

Organizational and Economic Models of Low-Rise Building in the Region Sustainable Development Strategy

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Abstract: Energy efficiency and environmental requirements for residential housing is an actual institutional and organizational task. In the contemporary globally unstable economy conditions, its solution can and should be considered as a basis for the strategy of sustainable development, particularly at the regional level. The potential of energy-, resource- and eco-efficiency realizing in housing demands of scientific research methodology, organization and innovation throughout the cycle of reproduction of residential real estate as well as the competitive territorial-reproductive systems in construction, implement a strategy to increase energy efficiency and environmental requirements for the construction and operation of buildings. The study presents the organizational and economic models derived from research conducted by the researchers. Program-target interactions on regional complex eco-projects implementation and innovative technological solutions in housing construction and upgrade are reflected by proposed multilevel model.

Key words: The region innovative potential, green building, resource saving, region sustainable development strategy, multilevel model

INTRODUCTION

In Russia and abroad, the prospects of low-rise construction are bound up with energy efficiency and environmental requirements for buildings construction and operation. In our country, under present day conditions, resource efficiency and ecological compatibility of housing is extremely important. Russian housing and communal complex consumes almost 2 times more generated electricity and heat than in developed countries, we are the first in the world in energy losses in the housing and communal services, building industry production is also high power intensive (Fenomenov, 2011). As a consequence resources in the industry are used ineffectively, operating costs and expenses of citizens on housing are increased, environmental and social situation becomes worse (Semenov, 2011). The problem of low resource efficiency and ecological compatibility of housing becomes a limiting factor for the Russian economy development and its decision at the regional level can and should be considered as a basis for a strategy for sustainable development (Glaziev and Fetisov, 2013).

In modern scientific research, the global policy of anti-crisis innovation development for the global

economy is more closely associated with the “green” economy and resource-saving technologies (Zaharova, 2011).

Analysis of Russian and foreign know-how experience in this area as applied to housing construction shows that there is significant potential to increase its resource efficiency (Novosyolova and Sheina, 2011) but its implementation requires research methods, models and methodology of resource-saving throughout the cycle of reproduction of residential real estate, including first of all:

- Possibilities of organizational and economic innovation in the construction of new housing
- Possibilities of organizational and economic innovation in existing housing operation, apartment block reconstruction and renovation
- Possibilities of competitive territorial reproductive systems organizing in construction, implementing a strategy of improving resource efficiency and environmental requirements for the construction and buildings operation

Specifically, long and costly cycle of residential real estate reproduction and long payback periods of

environmental projects require specific organizational and economic models in design and implementation of such projects (Avilova, 2007a, b). Innovation and technology projects promoting for new housing construction that improve resource efficiency of operation and updates the existing building can be competitive, provided.

The long-term mobilization of significant organizational and managerial and production and economic potential of a large territory under the implementation of interrelated projects set (eco park or complex).

Reasoning and the most careful selection of organizational and economic mechanisms for resource efficiency based on full consideration of the institutional, infrastructural and natural resource specifics of the given territory.

The need for long-term and large-scale financing of innovative development while taking into account territorial specificity causes that to promote and model of innovation and technological development of housing is appropriate and efficiently at the regional level (Kulakov and Stepnova, 2012).

sustainable development of the region (territory), identified as a key factor of territorial potential of the region, the presence of a regional program of housing construction, eco-resource potential of the region, the regional infrastructure of innovation, organizational and economic mechanisms to promote innovation and technological eco-stable projects of housing. Territorial potential of the region, infrastructure and innovation markets integrated with factors determining an appropriate mechanism of interactions in the models shown in Fig. 1.

The tasks of organizational, economic, administrative and industrial potential mobilization of the region (the “territorial potential”), under the strategy of innovative eco stable development are structured on the basis of a mathematical model of multiple-factor function. Territorial potential is quantified by the maximum possible output of the gross regional product for a given amount of economic resources and the conditions determining their maximum utilization. Territorial potential (Q) can be represented by multiple-factor function:

$$Q = f(L, K, P, I, M)$$

Where:

L = Employment potential of the economically active population of the territory

MATERIALS AND METHODS

Considering the resource efficiency and ecological compatibility of housing as basis for the strategy of

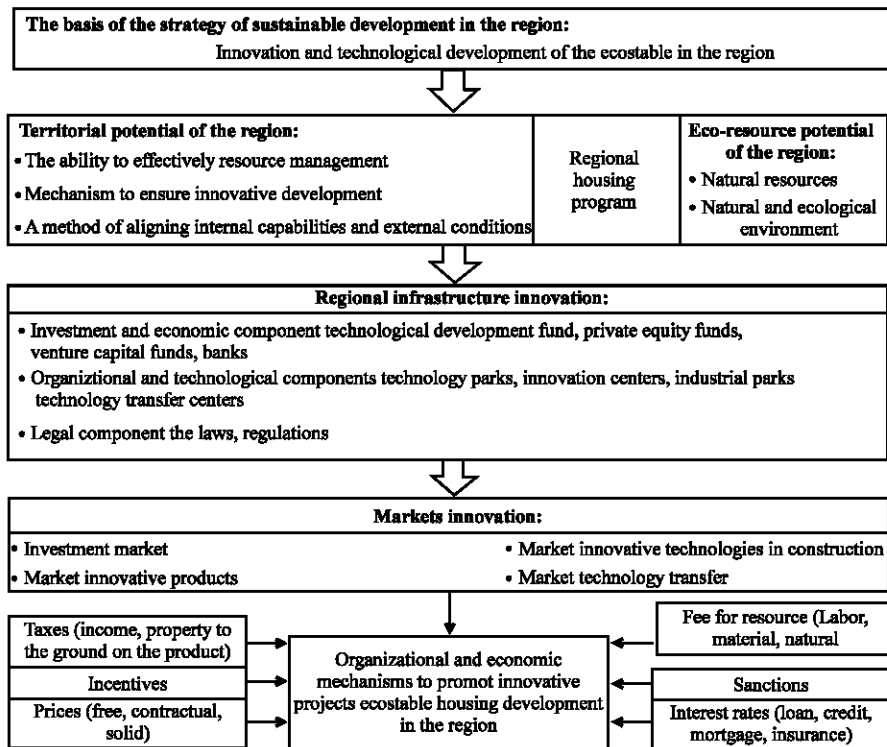


Fig. 1: The model of innovation and technological eco-stable housing development in a region

- K = The potential of main and material component of working revolving fund focused on this area
- P = Natural-resource potential of the area
- I = Innovative potential or potential of scientific and technological progress
- M = Intraproductive turnover that characterizes the work of production system on itself, including the costs of raw materials, materials, fuel, energy, etc.

Labor potential (L) of the active population is represented by the following function:

$$L = f(R, I_0, I_h, I_l)$$

Where:

- R = Active population size
- I_0 = Indicator of the average educational level of the active population
- I_h = Indicator of population health of the territory in terms of the environment quality
- I_l = Indicator of population standards of living

Production potential (K) the function from the following arguments:

$$K = f(A_0, R_a, A_m, A_s)$$

Where:

- A_0 = Residual value of regional fixed assets
- R_a = Relative density of active part of fixed assets
- A_m = Average annual balance of material component of fixed assets
- A_s = Indicator of technological progress that affects the fixed assets efficiency

Natural resource potential in overview (specific productivity of resource, taking into account the impact of environmental quality):

$$P = f(N, C, I_e)$$

Where:

- N = Quantity of one or another type of natural resource
- C = Effective component content, reflecting the qualitative state of resource
- I_e = Indicator that takes into account the impact of environmental quality on productivity of natural resource

The amount of waste (Z) is a function of output of the final product (Q) and intermediate product (m):

$$Z = f(Q)+f(m)$$

The dependence between the total gross regional product and the influence of factor can be described by Cobb-Douglas dynamized production function:

$$Q(t) = a_0 [L^*(t)^{a_1} \times C^*(t)^{a_2} \times N^*(t)^{a_3} \times e^{jAt}]$$

Where:

$L^*(t), C^*(t), N^*(t)$ = Labor costs, capital and natural resources, depending on time factor, taking into account the impact of materialized technical progress, respectively

- a_1, a_2, a_3 = Function parameters
- e^{jAt} = Parameter characterizing the autonomous technical progress
- j = Parameter reflecting the effect of production scale

RESULTS AND DISCUSSION

Reproduction processes in the construction regional complex, residential projects competitiveness, productivity of territorial systems of building complex are integrated by program-target control methods at the regional and municipal levels and level of local business communities. Appropriate programs are inherently long-term reproductive management programs of territorial complex residential real estate projects on the basis of its innovation system reform (Kovaleva, 2011). At the same time, strategic regional programs for sustainable eco-stable development with a cluster organization of the system can be a tool to control the process at the regional level (local i-level) to the inter-regional and international levels (j-levels).

Organizational-economic mechanisms of innovative programs interaction are structured in the form of systems consisting of the following subsystems: component FTP; realization of the target subprogram as part of the Federal Target Program; RTP; implementation of synchronous Regional Targeted Programs of the subject of the federation. In turn, the regional program subsystem includes blocks:

- A program-targeted co-financing from the regional budget
- B program-targeted co-financing from the municipality budgets
- C program target extra budgetary sources of co-financing

This system can be represented as a multilevel model of program-target interactions on the implementation of a regional complex of innovative environmental projects in new housing construction and existing building renewal (Fig. 2).

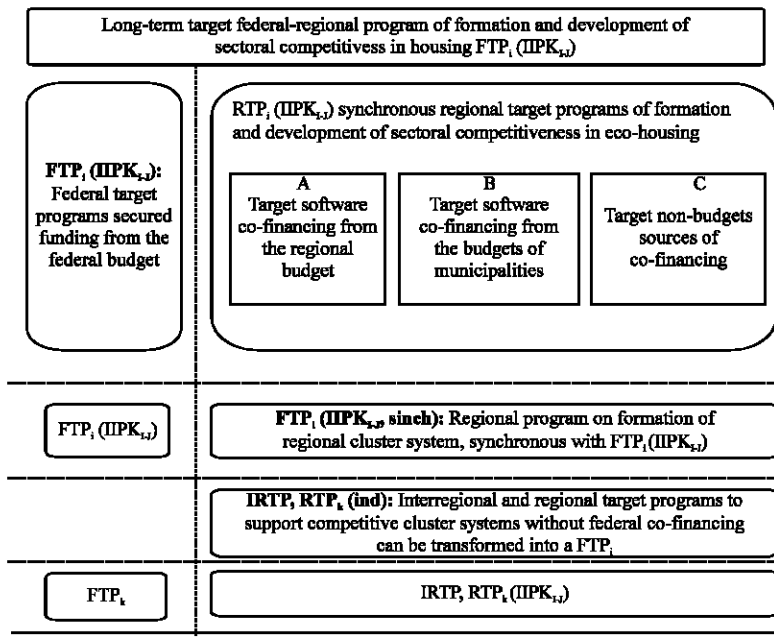


Fig. 2: Multi-level program-target model of regional complex implementation of innovative eco-projects in new housing construction and existing building renewal

Competitive territorial reproduction building systems improving as applied to the regional level of construction industry (or meso-level) is today's actual task of the state (Maznitsa, 2013). It is in line with the decentralization of the current system of management by establishing of quality regional institutions of governance and strategic planning and a unified subvention on implementation of transferred to subjects from the Federation authorities. As the analysis of world experience shows to mobilize the territorial capacity and competitiveness of territorial systems, special organizational structures of consortia type are effectively use. Consortia are created with banking sector involvement, research organizations, owning of innovative developments of technological, organizational, economic and managerial nature.

There are five stages in the development process and programming of competitive advantages at the regional level of construction.

Stage 1: Federal target program initiation to support innovation important national priorities of eco-housing, synchronously implemented in regions. At this stage, territorial problem situations in real estate markets are determined and settled, the initial conditions of their decision at the state level through the program-target investment system are determined, tasks of resource support of investment and innovation processes at the

regional level (Aksenova and Boldireva, 2012) are identified, organization type is determined (simple or complex model of consortium).

Stage 2: Development within the existing federal target program IIPK_{1,j} to support important national priorities but not implemented in regions. Economic regulation of eco-projects at this stage takes place through business participants of developer type.

Stage 3: Development within the framework of inter-regional programs of supporting competitive advantage in inter-regional real estate markets, the most significant for the interconnected system of the Federation but do not have federal status. At this stage, the degree of economic stability of the consortium increases, the stage begins payback and return of funds to participants of the consortium.

Stage 4: Transformation of inter-regional and regional programs to support competitive advantages in inter-regional and regional real estate markets into federal with corresponding co-financing. Stage 4 involves state participation reduction, access to the stable functioning on the basis of eco-housing construction projects self-repayment. Its effectiveness depends on the quality of management of meso-regional system (Amirova and Ekimova, 2013).

Stage 5: Liquidation of existing programs of supporting competitive advantages at the federal level and inter-regionals, regionals, territorial local real estate markets due to their inefficiency and obsolescence. At this stage, there is an autonomous economic operation of high-performance business systems in construction with self-regulation on market conditions and residual state monitoring.

In the future, these stages are repeated, retrospective analysis confirms that the degree of state influence on reproductive processes on regional property markets has steadily cyclical nature (Erohina, 2013).

In terms of it is possible to simulate the cycle of state regulation of competitiveness in eco-housing construction on the basis of targeted programs IIPK₁₋₃. Conceptual model of this cycle as a combination of involvement degree of major partners of the consortium (temporary and permanent) and the system of state-municipal partner participation (G), Banks participation (B), initiators of competitive Innovation (I) and partners of production type as development companies and their associated vertical-integrated business systems (D) is shown in Fig. 3.

Strategically, the functions of state regulation of eco-housing construction competitiveness is a special “catalyst” that brings into action the large amounts of extra investments at the expense of administrative

resources consolidating with budgetary financing. Its action mechanism can be analyzed with the help of organization functional model of consortia-type territorial-reproductive structures for competitiveness regulation in building at the regional level (Fig. 4) (Baburin, 2010).

The purpose of government regulation is formation of long-term mortgage and investment reproduction flows in construction and influence on structural changes on regional real estate markets, including business communities, banking sector, territorial and production organizations, developers and other members of consortium for development of innovative eco-housing. Under present day conditions of crisis this influence is primarily aimed to find points of economic growth based on innovation and activities to improve innovation of economy construction sector as the basis for the formation of competitive advantages of eco-housing construction by reducing costs, time decrease and improvement of construction quality (Egorov *et al.*, 2011).

Research, conducted by the researchers have shown that innovation organization to the complete cycle of residential properties reproduction must be based on a model of innovation and technological eco-stable housing development of a region, territorial potential of which is multifactorial function. Program-target interactions on regional complex eco-projects implementation and

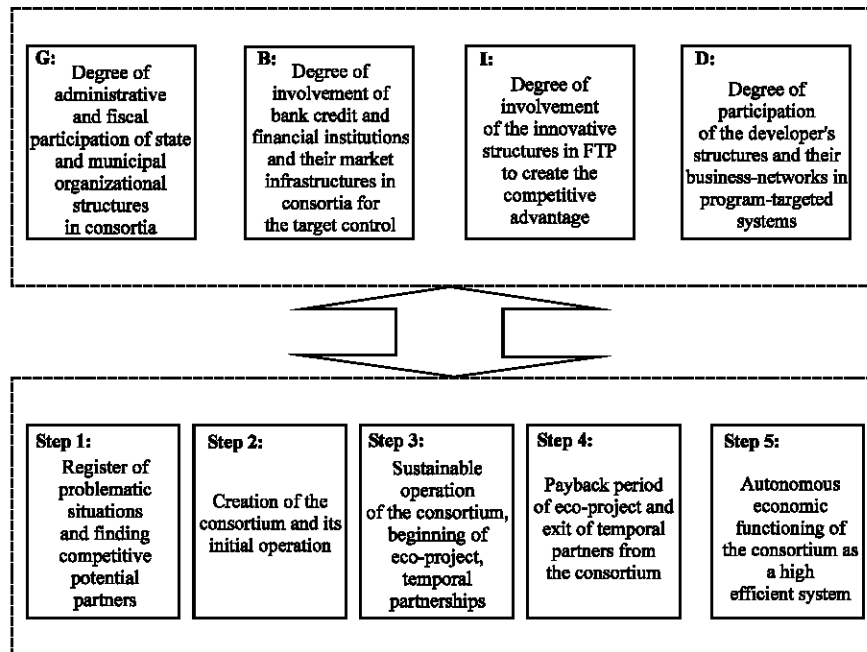


Fig. 3: Conceptual model of the cycle of state regulation of competitiveness in the construction of eco-housing on the basis of targeted programs within the bounds of consortium

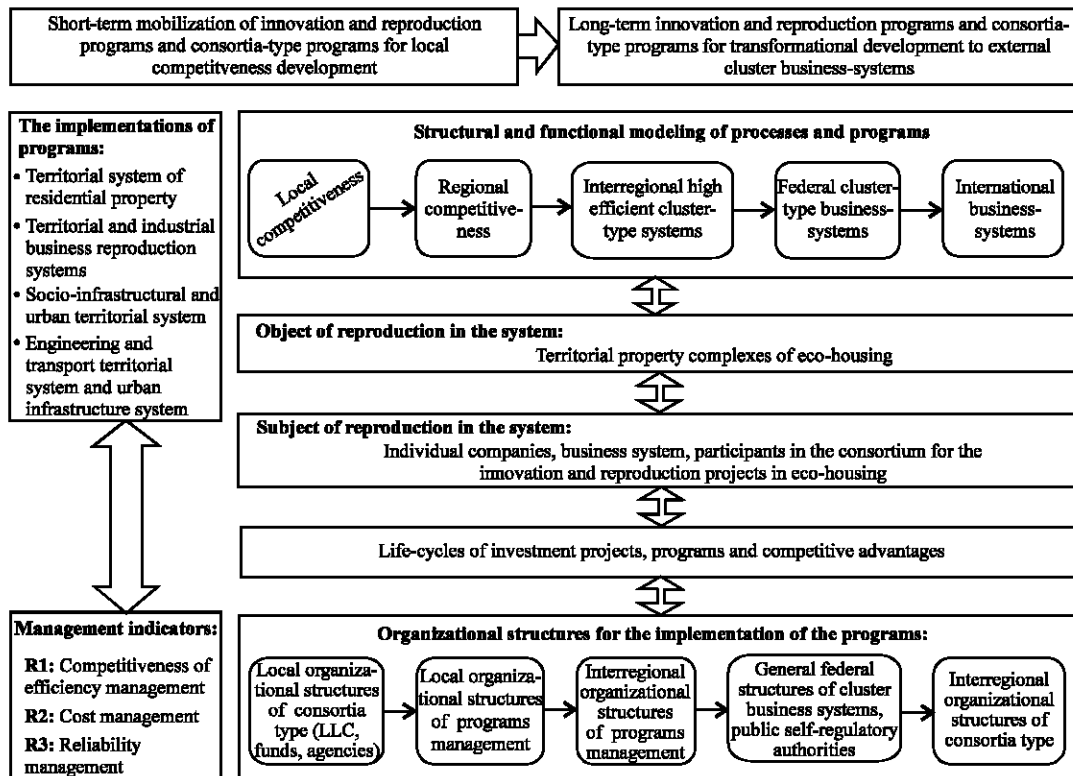


Fig. 4: Functional model of organization of territorial-reproductive structures such as consortia for competitiveness regulation in the building at regional level

innovative technological solutions in housing construction and upgrade are reflected by multilevel model that allows to:

- Organize competitive territorial reproductive systems of developer- and consortia-type as applied to regional level of construction industry
- Plan strategy, organizational and technological priority of eco-housing construction
- Plan specific organizational and technological activities on eco-housing exploitation

Thus in global unstable economy, resource efficiency and environmental requirements increase for housing is an actual state organizational task can and should be regarded as the basis of sustainable development strategies, primarily at the regional level of management.

Such approach within the framework of a comprehensive whole of public policies for the development and modernization of the economy at the forefront of structural and technological basis will speed up the growth rate of the economy and to pass to innovative path of development (Graboviy *et al.*, 2013).

Potential implementation of housing resource and eco-efficiency improving needs methodology scientific research of organization and innovations implementation in the whole cycle of residential real estate reproduction as well as organization of competitive territorial and reproductive systems in construction, implementing a strategy of energy efficiency and environmental requirements improving for the construction and use of buildings (Avilova, 2007a, b).

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