Problematic aspects of the management system for large-panel low-rise construction

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Abstract. Solving the housing problem in the Russian Federation is one of the strategic and priority directions of the state's social and economic policy. The government of the Russian Federation is taking consistent steps to activate low-rise housing construction in the construction market. In 2018, the share of low-rise housing construction in the Russian Federation was 42% of the total volume of housing commissioned. It should be noted that in order to solve the housing problem in Russia, when building low-rise buildings, it is necessary to give priority to technologies that will ensure low cost of housing for consumers, fast construction times and the required design solutions. Based on these requirements, the progressive technology of low-rise housing construction is large-panel housing construction. The relevance and versatility of the problem of increasing the efficiency of large-panel housing construction technology in low-rise construction determines the need to improve the entire economic mechanism and management of production and economic processes. Improving and implementing new management methods, in this case, the form of organizing a consortium, will allow construction organizations to ensure effective interaction with elements of the macro environment, ensure the implementation of the strategy for the development of the housing sector, efficiently allocate the resources of organizations and achieve their goals, both in the long and short term.

To date, Russia has seen a period of multiple increases in the share of low-rise housing construction in the housing stock and a period of changing accents in domestic urban planning. Many researchers and scientists, based on the growth rate of the housing stock and global trends, argue that in the near future low-rise housing construction will replace the construction of multistory building construction and will become the foundation of the city of the future and housing for citizens. This statement is confirmed by the fact that the growth of low-rise construction occurs with a general fall in the volume of housing being built on the territory of Russia, so since 2010 there has been a steady trend of an annual increase in the volume of low-rise housing being built with an index of 0.85 [1]. Construction of low-rise housing today is one of the most promising areas of the construction industry, a key factor in the integrated development of territories and the most important direction of state policy in the Russian Federation. Thus, state authorities have developed measures of program-targeted support to stimulate low-rise housing construction using federal and regional programs, such as “Housing”, “Providing housing for young families” and others [2]. Moreover, bank support for consumers of low-rise construction is widespread through the use of special banking products for lending and mortgages.

The analysis of foreign experience of management and organization of low-rise construction in such countries as Germany, Great Britain, and the United States revealed a rich experience and identified the main components of the management system that can also be applied in our country [3].
However, before implementing innovative components of the management system, it is necessary to solve a number of problems that hinder the development of low-rise construction in Russia.

The implementation of projects in low-rise housing construction largely depends on both external conditions and the investment attractiveness of the projects themselves, which is influenced by a large number of various factors (figure 1). Let's consider in detail the micro-factors of low-rise construction projects, since it is these factors that the subject of the low-rise construction management system has a direct impact on [4].

**Factors of comfort of living and quality of objects**
- Convenience of location of LRHC objects
- Transport accessibility
- Social infrastructure
- Number of recreational areas

**Criteria for the location of LRHC objects**
- Construction technology
- Facade finishing
- Insulation technology
- Seismic activity

**Design and technical criteria of the LRHC**
- Area of housing
- Ceiling height
- Availability of balconies, loggias
- Quality of repair

**Criteria for the internal layout of LRHC facilities**
- Domestic territory
- Security system
- Development of the road network

**Criteria for the infrastructure of LRHC facilities**
- Operational efficiency
- Durability of structures

**Factors for the availability of LRHC objects**
- The price of 1m² of LRHC objects
- Average monthly income of the population
- Availability and cost of resources
- Total construction volume of housing under construction

**Factors of economic efficiency of LRHC projects**
- Profit on sales
- Profitability
- Payback

*Figure 1. System of factors affecting the implementation of low-rise construction projects*

In order to bridge the gap between the Russian management system and foreign country and ensure the implementation of urban planning tasks, it is necessary to solve a number of problems that at this stage negatively affect the system of factors that affect the implementation of low-rise large-panel construction projects.
The construction industry is a complex dynamic system that requires competent management influence directed by the subject of management. In the process of organizing mass low-rise housing construction in the subjects of the Russian Federation, it is necessary to solve a number of issues presented in Table 1.

**Table 1. Identification of problems of management of low-rise large-panel housing construction**

| Type of problem | Characteristic of the problem |
|-----------------|-------------------------------|
| urban planning problem | lack of territorial planning documents for municipalities in the regions, which has a deterrent effect on the timely preparation of land plots suitable for housing construction |
| resource problem | acquisition of land or the receipt of rent is an issue for the individual developer and for the developer-builder; land plots intended for integrated development for housing construction from the lands being in state or municipal property, are provided by results of auction on selling rights; at the conclusion of the contract of lease of a land plot without preliminary agreement on the object location, however, to participate in the auction of land must pass state cadastral registration; as a result, the share of land plots granted under auction conditions in the total area of plots occupied for construction is less than 15% [5] |
| technological problem | cheap when choosing contracting organization for construction of comfortable, aesthetically pleasing home that meets optimum technical solutions and costs; need to move on the most effective system with a wide step of supporting structures and the use of prefabricated wall systems allow to reduce production costs by about 10-15%; the most promising types of residential buildings for low-rise development are: one-, two story with attics, detached or blocked buildings, built on the basis of effective light structures using local building materials |
| social problem | lack of developed transport and social infrastructure and insufficient number of places of employment |
| financial problem | lack of financial opportunities for local self-government bodies of municipalities to perform land management preparation of territories for the purpose of organizing auctions for land plots, their arrangement with engineering and social infrastructure |

In order to solve the above problems, it is necessary to ensure the development and creation of functional and territorial zones in the general plans for the development of settlements with predominantly low-rise buildings. At the same time, measures should be taken to update the rules of land use and development during urban development activities. These measures will eliminate administrative barriers and create a market for affordable low-rise housing.

The problem of insufficient development and provision of engineering and transport infrastructure for land plots allocated for low-rise buildings is quite acute. In most cases, the sites are not attractive for investment and require high costs to ensure the connection of external engineering networks. That is why the formation of the land market provided with the required engineering infrastructure is a particularly urgent problem of large-panel low-rise construction. It is necessary to make qualitative changes to the urban planning and land codes, aimed at the possibility of providing engineering-secured and fully ready-to-build land plots. In the future, it will be possible to organize land development on the basis of this project, which will fully provide a design approach to managing low-rise construction [6].

The high cost of land plots in most cases is more than half of the cost of construction. Land markets are focused on large developers, which is why when conducting auctions for land plots, those developers who adhere to the trend of increasing prices win, which leads to the monopolization of the market for...
low-rise large-panel housing construction. It will be very promising to hold an auction to lower the price, where the initial price of the auction will be the market price of the sale of finished housing.

To ensure proper management of large-panel low-rise construction, it is necessary to segment consumers in this category. Large-panel low-rise construction belongs to the economy class segment, which in turn makes up more than 54% of the population able to purchase this housing. In connection with segmentation, it will be possible to create investment and construction processes focused on efficiency, energy efficiency and environmental friendliness. Since large-panel low-rise construction is more of an economy-class segment, it is necessary to use innovative energy-efficient technologies when implementing projects [7]. The use of these types of technologies will increase the competitive advantages of large-panel housing construction over other technologies by reducing the cost and time of construction.

The main problem is the lack of an organizational mechanism for regulating and managing large-panel low-rise housing construction at the federal, regional, municipal and project levels [8]. It is necessary to determine the method of cooperation of participants at all levels, which will increase the competitiveness and profitability of large-panel low-rise construction projects.

In order to develop large-panel low-rise construction, it is necessary to ensure the design of the management system of the subjects, which will be aimed at popularizing large-panel low-rise construction and creating demand. It is appropriate to define conceptual approaches aimed at technical, technological, organizational and managerial solutions that cover all levels of management in the management system of low-rise housing construction (figure 2).

The proposed concept is implemented at four levels. The first level is federal, which includes a system for managing the development of large-panel low-rise construction at the level of the Russian Federation, implying the development of federal laws, target programs and federal standards. The second level is regional, which includes a system for managing the development of large-panel low-rise construction at the level of the subject of the Russian Federation, which implies the development of a regional concept and strategy.

The third level is municipal, which includes evaluating the strengths and weaknesses of the current state of large-panel low-rise housing construction in each municipality, as well as identifying needs to change the existing characteristics of the participants in the investment and construction process that hinder the effective development of this area in the region. The fourth level is the project level, which includes direct management of the design, construction and commissioning of individual buildings or groups of large-panel low-rise housing construction.

These levels form the main subsystems of development through interaction with each other. As the main functional directions of regulation of the management mechanism, formation and development of large-panel low-rise housing construction, it is proposed to use the active subsystems presented in the figure (figure 3).

At the same time, the effectiveness of the system management will be tracked by the following indicators:

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Criterion for managing housing affordability for consumers. As an indicator of affordability, a coefficient is used that is mandatory for use in all federal and regional housing programs. The coefficient is calculated as the ratio of the cost of a typical house with an area of about 90 m² to the annual income of a family of three people. By its content in the final value, the coefficient shows the number of years for which a family can buy a house into ownership, if all the income will be used to pay the cost of the purchased house [9-10];

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Criteria for managing the effectiveness of investment projects and programs. To evaluate this criterion, economic performance indicators are used, which include: net present income, internal rate, payback period, and other accepted indicators.

When implementing large-panel low-rise housing construction programs, it is advisable to use management methods that contain operational and technological functions and economic and
mathematical methods that are implemented when making management decisions. A key role in the implementation of large-panel low-rise housing construction programs is played by participants, i.e. subjects of the investment and construction process. Participants' activities are tracked when implementing management decisions made at various phases of the program's life cycle.

It is important to note that the quality of management will consist in encouraging the regional management body of project-level participants to choose certain actions related to technological and organizational solutions in accordance with the developed management concept. Based on this, the effectiveness of the territorial level depends directly on the results of the activities of the project level participants [11]. Thus, the territorial management body is interested in providing a set of control actions on the participants of the project level that has the maximum efficiency.

At the same time, one of the ways to reduce the degree of uncertainty in management decisions when implementing large-panel low-rise construction projects is to create integrated organizational and production structures that seek to find a balance between centralization and decentralization of management. It should be noted that this kind of cooperation does not slow down the development of existing types of integration of companies, but rather complements them. Due to this, the nature of relationships between companies in the construction sector becomes more complex and diverse, due to the possibility of cooperation of integrated structures.

The limitations and insufficiency of common methodological tools for organizing low-rise housing construction predetermines the need to create an association of construction companies, manufacturers of construction materials, suppliers of material, labor, scientific and investment resources, organized in the main technological chain of creating added value to ensure the technological development of large-panel low-rise construction [12].
Level I. Federal level  
(legislative function)  
Ensuring the quality and safety of construction sites; creating a high culture of construction; creating a favorable environment for innovative development of the industry; ensuring the independence and development of the initiative of the professional business community in accelerating technical progress and increasing the competitiveness of construction products on the world market.

Level II. Regional level  
(support and implementation function)  
Definition of mechanisms and methods for taking into account regional characteristics (climate, geophysical, etc.) in the development of normative technical documents; creation of mechanisms for interdepartmental coordination of technical committees for standardization in the construction industry; optimization of the system for training specialists and experts in the field of standardization, taking into account the priority method of standardization.

Level III. Municipal level  
(function of the program developer and distributor)  
Combination of state regulation functions and self-regulation mechanisms in the system of conformity assessment of subjects and objects of technical regulation; ensuring compliance of subjects and objects of technical regulation with the requirements of normative documents and urban planning legislation; ensuring transparency of supervision and control procedures in construction activities.

Level IV. Project level  
(function of implementation of the projects)  
Criterion 1. Criterion for managing housing affordability for consumers  
Criterion 2. Criteria for managing the effectiveness of investment projects and programs

Program and target management  
Environmental management  
Cost-effectiveness development  
Risks of Meso-level  

Energy efficiency development  
Land development  
Marketing  
Risks of Macro-level

Figure 2. Large panel low rise construction management system
Development of cost-effectiveness of objects, which includes monitoring and managing the price level of real estate objects in the territorial markets for various segments of demand.

Development of energy efficiency of objects, which includes monitoring compliance with requirements in construction for the class of buildings for energy efficiency and increasing requirements for this category of management in construction for all types of residential buildings.

Environmental development, which includes the priority direction of the transition to environmental friendliness of construction and the formation of ecological systems of the human environment.

Marketing, including analysis of federal, regional and municipal territorial markets for low-rise housing construction by various management entities.

Land development, which includes territorial and urban planning, the formation and presentation of land plots for large-panel type of development by all branches of government with the organization of open land auctions for large-panel low-rise construction.

Program and target management aimed at creating and developing specialized programs for demand management.

Figure 3. Active subsystems of the low-rise housing construction management system

This type of association is called a consortium in the scientific literature. A consortium is a temporary association of several independent companies that are united to implement a specific project. The main goal of the consortium is to combine all the resources of each organization to improve the effectiveness of the project. As practice shows, the main advantage of the consortium is the ability to reduce the cost of construction and installation work by integrating the material, labor and financial resources of organizations in the construction industry.

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