Development of organizational and economic mechanism of intensification of low-rise housing construction in remote areas with special climatic conditions

Natalya Gusakova¹*, Alexander Gusakov¹, Yulia Prokhorova², and Irina Karakozova²

¹Tomsk State University of Architecture and Building, Tomsk, Russian Federation
²Moscow State University of Civil Engineering, Moscow, Russian Federation

Abstract. The article is devoted to the issues of development of low-rise housing construction in remote areas with special climatic conditions of the Russian Federation. The necessity was specified to improve quality of low-rise residential construction with introduction of energy-saving technologies and modern materials that provide comfortable living conditions for citizens through formation of state housing policy in order to solve important socio-economic issues. An approach has been justified to the formation of regional programs for the development of low-rise housing construction, which is based on formation of organizational and economic mechanism for the development of low-rise housing construction which simultaneously ensures steady growth of low-rise housing construction in remote areas with special climatic conditions and solves the problem of providing high level of comfort and quality of low-rise housing to certain categories of citizens employed in socially significant industries.

1 Introduction

The main aim of the state housing policy of the Russian Federation is to build an affordable housing market, improve the quality of construction by introduction of saving technologies, modern materials that can provide comfortable living conditions for citizens. An important goal in solving this problem is the development of an organizational and economic mechanism that ensures intensification of low-rise housing construction (LHC) with a high level of comfort and quality in remote areas with special climatic conditions. The remote areas with special climatic conditions include territories with temperate zone continental climate which are distantly located from large residential settlements and regional centers and are most often inaccessible by regular types of transportation [1].

At the moment, affordable housing created under special measures is mainly housing that does not always meet basic requirements of energy efficiency, safety, and comfort of living. At the same time, settlements of the Russian Federation located in remote areas with special climatic conditions are the most struggling, underdeveloped in basic social, demographic and economic indicators, requiring improvement of low-rise housing construction, clear

* Corresponding author: derikova@gmail.ru

© The Authors, published by EDP Sciences. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (http://creativecommons.org/licenses/by/4.0/).
organization of the process of housing development, systematic state policy in provision of housing for qualified personnel employed in socially significant industries (healthcare, education, culture, sports, etc.) [2].

In recent research papers the expression "sustainable development" is often used. Under this notion, a model of development of modern society aimed at catering for the needs of the current generation without endangering future generations is described [3].

The concept of sustainable development, which emerged in 1970s of XX century, focused on rapid scientific and socio-economic development including awareness of the problems of exhaustibility of natural resources and environmental pollution for the first time.

The UN Sustainable Development Action Plan, named the Agenda for XXI Century, sets out new concepts and rules of sustainable development [4]. The main objective of the document is to improve the quality of life of the world's population without increasing the intensity of natural resources utilization. The program areas of sustainable development include not only the quality of people's lives, but also contributions of the state, companies and organizations by means of an optimal combination of objectives, means and results of activities in each of the areas.

The following authors N.A. Asaul, Yu.N. Kazakov, N.I. Pasyady, I.V. Denisova studied the existing conditions, issues and opportunities for the development of low-rise housing construction, including rural areas, among which implementation of models for the development of individual low-rise housing construction in order to attract qualified personnel to rural areas [5].

In the authors' studies, the concept of organizational and economic mechanism has different interpretations, capable of solving a number of state tasks. The design of the organizational and economic mechanism includes an integrated system of state and commercial enterprises, which allows solving socially significant tasks at the present stage [6].

The development of the organizational and economic mechanism in modern conditions should be based on taking into account the interests of all subjects, as well as include harmonious relations between the state, private business and science, making it possible to ensure the efficiency of development of the Russian economy. To this date, an effective tool for the development of housing in the remote areas of special climatic regimes can be the development of regional programs that will include new organizational and economic mechanisms, as well as a comprehensive approach to the optimal selection of space-planning and structural solutions of buildings, ensuring energy efficiency and economic feasibility [7, 8].

S.G. Sheina developed a methodology for choosing optimal organizational and technological resource-saving solutions in housing construction based on multi-criteria evaluation system. The application of this methodology will contribute to the implementation of modern investment and construction projects in the construction industry as one of the stages of the organizational and economic mechanism of housing development and its transition to the principles of sustainable development [9].

The authors of the correspondent research E.Y. Bondarenko and L.V. Ivanenko analyzed leading foreign countries and concluded that low-rise housing construction should be carried out using rapidly erected technologies based on rigid unification of construction technology and mass construction of low-rise buildings. They also point out the priority of development of wooden housing construction [10].

As a separate matter, the analysis of housing development programs has shown that today there are no programs for development of low-rise housing construction and approaches to their formation in remote areas with special climatic conditions. A significant labour force insufficiency in these areas in the field of health and education is being solved with the help of programs that are currently working rather poorly and mostly only involve transfer of
funds and their distribution. Therefore, it is necessary to develop organizational and economic mechanism for the development of low-rise housing construction which can become an important tool in solving socially significant tasks by providing low-rise, energy-efficient, comfortable housing for certain categories of citizens engaged in socially significant industries (health, education, culture, sports, etc.) [11].

2 Materials and Method

The following methods and approaches are used to develop a new organizational and economic mechanism for the development of low-rise housing in remote areas with special climatic conditions: modeling methods used to develop measures to intensify the processes of low-rise housing construction; assessment and justification of organizational and economic mechanism of investment activity in low-rise housing construction are performed by means of a scenario method and an integrated approach.

The development of methodological approaches to the formation of organizational and economic mechanism is based on non-collectability of budgetary funds, i.e. housing within the framework of the regional program for development of low-rise housing construction in remote areas with special climatic conditions is provided free of charge. Taking into account the complexity of the program and its multidimensional nature, not to mention the application of the result-oriented method within the framework of systematic approach, the program should be subsidized in full [12].

The basis for specifying the principles of formation of organizational and economic mechanism for the development of low-rise housing construction in remote areas with special climatic conditions is project management based on the following principles: unity of command, collective leadership, economic feasibility, planned character, scientific validity, combination of rights, duties and responsibilities. When forming organizational and economic mechanism, the above principles are consolidated, decisions are made collectively, interaction occurs between all levels of the budget system (federal, regional, local). The regional operator also participates in decision-making.

The proposed organizational and economic mechanism enables the solution of a major socio-economic task 3 provision of housing for individual and other categories of citizens, time and resource constraints are coherent, so project management is suitable for solution of the given task.

3 Results

In order to achieve the objective of the development of LHC in remote areas with special climatic conditions, organizational and economic mechanism for development of LHC has been developed which can be utilized in the development of territorial planning documents. The organizational and economic mechanism is shown in Figure 1.
The central object of management is a low-rise block-type house. The central subject of management is the regional operator which is the link between all the subjects of organizational and economic mechanism. The subjects of management are certain categories of citizens engaged in socially significant industries (healthcare, education, sports, social service workers, categories of citizens who have been retrained) and other categories of citizens, public authorities at all levels, organizations that carry out the entire cycle of design, construction and operation of the facility. Each subject is interested in achieving the main goal, citizens in obtaining housing, authorities in solving an important socio-economic task, construction organizations in obtaining benefits.

The relationship between the subjects of individual and other categories of citizens and public authorities is a prerequisite for the formation of programs for development of low-rise housing construction in remote areas with special climatic conditions. In order to implement the programs, the authorities ensure coordination of activities for preparation and implementation of program activities, as well as for analysis and rational utilization of federal and regional budget funds.
The relationship between public authorities and organizations that carry out the entire cycle of construction and operation of a low-rise building is based on a system of contractual relations. As a result of agreement conclusion between the developer and the local self-government body for the construction of low-rise buildings in remote areas with special climatic conditions and fulfillment of a number of conditions of such an agreement (preparation of planning documentation, project development, etc.), the state customer approves lists of target indicators and indicators for implementation of program activities.

The authorities and potential tenants (other categories of citizens) conclude an agreement regulating relations related to works under the contract of temporary ownership of a block-section in a low-rise block-type house during 5 years or more.

After 5 years period, tenants have the right to obtain the block-section into ownership but with the encumbrance (without the right to sell). After 10 years, full ownership passes to the owner.

Interaction between individual and other categories of citizens and organizations that carry out the entire cycle of construction and operation is based on the conclusion of a service agreement. Within the framework of the concluded agreement, the tenant is to pay for the maintenance of apartment, housing and utility services (heat, water and electricity payments) and is to independently maintain and repair the provided block-section in a low-rise block-type house.

In order to ensure balanced development and take into account socio-economic interests of all participants in investment and construction projects, it is necessary to develop variable models of organizational and economic mechanism of LHC accounting for the specific features of different settlements in remote areas with special climatic conditions. Variability of models is determined by the level of centralization and decentralization, level of socio-economic development (SED) of settlement, level of housing needs of certain categories of citizens, level of development of local industry in production of building materials and is determined by the entry criteria into a particular type of settlement.

In order to take into account the peculiarities of different settlements in remote areas with special climatic conditions, the level of settlement development is determined. It is calculated by the ratio of budget revenues to the population size. The average Russian indicator in 2021 is 9.18 thousand rubles/person. We will classify a settlement with a population of up to 3 thousand people as 8a small settlement9. 8A large settlement9 is a settlement of more than 3 thousand people. For this purpose, division of settlements into 4 groups was conducted (Table 1).

1) The first group includes a large settlement with a high level of SED.
2) The second group includes a large settlement with a low level of SED.
3) The third group includes a small settlement with a high level of SED.
4) The fourth group includes a small settlement with a low level of SED.

For the purposes of practical implementation of the proposed variable models of organizational and economic mechanism of development of LHC based on statistical data, 4 settlements that are located in remote areas with special climatic conditions and have different levels of development and population were selected. Variable models of organizational and economic mechanism of development of LHC are classified into 4 types: market, decentralized, centralized, and social. They differ in the degree of state regulation tools and methods9 utilization.
Table 1. Types of settlements depending on the SED level.

<table>
<thead>
<tr>
<th>Types</th>
<th>Name of settlement</th>
<th>Own budget revenues (million rubles)</th>
<th>Population (thousand people)</th>
<th>Income per person (thousand rubles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Large settlement with a high level of SED</td>
<td>Salymskoye rural settlement (KhMAD)</td>
<td>174,695</td>
<td>7,275</td>
<td>24,01</td>
</tr>
<tr>
<td>2. Large settlement with a low level of SED</td>
<td>Plotnikovskoye rural settlement (Kemerovo Oblast)</td>
<td>37,642</td>
<td>6,825</td>
<td>5,51</td>
</tr>
<tr>
<td>3. Small settlement with a high level of SED</td>
<td>Astyrovskoye rural settlement (Omsk Oblast)</td>
<td>19,655</td>
<td>1,261</td>
<td>15,58</td>
</tr>
<tr>
<td>4. Small settlement with a low level of SED</td>
<td>Mogochinskoye rural settlement (Tomsk Oblast)</td>
<td>15,784</td>
<td>3,075</td>
<td>5,13</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors on the basis of [13].

According to the developed procedure for the formation of regional programs for the development of LHC in remote areas with special climatic conditions in all variable models of organizational and economic mechanism, housing is firstly provided to certain categories of citizens employed in the fields of health, education, culture and sports, then to categories of citizens specified by the decision of local administration, and finally, if there is consumer demand in the settlement, an application for an individual purchase of such housing in a low-rise block-type house can be considered [14].

4 Discussion

It should be noted that the state has the greatest influence in the design of the organizational and economic mechanism for the development of low-rise building, as long-term planning, reduction of time and financial costs must be ensured, and the interests of each entity must be taken into account [15].

The authors K.E. Filyushina, S.A. Astafiev, in their studies, proposed an organizational and economic mechanism to manage the construction of energy-efficient low-rise housing on the basis of public-private partnership. The mechanism includes the use of a differentiated approach in the process of choosing the optimal technical solutions for low-rise buildings of block type, but it does not take into account the features of remote territories and the level of SED of settlements [16].

Depending on the level of SED and population size variable models of the organizational and economic mechanism of the development of LHC in remote areas with special climatic conditions are proposed. The distinctive features of variable models of organizational and economic mechanism of the development of LHC in remote areas with special climatic conditions are presented in table 2.
Table 2. Distinctive features of variable models of organizational and economic mechanism of development of LHC in remote areas with special climatic conditions.

<table>
<thead>
<tr>
<th>Type of variable model of organizational and economic mechanism</th>
<th>Special features of variable model of organizational and economic mechanism</th>
<th>Additional options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Market (variable) model of organizational and economic mechanism of LHC development</td>
<td>Large settlement of more than 3000 people</td>
<td>High level of SED</td>
</tr>
<tr>
<td>2. Decentralized (variable) model of organizational and economic mechanism of LHS development</td>
<td>Large settlement of more than 3000 people</td>
<td>Low level of SED</td>
</tr>
<tr>
<td>3. Centralized (variable) model of organizational and economic mechanism of LHC development</td>
<td>Small settlement of less than 3000 people</td>
<td>High level of SED</td>
</tr>
<tr>
<td>4. Social (variable) model of organizational and economic mechanism of LHC development</td>
<td>Small settlement of less than 3000 people</td>
<td>Low level of SED</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors.

The type of variable model of organizational and economic mechanism varies from a social type to a less social one and differs in the degree of centralization and social orientation. Variable models include subject-object relationships, ensure balanced development of low-rise housing construction in remote areas with special climatic conditions and take into account socio-economic interests of participants in investment and construction projects.

5 Conclusion

Efficient organizational and economic mechanism for the development of low-rise housing construction in remote areas with special climatic conditions is aimed at solving an important socio-economic task 3 providing low-cost, comfortable and energy-efficient housing for certain categories of citizens and at the same time allows ensuring sustainable development of housing in remote areas with special climatic conditions, as well as offering solutions to the problem of providing low-rise housing with a high level of comfort and quality for certain categories of citizens engaged in socially significant industries (healthcare, education, culture, sports, etc.).

With the help of the provided organizational and economic mechanism for the development of low-rise housing construction, utilization of integrated approach in the process of choosing best technical solutions for low-rise buildings of the blocked type is proposed.

Further research is aimed at developing regional program for the development of low-rise housing construction in remote areas with special climatic conditions, as well as at substantiation of spatial planning and design solutions, systematization and justification of
most efficient energy-saving equipment and technologies in terms of energy efficiency requirements, economic feasibility and comfort of living in a low-rise block-type house as the most accessible to population allowing to develop common guidelines in the development of low-rise housing construction in remote areas with special climatic conditions

References

2. N. Gusakova, N. Minaev, A. Gusakov, XVII International Conference of Students and Young Scientists «Prospects of Fundamental Sciences Development» SHS Web of Conferences 80, 01006 (2020)
9. S.G. Sheina, Development of Optimized Model for Selection of Energy Efficient Solutions in Low-rise Construction (Rostov State University of Civil Engineering, Rostov-on-Don, 2013)
11. N.V. Gusakova, Bulletin of the Tomsk State University of Architecture and Civil Engineering 1(24), 106-120 (2022)