housing during construction and operation of buildings. The direction is represented by a certain structure of normative and technical documentation, however, its application is not an obligatory condition for conducting construction operations. Eco-development is at the stage of formation in Russia, and the "green" code for construction and operation of buildings is mandatory only for environmentally literate entrepreneurs.

The second approach is based on the world experience of "green" construction and building certification in accordance with the requirements of the standards of national systems for voluntary standardization of capital construction projects (in the *UK in BREEFM*, in the *US in LEED*, etc., 32 systems in 24 countries).

The third approach is the concept of biosphere compatibility proposed by the Russian Academy of Architecture and Building Sciences (supervisor – *academician V.A. Ilyichev*). In accordance with this concept, the degradation of the natural environment in the process of inefficient production and economic activity reduces the assimilation potential of the biosphere, hinders further development and reduces the potential of future generations. In this context, the self-sustaining development of housing construction requires the coordinated development of the scientific and technological field and the evolution of the consumption structure.

The approaches considered above are logically connected with the concept of sustainable development of the country's economy. The development of this concept

resulted in the emergence of a new model of social and economic development, for which the priority vector for modernizing the economy is to improve the living conditions of the current generation of people and to provide favorable conditions for future generations.

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