ISSN 2073-8412 (PRINT)
ISSN 3034-1485 (ONLINE)

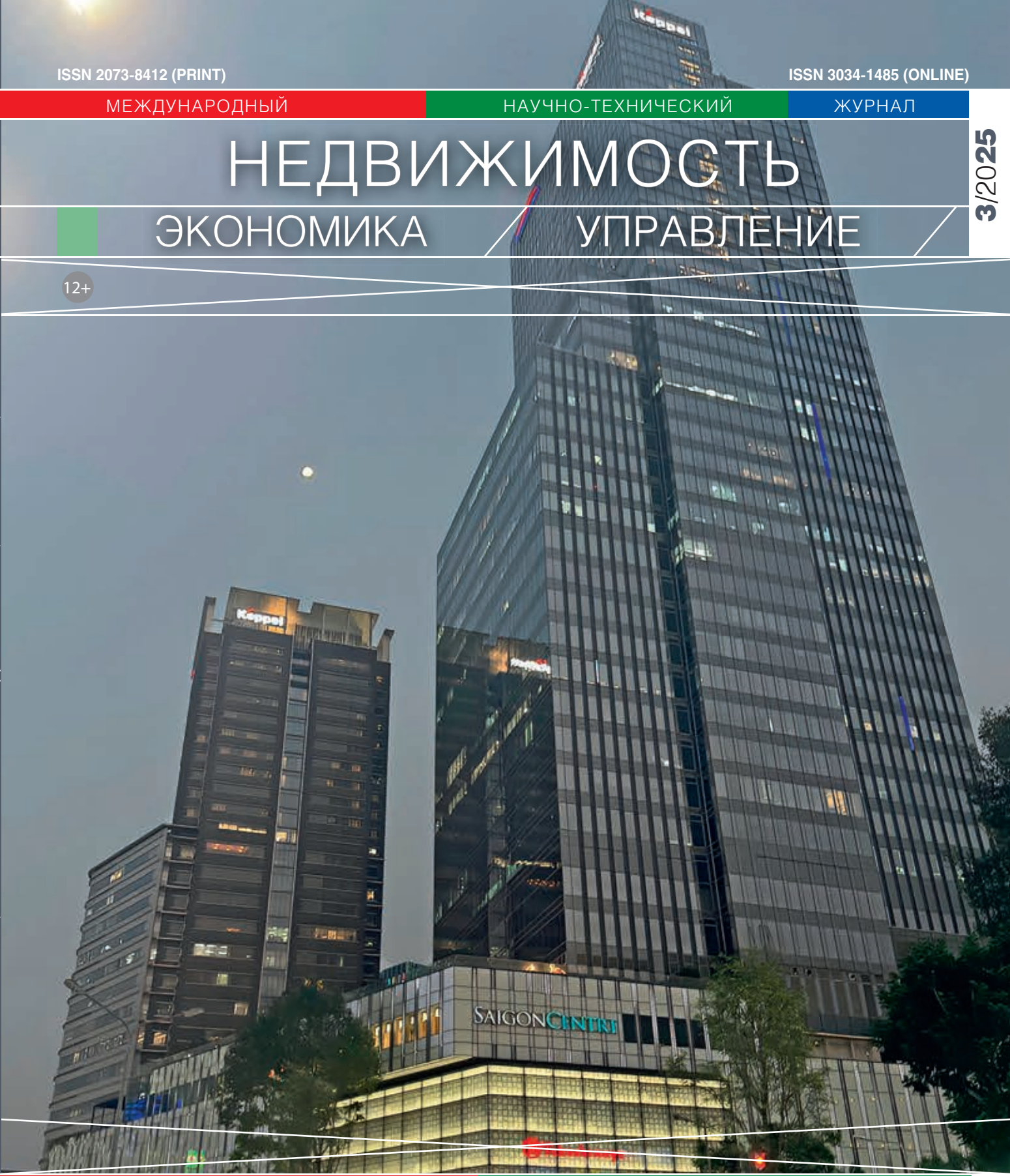
МЕЖДУНАРОДНЫЙ НАУЧНО-ТЕХНИЧЕСКИЙ ЖУРНАЛ

НЕДВИЖИМОСТЬ

ЭКОНОМИКА / УПРАВЛЕНИЕ

3/2025

12+



INTERNATIONAL SCIENTIFIC & ENGINEERING MAGAZINE

REAL ESTATE

ECONOMICS / MANAGEMENT

3/2025



ISSN 2073-8412 (Print) ISSN 3034-1485 (Online)

НЕДВИЖИМОСТЬ

ЭКОНОМИКА ■ УПРАВЛЕНИЕ

Учредители:

Федеральное государственное бюджетное образовательное учреждение высшего образования «Национальный исследовательский Московский государственный строительный университет» (НИУ МГСУ);
Издательский дом «АСВ»

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Основан в 2001 году. Выходит 4 раза в год.
Подписан в печать 29.09.2025.
Выход в свет 30.09.2025

СВИДЕТЕЛЬСТВО О РЕГИСТРАЦИИ СРЕДСТВА МАССОВОЙ ИНФОРМАЦИИ: ПИ № 77-11025 от 30 октября 2001 г. выдано Министерством Российской Федерации по делам печати, телерадиовещания и средств массовых коммуникаций. Адрес в сети Интернет: **http://n-eu.iasv.ru/**

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Тел.: +7 (968) 903-00-04; e-mail: journals@mgsu.ru

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Дорогие читатели!

Современные рыночные отношения в сфере преобразования жилищного фонда превратили жилье в труднодоступное благо для значительной части населения. Особенно остро эти проблемы проявляются в историческом жилищном фонде, поскольку исторические жилые здания требуют дополнительных мер и средств для их охраны и воспроизводства.

Выбор теоретической основы для формирования стратегии управления реконструкцией исторического жилищного фонда определяется теми условиями и ситуацией, которые складываются в конкретной среде функционирования исследуемой категории. При этом важнейшим условием процесса реконструкции является установление системы управления и организационных форм этого процесса.

Процесс реконструкции развивается в настоящее время в двух направлениях:

• реконструкция жилищного фонда исторических городов с сохранением и преобразованием старого жилищного фонда, ценного по градостроительным, архитектурным и историко-культурным характеристикам;

• реконструкция жилой застройки периода массового индустриального домостроения.

Главные задачи реконструкции города:

• регулирование развития города путем переустройства планировочной структуры и совершенствования территориального зонирования;

• обеспечение преемственности городского развития, сохранение и обогащение исторически сложившегося своеобразия планировки и пространственной композиции города;

• оздоровление окружающей человека среды путем борьбы с загрязнениями и шумом, озеленения, обводнения, повышения уровня эффективности использования открытых пространств, совершенствования инженерного оборудования территории и другого;

• совершенствование транспортной инфраструктуры, повышение комфорта и безопасности движения;

• создание необходимых предпосылок для улучшения архитектурно-пространственной среды жилых районов, общегородского центра и других функционально-территориальных зон сложившейся части города.

Проект реконструируемого района должен представлять собой целостный градостроительный замысел, в результате осуществления которого город, сохранив свой индивидуальный художественный облик, получит современное техническое оснащение, а его население — современный уровень комфорта.

Этим и другим вопросам основных форм воспроизводства объектов недвижимости посвящен данный номер журнала.

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ECONOMICS, MANAGEMENT
Scientific and technical journal

Founded in 2001. Published quarterly
Founders: Moscow State University of Civil Engineering (National Research University) (MGSU), ASV Publishing House
The Journal has been included in the list of the leading review journals and editions of the Highest Certification Committee of Ministry of Education and Science of Russian Federation in which the basic results of PhD and Doctoral
Thesis are to be published.
The subject matter coverage complies with the approved list of scientific specialties:
5.2.3. Regional and sectoral economics (economic sciences);
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2.1.10 Environmental safety of construction and urban economy (technical sciences);
2.1.13 Urban planning, planning of rural settlements (technical sciences);
2.1.14 Life cycle management of construction objects (technical sciences).

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Address: MGSU,
26 Yaroslavskoye shosse, Moscow, 129337
Tel.: +7 (968) 903-00-04;
e-mail: journals@mgsu.ru
On-line version of journal: http://n-eu.iasv.ru/
Signed for printing: 29.09.2025

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UDC 624.014:620.193

Grabovyy P.G.
Kushchenko I.V.

Organizational forms of updating the management structure of urban real estate cluster territories in Donbass

The paper raises the issues of ensuring the sustainable development of the urbanized border territories of Donbass, as well as the main problems standing in the way of achieving the restoration of reproduction in the housing sector. The features of managing the restoration processes of spatial and resource development of housing stock in new regions are considered. Special attention is paid to substantiating the classification features of the organizational and economic mechanism of renewal, taking into account the options for territorial cluster portfolios of real estate. The urban development of the historical center of Mariupol was chosen as an example for consideration. A detailed analysis of the factors of resilience and life support of urban real estate, approaches to the formation of adaptation mechanisms for carrying out repair and restoration work has been carried out. Functional areas such as regulation of investment and innovation potential, introduction of socio-economic, environmental and informational changes, design and scenario modeling, analysis of the sustainability of spatial resource development and housing revitalization solutions, as well as urban renewal, are highlighted. A structural model of spatial and resource development of the housing stock in Mariupol has been formed, which will improve the investment attractiveness and ensure flexible planning of repair and restoration work.

Keywords: *sustainable development, organizational forms of management, cluster territories, urban real estate, revitalization, restoration of housing reproduction*



Grabovyy Petr Grigorievich,
Doctor of Economics, Professor, Head of the Department of Construction Organization and Real Estate Management; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation;
ID RSCI: 302471,
Scopus: 57164862700,
ResearcherID: AAE-7942-2022,
ORCID: 0000-0002-8696-3718;
GrabovyiyPG@mgsu.ru



Kushchenko Igor Vladimirovich,
Candidate of Technical Sciences, Acting Rector; Pryazovskyi State Technical University (PSTU); 7 Universitetskaya St., Mariupol, 287642, Donetsk People's Republic, Russian Federation;
ORCID: 0000-0002-3338-6793;
kigorvlad@yandex.ru

INTRODUCTION

The sustainable development of the liberated urbanized territories of Donbass is associated with the use of modern scientific approaches to the rational use of regional factors to increase efficiency and intensify the construction industry. Therefore, a comprehensive consideration of the issues of updating organizational forms of management is an urgent problem of improving the economic mechanism of municipal authorities, combining the mechanisms of sectoral and territorial planning[1, 2].

The development of forms of production organization in the construction sector reflects the industrial and technological specialization of the Donetsk region, related to the functional structure of the Donetsk-Makeyevka industrial agglomeration and Kramatorsk-Slavyansk, Krasnoarmeysky, Gorlovsko-Yenakiyevsky, Torezo-Snezhnyansky and Mariupol industrial districts [1]. Territorial division of labor, spatial and resource development is the basis for restoring the reproduction of housing stock through the creation of cluster associations, which are designed to promote the innovative and investment development of engineering and construction life support systems for urban real estate [2].

The scientific, methodological and practical orientation of the cluster-territory renewal problem has determined the main purpose of the work — the systematization and substantiation of methodological provisions and organizational and economic mechanisms for managing aggregate resources during construction and restoration work.

Improving the theory and practice, technology and organization of repair and restoration work requires consideration of the following tasks:

- to analyze the specifics of managing the restoration processes of spatial and resource housing development in new regions;
- to formulate the classification features of the organizational and economic mechanism of renewal, taking into account the options for territorial cluster portfolios of real estate ($TCPR_i$);
- to develop the provisions of problem-oriented management of repair and restoration works based on the matrix of scenarios of cluster-territories of development.

Taking into account the distinctive factors of resilience and life support of urban real estate in $TCPR_i$, approaches to the formation of adaptation mechanisms for carrying out repair and restoration work are based on common signs of housing stock reproduction:

- continuity of the process of sustainable housing renewal throughout the life cycle of buildings;
- maintaining performance and durability to prevent physical and moral deterioration;
- continuous improvement of the quality of the residential environment and urban infrastructure.

[1] Strategy for the development of the construction industry and housing and communal services of the Russian Federation for the period up to 2030 with a forecast up to 2035. URL: https://sudact.ru/law/rasporiazhenie-pravitelstva-rf-ot-31102022-n-3268-r/strategiia-razvitiia-stroitelnoi-otrasli-i / (date of access: 02/15/2024).

[2] The State programme "Restoration and socio-economic development of the Donetsk People's Republic, Lugansk People's Republic, Zaporizhia region and Kherson region". URL: https://постановление-правительства.рф/gosudarstvennaya-programma-vosstanovlenie-i-soczialno-ekonomicheskoe-razvitie-doneczkoj-narodnoj-respubliki-luganskoj-narodnoj-respubliki-zaporozhskoj-oblasti-i-hersonskoj-oblasti/

When considering the organizational and economic mechanism for the implementation of real estate reproduction processes, such functional areas are highlighted as: regulation of investment and innovation potential; making changes of a socio-economic, environmental and informational nature; design and scenario modeling; analysis of the sustainability of solutions for spatial resource development, renovation, redevelopment and revitalization of housing and the urban environment [3].

MATERIALS AND METHODS

The fundamental provisions and principles of system analysis and process approach, business continuity, real estate management, special methods of modeling the life cycle of capital construction facilities, economic theory, cybernetics, anti-crisis management of construction and housing rehabilitation, emergency situations and disasters are used to scientifically substantiate the organizational forms of updating the urban real estate management structure.

Emergency recovery operations in the aftermath of natural and man-made emergencies provide for a complex of emergency rescue operations, which, depending on the time of their implementation and complexity, include the stages of urgent and priority emergency recovery operations[3].

The restoration of the housing stock is carried out after the completion of design work, as a rule, in parallel with emergency recovery work and resource provision, supplies of the required mechanisms and materials. Depending on the factors of resilience and life support of urban real estate, there are three types of housing rehabilitation: short-term, temporary, and capital.

Modern literary sources reveal diverse aspects of organizational and technological preparation of reproduction processes in the housing sector: the economic essence and features of the manifestation of various forms of reproduction [4]; analysis of the organizational and technological reliability of emergency facilities in conditions of spatial and temporal uncertainty, the development of means and methods of organizing information support for adaptive and operational management processes [5, 6]; principles of organizational and managerial activities in carrying out construction and restoration work carried out in emergency situations and under martial law [7]; a special mechanism for managing balanced indicators of housing stock reproduction [8]; programmatic approaches to the reproduction and restoration of residential facilities in the Donetsk People's Republic [9]; sustainable development of urban areas in the presence of threats from modern man-made societies [10]; requirements for residential areas with signs of significant physical and moral deterioration of buildings and structures during the implementation of renovation programmes [11]; the use of innovations, the use of new materials, structures, equipment, technologies, design developments, modern methods of organization in the management of repair work during the reconstruction and modernization of dilapidated housing [12].

The capabilities of construction organizations make it possible to restore buildings, but the specifics of emergency recovery work require an increase in the organizational and technological level, the effectiveness of investment decisions to restore the reproduction of urban real estate [13]. The current level of $TCPR_j$ renewal is achieved on the basis of problem-oriented management through the implementation of combined spatial and resource development measures.

The hierarchical subordination of the reproductive processes of new construction, modernization, reconstruction, renovation, revitalization and redevelopment is built depending on the integral indicator of the effectiveness of cluster-territories of development, taking into account:

- *technical* aspect of all options for the reproduction of real estate and housing and communal infrastructure;
- *technological* aspect of the qualitative change in the communication characteristics of the territories of the current development (including communications for the provision of all types of resources used in the operation of housing stock, transport communications, service communications for various types of public utilities);
- *organizational* aspect of the formation and subsequent functioning of management structures, ensuring the effectiveness of the regime for the use of residential real estate, complexes of facilities, territories and, ultimately, the city as a whole;
- *economic* aspect of the cost assessment of life processes and management;
- *social* aspect of constraints in the implementation of specific renovation projects.

Thus, the restoration of the viability of urban spaces is achieved by ensuring a balanced functional structure of real estate and the biospheric compatibility of urbanized territories with transport and communal infrastructure facilities. The processes of restoration of housing stock reproduction include urban planning, regulation and arrangement, organizational and technological development and resource provision of enterprises of the construction complex.

The elimination of the imbalance in the urban development of new territories during the transition period is associated with the implementation of the principles of complexity, long-termism, security, and integration in the format of a macroregion with a single development strategy [14].

RESULTS

Restoration of housing stock reproduction and its long-term effective use is impossible without the implementation of problem-oriented management and organizational and technological preparation of state support measures in accordance with Federal Law No. 224-FZ dated July 13, 2015 “Public-Private Partnership in the Russian Federation and Amendments to Certain Legislative Acts of the Russian Federation” (hereinafter referred to as the Law on PPP).

Since the beginning of hostilities in the territory of the Donetsk People's Republic, more than 800 thousand real estate objects have been registered, among which more than 40 thousand buildings have been destroyed. Records of all destroyed housing stock facilities are maintained by local administrations in accordance with the mechanism for conducting damage surveys, assessing the criticality and extent of damage to housing stock, identifying recovery opportunities, required resources, and the need to build new housing.

According to the data of the public law company “Unified Customer in the field of construction”, which performs the functions of a state customer in the framework of ensuring the construction of civil facilities, the housing rehabilitation programme in Mariupol has been completed by 90 %. The next step is to work on historical sites

[3] Main directions and issues of organizational and technical preparation of design and construction organizations for emergency recovery operations. Developed by: Moskomarkhitektura; GUP NIATs; GUP EkInTS. Moscow, Moskomarkhitektura, 2004. URL: http://libnorm.ru/Files1/42/42313/index.htm (rus.).

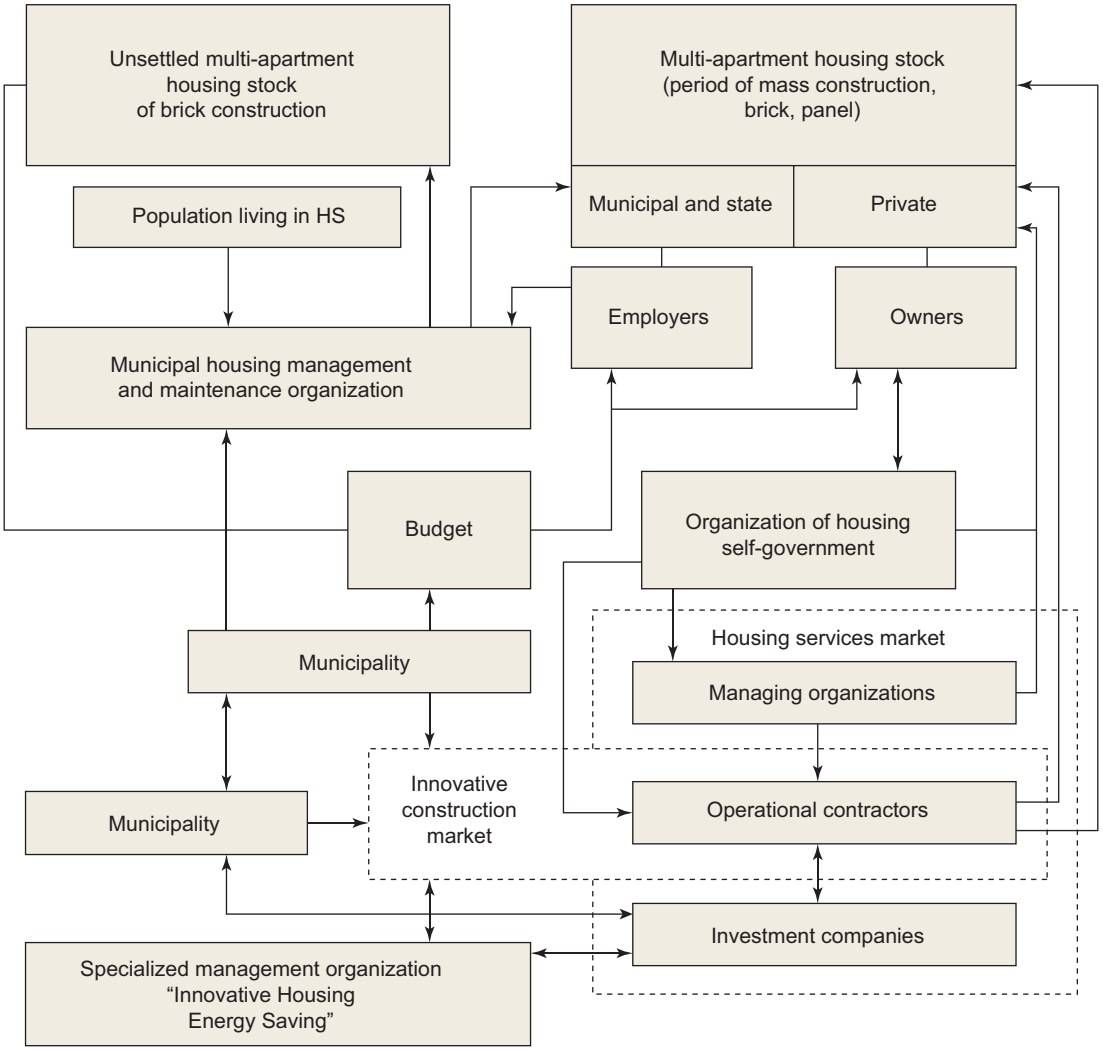


Fig. 1. The structural model of management of restoration processes of spatial and resource development of housing stock in Mariupol

and buildings with a high degree of destruction[4]. Thus, the completion of the stage of urgent and priority emergency recovery work opens up new opportunities for restoring the reproduction of housing stock and updating the quality of the urban environment.

Based on the analysis of the state and problems of developing organizational and economic solutions during construction and restoration work, a functional typology is proposed that allows both taking into account the level of socio-economic development (in terms of the isolated influence of external factors) and positioning the territorial organizational and economic cluster depending on the degree of development of the housing sector (Fig. 1). This typology allows us to evaluate and adjust the direction of development of the organizational and economic cluster-the territory of historically developed buildings within the city of Mariupol, taking into account the socio-economic principles of real estate revitalization in the structure of the urban economy (crisis, liberal and innovative territories).

Scenarios for choosing development directions in the territory of a historically established territorial multifunctional complex (TMFC) provide for consideration of socio-market, evolutionary-breakthrough, as well as innovative options for continuous improvement of the quality of housing stock and urban renewal. Due to the impossibility of solving all problems simultaneously within the framework of the cluster approach, an organizational and economic territory is being formed — a cluster of existing buildings, which provides for the implementation of priority investment and innovation projects within the framework of the municipal strategy for the establishment and functioning of territories historically part of Mariupol.

Let's consider the main options for the development of cluster territories when investing in the revitalization of real estate in the historical part of the city (Table 1).

The choice of priority options for restoring urban real estate reproduction is determined by the classification of investment attractiveness (very high, high, medium, satisfactory, low), taking into account the industrial and technological specialization of the region. Thus, the choice of a cluster-territory development scenario is influenced by the investment attractiveness of both the region and the city, with the allocation of basic scenarios. The difference between the proposed management models of $TCPR_i$ is the application of a problem-oriented approach that takes into account the conditions for restoring the reproduction of housing stock in a complex emergency situation.

[4] URL: https://realty.ria.ru/20250130/mariupol-1996106808.html

Table 1. Typology of cluster territories by state of TCPR$_i$

Variants of territorial cluster real estate portfolios	City types		
	A. Innovative	B. Evolutionary breakthrough	C. Socio-market
I. Innovative	Innovative city (IA)	Innovative city (IB)	Evolutionary breakthrough (IIA)
II. Evolutionary breakthrough	Innovative city (IC)	Evolutionary breakthrough (IIB)	Socio-market (IIIA)
III. Socio-market	Evolutionary breakthrough (IIC)	Socio-market (IIIB)	Socio-market (IIIC)

Table 2. Matrix of optimal costs ($C_{ad.i}$) for rebuilding options of urban real estate revitalization

Revised (i-th) option	Option (γ-th), for which the revitalization is performed						
	I	II	III	…	γ-th	…	m
I	0	C_{12}	C_{13}	…	$C_{1\gamma}$	…	C_{1m}
II	C_{21}	0	C_{23}	…	$C_{2\gamma}$	…	C_{2m}
III	C_{31}	C_{32}	0	…	$C_{3\gamma}$	…	C_{3m}
…	…	…	…	…	…	…	…
i	C_{i1}	C_{i2}	C_{i3}	…	$C_{i\gamma}$	…	C_{im}
…	…	…	…	…	…	…	…
m	C_{m1}	C_{m2}	C_{m3}	…	$C_{m\gamma}$	…	0

1 stage: identification of external and internal environment of TCPR$_i$

2 stage: systematization of classification features of organizational and economic renewal, taking into account the options of the TCPR$_i$, development of priority scenarios for the restoration of urban real estate reproduction

3 stage: analysis and assessment of the organizational and technological level, investment attractiveness of TCPR$_i$ in restoring the reproduction of housing stock and updating the quality of the urban environment

4 stage: choosing of options for the development and management of TCPR$_i$

5 stage: development of an innovative management model for TCPR$_i$ and justification of projects for the revitalization of cluster development territories

6 stage: building a multi-stage model of problem-oriented management and flexible planning of repair and restoration work

7 stage: assessment of the resilience of the construction business in a complex emergency situation of reproductive processes in the housing sector

Fig. 2. The stages of programme-oriented management of a territorial cluster in the restoration of urban real estate reproduction

Priority revitalization options are analyzed taking into account the matrix of optimal costs for rebuilding options ($C_{ad.i}$), criteria of manufacturability, reliability, availability of resources, volume of reconstructive solutions, etc., which makes it possible to adapt design preferences in conditions of uncertainty of post-crisis recovery (Table 2).

A characteristic feature of the procedures for assessing priority megaprojects is the much greater role of various natural and resource indicators than in other cases, which sometimes dominate the cost. There are two reasons for this. Firstly, the cost indicators for the future are predicted with a lower degree of probability, while the resource base has a reliable description in physical terms. Secondly, the prospect of large-scale megaprojects often depends on the availability of significant required resources. The assessment of their size and the possibilities of their real provision is becoming a priority and critical aspect for regional municipal authorities.

Thus, the proposed typology according to the state of the TCPR$_i$ and the level of their socio-economic development made it possible to develop classification features of scenarios for the development of cluster territories (see Table 1, 2). The matrix model shows 9 variants reflecting the type of territory historically developed in the city, depending on the level of socio-economic development and the state of the TCPR$_i$. At the same time, each option has its own composition of possible development scenarios.

The developed typology of cluster territories according to the state of TCPR$_i$ (see Table 1) and the formed cost matrix of urban real estate revitalization options are adapted for spatial and resource development and management of the resilience of the construction business in a complex emergency situation in order to sustainably reproduce urban real estate and attract investment funds and innovative materials and technologies (Fig. 2).

The application of the developed methodology made it possible to gain competitive advantages by substantiating the investment attractiveness of historical buildings in the urbanized territory of Mariupol:

- urban planning — creation of a new public space;
- social — creation of new jobs, a multifunctional center that includes hotel, office, shopping, cultural, entertainment and residential functions as a result of the relocation of production;
- functional and economic — increasing the competitiveness of a territorial object in the real estate market by creating new points of attraction for human flows;
- environmental — reduction of pollutant emissions, as well as reduction of noise impact from production facilities;
- cultural and historical — preservation and development of valuable urban territory by preserving the history of objects;
- engineering and technical — reducing the negative impact of the facility's activities on transport and engineering networks, as well as eliminating the depressive state of the surrounding buildings; arrangement of underground and aboveground parking lots.

CONCLUSIONS

In the current conditions of a complex emergency situation, the completion of the stages of urgent and priority emergency recovery work in certain border territories of Donbass contributes to the processes of restoring the reproduction of housing stock and updating the quality of the urban environment. Overcoming the crisis phenomena in the housing sector of new regions requires further development of problem-oriented management methods, solving acute problems of improving organizational and economic mechanisms to ensure the effectiveness of construction and restoration work in the housing sector.

Based on the consideration of scientific and methodological approaches to improving the economic mechanism of municipal authorities, a combination of sectoral and territorial planning mechanisms, taking into account the peculiarities of industrial and technological specialization of the Donetsk region, classification features of the organizational and economic mechanism for updating organizational forms of management of cluster territories of urban real estate development are formulated.

The principles of the matrix method of scenario justification of cluster territories have been developed in order to invest in the revitalization of urban real estate. The competitive advantage of the developed models of renovation and reproduction based on territorial cluster portfolios of real estate is the use of a problem-oriented approach that takes into account the conditions of flexible planning of repair and restoration work in a complex emergency situation.

REFERENCES

1. Kushchenko I.V., Volgin V.V. Spatial and resource development in creating a quality framework for the urban environment of the Donetsk People's Republic. Real estate: economics, management. 2023; 4:6-13. DOI: 10.22337/2073-8412-2023-4-6-12. EDN LGBPWK.
2. Kushchenko I.V., Grabovyy P.G. Cluster model of construction and economic development in the conditions of urban housing stock restoration in DPR. Real Estate: Economics, Management. 2024; 1:6-13. EDN ALHQOQ.
3. Grabovyy P.G., Kushchenko I.V. Investment and innovation potential of ensuring the viability of the construction business in new regions. E3S Web of Conferences 535. 2024; 02019:9. DOI: 10.1051/e3sconf/202453502019
4. Perov V.A. Capital repair and modernization in the system of reproduction of housing fund objects. Problems of modern economics. 2010; 1(33):351-353. EDN MUPUBV (rus.).
5. Larin S.N. Modern toolkit of modeling and optimizing programs of reproduction of available housing. Audit and financical analisis. 2011; 5:347-359. EDN OHEVVH (rus.).
6. Kuznetsov P.A., Kolotilov Yu.V., Lim V.G. Information and computing technologies in organizational and technological design. Moscow, Energoatomizdat, 2002; 450. EDN YOBFXK (rus.).
7. Tkachenko V.B., Grishin V.N. The main principles of construction and restoration work in emergencies. Real Estate: Economics, Management. 2023; 2:65-69. DOI: 10.22337/2073-8412-2023-2-65-69 (rus.).
8. Vasilyeva O.T. Reproduction processes as basis for strategic development of housing sphere. Intellect, innovations, investments. 2013; 3:10-14. EDN RDUIFL (rus.).
9. Malova N.Y., Kalustyan Ya.V., Mikhaleva E.V. Program approaches to the reproduction and restoration of residential facilities of the Donetsk People's Republic. Online journal "Economics of Civil Engineering and Municipal Economy". 2020; 16(4):245-257. EDN WYQQCB (rus.).
10. Vagin V.S., Sheina S.G., Chubarova K.V. Principles and factors of sustainable development of territories. Online journal "Naukovedenie". 2015; 7(3-28):9. DOI: 10.15862/91EVN315. EDN UMFVUL (rus.).
11. Kaganova I.O. Reconstruction of a housing estate in cultural historical centers of the cities: experience and problems. Humanities scientific researches. 2014; 12-2(40):103-106. EDN TFMBEX (rus.).
12. Pershina T.A., Kalenteva N.A. Features reproductive management of emergency and dilapidated housing stock from the standpoint of system and process approaches in order to improve the comfort of living of the population of the city. Fundamental research. 2016; 5(3):611-615. EDN WBCXZV (rus.).
13. Grabovyy P.G., Volgin V.V., Kushchenko I.V., Sezemin D.E., Tkachenko V.B. Technology of organizing territorial-spatial renewal of urban real estate, concentration and specialization of industrial production : monograph / ed. P.G. Grabovyy. Moscow, Publishing house "Prosvetitel", 2024; 290. EDN MIWUJI (rus.).
14. Marintsev L.S. Principles of integration of Russia's "New regions". Aspects of territorial planning. Real estate: economics, management. 2024; S4:15-20. EDN LWMOCP (rus.).

Организационные формы обновления структуры управления кластер-территориями городской недвижимости в Донбассе

В статье поднимаются вопросы обеспечения устойчивого развития урбанизированных приграничных территорий Донбасса, а также основные проблемы, стоящие на пути достижения восстановления воспроизводства в жилищной сфере. Рассматриваются особенности управления восстановительными процессами пространственно-ресурсного девелопмента жилого фонда в новых регионах. Отдельное внимание уделяется обоснованию классификационных признаков организационно-экономического механизма обновления с учетом вариантов территориальных кластер-портфелей недвижимости. В качестве примера для рассмотрения выбрана городская застройка исторического центра Мариуполя. Проведен подробный анализ факторов жизнестойкости и жизнеобеспечения городской недвижимости, подходов к формированию адаптационных механизмов для выполнения ремонтно-восстановительных работ. Выделены такие функциональные направления, как регулирование инвестиционно-инновационного потенциала; внесение изменений социально-экономического, экологического и информационного характера; проектное и сценарное моделирование; анализ устой-

чивости решений пространственно-ресурсного девелопмента и ревитализации жилищного фонда, а также обновления городской среды. Сформирована структурная модель пространственно-ресурсного девелопмента жилого фонда в г. Мариуполь, что позволит улучшить инвестиционную привлекательность и обеспечит гибкое планирование ремонтно-восстановительных работ.

Ключевые слова: *устойчивое развитие, организационные формы управления, кластер-территории, городская недвижимость, ревитализация, восстановление воспроизводства жилья*

СПИСОК ИСТОЧНИКОВ

1. Kushchenko I.V., Volgin V.V. Spatial and resource development in creating a quality framework for the urban environment of the Donetsk People's Republic // Real estate: Economics, Management. 2023. No. 4. Pp. 6–13. DOI: 10.22337/2073-8412-2023-4-6-12. EDN LGBPWK.
2. Kushchenko I.V., Grabovyy P.G. Cluster model of construction and economic development in the conditions of urban housing stock restoration in DPR // Real estate: Economics, Management. 2024. No. 1. Pp. 6–13. EDN ALHQOQ.
3. Grabovyy P.G., Kushchenko I.V. Investment and innovation potential of ensuring the viability of the construction business in new regions // E3S Web of Conferences 535. 2024. No. 02019. 9 p. DOI: 10.1051/e3sconf/202453502019
4. Перов В.А. Капитальный ремонт и модернизация в системе воспроизводства объектов жилищного фонда // Проблемы современной экономики. 2010. № 1 (33). С. 351–353. EDN MUPUBV.
5. Ларин С.Н. Современный инструментарий моделирования и оптимизации программ воспроизводства жилищного фонда // Аудит и финансовый анализ. 2011. № 5. С. 347–359. EDN OHEVVH .
6. Кузнецов П.А., Колотилов Ю.В., Лим В.Г. Информационно-вычислительные технологии в организационно-технологическом проектировании. М. : Энергоатомиздат, 2002. 450 с. EDN YOBFXK.
7. Ткаченко В.Б., Гришин В.Н. Основные принципы строительно-восстановительных работ в чрезвычайных ситуациях // Недвижимость: экономика, управление. 2023. № 2. С. 65–69. DOI: 10.22337/2073-8412-2023-2-65-69
8. Васильева О.Т. Воспроизводственные процессы как основа стратегического развития жилищной сферы // Интеллект, инновации, инвестиции. 2013. № 3. С. 10–14. EDN RDUIFL.
9. Малова Н.Ю., Калустян Я.В., Михалева Е.В. Программные подходы к воспроизводству и восстановлению жилых объектов Донецкой Народной Республики // Экономика строительства и городского хозяйства. 2020. № 16 (4). С. 245–257. EDN WYQQCB.
10. Вагин В.С., Шеина С.Г., Чубарова К.В. Принципы и факторы устойчивого развития городских территорий // Интернет-журнал «Науковедение». 2015. № 7 (3–28). С. 9. DOI: 10.15862/91EVN315. EDN UMFVUL.
11. Каганова И.О. Реконструкция жилой застройки в культурно-исторических центрах городов: опыт и проблемы // Гуманитарные научные исследования. 2014. № 12–2 (40) С. 103–106. EDN TFMBEX.
12. Першина Т.А., Калентьева Н.А. Особенности управления воспроизводством аварийного и ветхого жилищного фонда с позиций системного и процессного подходов в целях повышения комфортности проживания населения города // Фундаментальные исследования. 2016. № 5 (3). С. 611–615. EDN WBCXZV.
13. Грабовый П.Г., Волгин В.В., Кущенко И.В., Сезёмин Д.Е., Ткаченко В.Б. Технология организации территориально-пространственного обновления городской недвижимости, концентрации и специализации промышленного производства : монография / под ред. П.Г. Грабового. М. : Изд-во «Просветитель», 2024. 290 с. EDN MIWUJI.
14. Маринцев Л.С. Принципы интеграции «новых регионов» России. Аспекты территориального планирования // Недвижимость: экономика, управление. 2024. № S4. С. 15–20. EDN LWMOCP.

Об авторах: **Грабовый Петр Григорьевич** — доктор экономических наук, профессор, заведующий кафедрой организации строительства и управления недвижимостью; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; РИНЦ ID: 302471, Scopus: 57164862700, ResearcherID: AAE-7942-2022, ORCID: 0000-0002-8696-3718; GrabovyiyPG@gic.mgsu.ru;

Кущенко Игорь Владимирович — кандидат технических наук, и.о. ректора; **Приазовский государственный технический университет (ПГТУ)**; 287642, Донецкая Народная Республика, г. Мариуполь, ул. Университетская, д. 7; ORCID: 0000-0002-3338-6793; kigorvlad@yandex.ru.

For citation: Grabovyy P.G., Kushchenko I.V. Organizational forms of updating the management structure of urban real estate cluster territories in Donbass. *Real Estate: Economics, Management.* 2025; 3:6-11.

Для цитирования: *Грабовый П.Г., Кущенко И.В.* Organizational forms of updating the management structure of urban real estate cluster territories in Donbass // Недвижимость: экономика, управление. 2025. № 3. С. 6–11.

UDC 332.832.4

Ovsiannikova T.Yu.
Prokopenko Ya.Yu.

Research of marginality of housing investment

The objective of this paper is to study the marginality of investment projects implemented by developers in the housing investment market. The paper claims that currently there is no unified understanding of such category as "marginality of housing investments" in economic theory and practice. Analyzing the etymology of the term, the authors give their own understanding of the essence of this category in relation to the housing investment market. It is shown that differences in quantitative estimates of projects' marginality in the housing investment market carried out in the framework of different studies indicate lack of a unified approach and necessity to form a common methodological framework for calculating and planning marginality of housing investments. Based on statistical analysis, it is shown that in the situation of transition to new conditions of financing housing construction, the housing investment market has not become less attractive for developers, which indicates that housing investments are still highly marginal.

Keywords: *marginality, housing investments, housing construction, developer, project feasibility*



Ovsiannikova Tatiana Yurievna,
Doctor of Economic Sciences, Professor, Head of the Department of Expertise and Real Estate Management; Tomsk State University of Architecture and Building (TSUAB); 2 2 Solyanaya Sq., Tomsk, 634003, Russian Federation; ID RSCI: 504255, Scopus AuthorID: 57200290377, WoS ResearcherID: E-6457-2016, ORCID: 0000-0002-0771-7114; tatovs@mail.ru



Prokopenko Yana Yurievna,
Master of Civil Engineering, Assistant of the Department of Expertise and Real Estate Management; Tomsk State University of Architecture and Building (TSUAB); 2 2 Solyanaya Sq., Tomsk, 634003, Russian Federation; ID RSCI: 1221285; yana-prokopenko@internet.ru

INTRODUCTION

Fully agreeing with V.Z. Balikoev that "accurate unambiguously understood scientific terminology is a sign of a well-developed scientific theory, its methodology and paradigm" [1], the authors of this paper have focused their research on one of the most debated categories of modern economics — marginality. Lack of a common understanding of such an important economic category as margin, presence of a multi-meaning interpretation of its derivatives (marginal income, marginal profit) signals the need and urgency of scientific research in this area. The objective of this paper is to study the concept of housing investments marginality and the factors influencing the marginality of investment projects implemented by dealers in the housing investment market.

The issues of investment efficiency in housing construction have traditionally attracted the attention of researchers and practitioners. The issues of assessing the efficiency and profitability of investment projects in housing construction remain a highly topical issue of modern scientific discussions, one of the key issues that requires the attention of the scientific community being the management of the margin of housing investment market development projects.

The modern understanding of marginality was formed as a result of a long historical process. First ideas about the nature of price and value appeared in antiquity, but the full development of the concept of marginality occurred only at the end of the 19th century. Scientific research devoted to marginalism (which is a neoclassical theory of economic processes based on marginal quantities (marginal utility) in which demand and prices are determined by subjective marginal estimates of the usefulness of products[1]), introduced definitions of equilibrium price values and output rate under various market structures, as well as the concepts of total and marginal revenue and costs into terminology. Subsequently, this theory became the basis of the methodology of the modern neoclassical trend of economic theory, introducing mathematical methods into economics.

Later, in the 20th century, scientists expanded their understanding of marginality linking it to issues of pricing, production planning, and cost management. However, theoretical categories are often assigned different meanings depending on the subject under analysis, and these meanings may not coincide with meanings used in practice. According to V.Z. Balikoev, the concepts of margin and marginality in economic theory and Russian applied economics may have different meanings due to etymological confusion [2]. In economic theory, marginal income is understood as additional income generated by an additional unit of sold goods. That being said, the concepts of margin, marginal income and marginal profit have also been utilized in the theory and practice of management accounting called direct-costing and are used in the marginal analysis of companies' activities in order to manage costs. Within the framework of this approach, marginal income is understood as the difference between revenue from the sale of products or services and variable production costs [3, 4].

This category has found its place in the theory and practice of cost management in the investment and construction sector [5, 6]. Modern understanding of marginality in the field of housing investments is associated with the development of the construction business and mortgage loan activity. The margin income indicator is often used as an indicator of investment efficiency. In practice, developers define marginal income as the difference between the income from the sale of apartments and construction costs (self-cost) throughout the life cycle of the project [7].

Effective management of the revenue-cost ratio is a key factor for a successful business development. When implementing projects, it is necessary

[1] Marginalism. The Great Russian Encyclopedia. URL: https://bigenc.ru/c/marzhinalizm-f93054 (rus.).

to constantly monitor cost structure and marginality in order to avoid reducing the profitability of the enterprise and ensure its financial stability. This, in its turn, requires to study the factors influencing marginality of investment projects and assess their impact on the final results of development activities.

DISCUSSION

According to the authors of this paper, the concept of marginality in the housing investment market ($M_{H.I.}$) can be viewed from two perspectives:

1. Marginality of a development project which is the ultimate profitability of development companies expressed by the ratio of the difference between revenue from sold construction products and total investment costs in housing construction to the sum of all investment costs for implementation of a development project:

$$M_{H.I.} = \frac{\text{Revenue from housing sales} - \text{Housing Investment}}{\text{Housing Investment}}.$$

2. Marginality of housing investments which is the total return on the activities of all subjects of the investment process expressed by the ratio of the difference between the total revenue from construction products and total operating costs for housing construction to the amount of investment costs for implementation of a development project:

$$M_{H.I.} = \frac{\text{Total revenue from contractors sales} - \text{Total contractors operating costs}}{\text{Housing Investment}}.$$

The first approach is based on profitability of a development company implementing projects in the housing investment market, the second approach is based on performance of all participants in housing construction and, in fact, overall marginality of housing investments. The latter approach takes into account the fact that the marginality of investment projects takes place at all stages of development project implementation starting from investment concept development, acquisition of land rights, completion of surveys and development of project documentation and ending with the sale of finished construction products (completed housing). Therefore, the total income from housing investments will be made up of the total expenses of all its participants including total operating costs. In case an investment project in the housing market is implemented by a large development company with vertical integration of all production processes also incorporating all main functions for making investments in the housing market, these two concepts become nearly identical and quantitatively almost equivalent.

DATA

Estimated marginality of investment projects is the main criterion for making an investment decision on implementation of developer's plan. Actual marginality of the project is a prerequisite for successful, effective functioning of the company in the real estate market. It often happens, that erroneous approaches to evaluation of the estimated marginality resulting from overestimating potential gross income from a project or underestimating potential gross costs of its implementation lead to a gap between the expected and actual marginality of the project. This leads to a decrease in financial stability of the developer, and often puts it on the verge of bankruptcy.

The level of housing investments marginality can vary significantly depending on the general economic situation and project implementation conditions. According to the study (SNL Financial, MPF Research)[2], margin of development projects in residential real estate market is quite high and takes the second place after the margin of commercial real estate projects, surpassing projects in the office or industrial real estate market. However, quantitative estimates of marginality vary significantly. For instance, according to the data given in the study[3] average rate of return in residential real estate is usually between 15 and 30 %. However, market research firm IBISWorld highlights an average industry profit margin at about 6 to 9 % and according to the National Association of Home Builders (NAHB) the average net profit margin for residential developers in recent years has ranged from 9 to 15 %. Such differences on the margin level of housing investments indicate the complexity of quantifying profitability of activities in the housing investment market and the need to develop a unified methodological approach for assessing and planning marginality of housing investments.

In Russia, the margin level in the construction business traditionally ranged from 12 to 18 %, which allowed developers to have certain financial backup in case of market instability and rising construction costs[4]. However, with the introduction of escrow accounts and stricter rules for attracting funding, developers have encountered increased costs, which directly affects their marginality. An increase in debt combined with the transition to project-tied lending reduces overall margin level for many developers and creates risks for projects' sustainability.

In 2019, prior to the transition to a new financing mechanism using escrow accounts, the current head of the Russian Ministry of Construction, V. Yakushev, stated that developers would receive project financing in case their margin between construction costs and sale revenues is at least 20 %[5] [10]. The experts' opinions on these ideas were mixed. Most of them agreed that not all developers are able to ensure this level of marginality for their projects, as it varies from 10 to 20 % and depends on a large number of factors.

Analysis of statistical data presented in the Unified Information System of Housing Construction NASH.DOM.RF u[6] shows that the period of steep decline in housing construction in 2020–2021 caused by adaptation of developers to the new project financing mechanism with escrow accounts, was replaced by a period of steady growth (Figure). Even changes in the macroeconomic situation, an increase in the cost of credit resources, and abolition of preferential mortgages in Russia as a whole did not lead to a decrease in the volume of multi-apartment residential housing construction.

After banks introduced stricter requirements for developers, it created certain difficulties in construction companies work and created some obstacles for new players to enter the market. Indeed, in 2020, there was a 10.9 % decrease in the number of developers

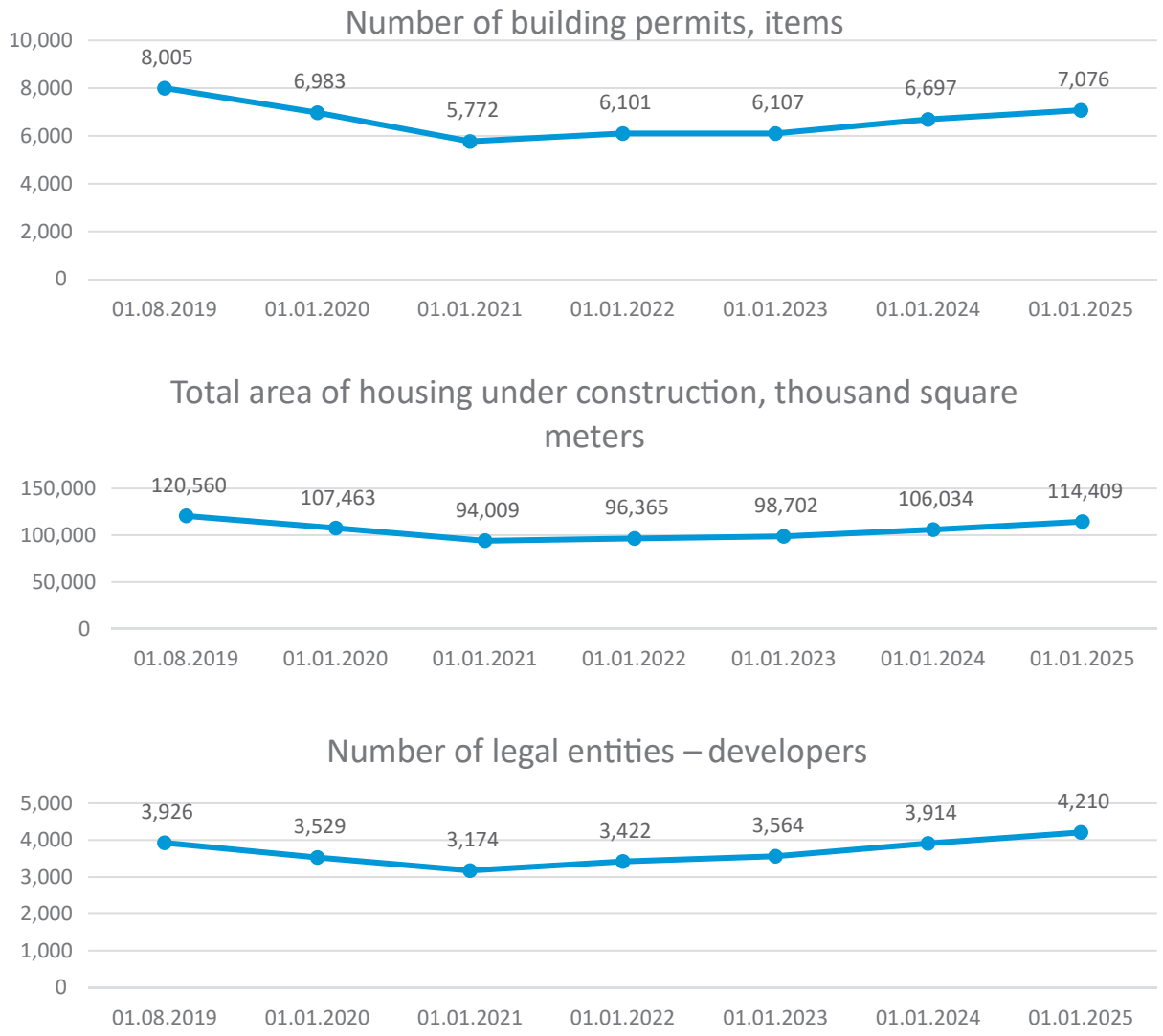
[2] Cited by An Inside View on Real Estate Profit Margins. URL: https://www.realpage.com/blog/an-inside-view-on-real-estate-profit-margins

[3] Sheykin H. How to Enhance Profitability in Residential Projects? *Finmodelslab*. August 6, 2025. URL: https://finmodelslab.com/blogs/profitability/residential-development

[4] Velesevich S. Developers's margin: how much do developers earn on housing sales. *RBC-Real Estate*. URL: https://realty.rbc.ru/news/5d6f8ad99a79476b1e5c6c17 (rus.).

[5] Burkovskaya N., Vermishev G. That's the margin. What determines developers' profitability? *Business Petersburg*. October 23, 2019. URL: https://www.dp.ru/a/2019/10/22/Vot_takaja_marzha (rus.).

[6] Shared-equity housing construction, including those with escrow accounts project financing. Unified Housing Information System NASH.DOM.RF. URL: https://наш.дом.рф/аналитика/долевое_строительство (rus.).



Main indicators of multi-apartment residential housing construction in the Russian Federation (compiled by the authors according to the data of NASH.DOM.RF)[3]

compared to 2019 (Table). However, banks' consistent funding of projects, which does not depend on sales, counter-balanced the costs incurred by the transition to a new financial mechanism. As of the end of 2023, according to the data from NASH.DOM.RF[7], the number of developers increased by 19.2 % compared to 2020. Despite the fact that 2025 was predicted to be a critical year for the construction industry as apartment sales had dropped significantly due to the abolition of preferential housing and some experts expected a massive bankruptcy of developers[4, 8], 139 new developers appeared on the housing construction market in the period between January – August 2025. While in 2019 a large housing construction market developer had a market share of 6.5–7 % of the total area under construction, in 2025 the biggest companies in residential real estate construction have a market share of not more than 3.5–4.5 % of the housing construction area. The majority of companies in the market share by housing area are those with a market share of up to 0.5 % of the total housing construction volume. These facts give evidence of positive changes in the structure of the housing construction market which is inherently oligopolistic and characterized by a large-scale localization of participants.

Based on the assessment of business activity conducted by DOM.RF[9], construction developers do not have any difficulties with availability of contractors. Only 6 % of developers mentioned deterioration in the level of competition in April 2025 compared to the previous year. However, competition still causes developers to lower marginality, especially in regions with low demand.

Despite the fact that overall situation is assessed by developers to be worse than the previous year, the arrival of new players to the market indicates the continued investment attractiveness of the housing investment market, even if there are other considerably attractive alternative investment instruments, for example, in the financial market. Consequently, the marginality of housing investments

[7] Will developer bankruptcy become a trend in 2025. Unified Resource of Developers. February 20, 2025. URL: https://erzrf.ru/news/stanet-li-bankrotstvo-zastroyshchikov-trendom-v-2025-godu ; Experts: there is a risk of bankruptcy in the housing industry, but primarily among small developers. Unified Resource for Developers. August 28, 2025. URL: https://erzrf.ru/news/eksperty-risk-bankrotstv-v-zhilishchnoy-otrasli-yest-no-prezhde-vsego-u-nebolshikh-zastroyshchikov (rus.)

[8] Trubiolina M. The number of bankrupt developers may increase by 2026. *Rossiyskaya Gazeta*. February 4, 2025. URL: https://rg.ru/2025/02/04/nanesli-riski.html (rus.).

[9] Assessment of business activity of developers in April 2025. DOM.RF. URL: https://дом.рф/upload/documents/20250203-otsenka-delovoy-aktivnosti-zastroyshchikov-aprel-2025-komplekt-at.pdf (rus.).

Quantity of developers with their market share by housing construction area between 2019 and August 31, 2025, in numbers (calculated and compiled by the authors according to data from NASH.DOM.RF[4])

	2019	2020	2021	2022	2023	2024	31.08.2025
Quantity of developers, total items	2,440	2,175	2,208	2,379	2,591	2,593	2,732
Market share by total area ≤ 0.5 %, items	2,416	2,150	2,187	2,354	2,566	2,570	2,708
Market share by total area 0.5–1.0 %, items	16	16	11	17	17	12	13
Market share by total area 1–1.5 %, items	5	6	5	3	3	5	7
Market share by total area 1.5–2.0 %, items	–	–	2	2	2	4	2
Market share by total area 2–2.5 %, items	–	1	1	–	1	–	–
Market share by total area 2.5–3.0 %, items	1	1	1	2	–	–	–
Market share by total area 3–3.5 %, items	1	–	–	–	–	1	–
Market share by total area 3.5–4.0 %, items	–	–	–	–	–		1
Market share by total area 4–4.5 %, items	–	–	–	–	1	1	1
Market share by total area 4.5–5.0 %, items	–	–	–		1	–	–
Market share by total area 5.5–6.0 %, items	–	–	1	1	–	–	–
Market share by total area 6–6.5 %, items	–	1	–		–	–	–
Market share by total area 6,5–7,0 %, items	1	–	–	–	–	–	–

remains at a fairly high level. In spite of all mentioned above, quantifying profitability of housing investments presents a certain methodological problem and requires additional research.

CONCLUSION

Attractiveness of any sphere of economy for economic agents is determined by the potential profitability that an economic entity can receive as a result of its activities. According to the authors, this profitability can be characterized by a category called marginality. However, currently there is no unified understanding of the essence of this category in economic theory and practice. This article offers the authors' approaches to understanding profitability of housing investments based on the specifics of this market. Conducted statistical analysis shows that despite the transition to project-tied lending and the increase in the cost of loaned financial resources, the main indicators of the housing construction market functioning, after a slight decrease, demonstrate upward trends, the volume of housing construction is growing, new players are entering the market. The housing investment market has not become less attractive for developers, which indicates that a high level of marginality of housing investments has been maintained.

At the same time, it is shown that differences in quantitative estimates of housing investment market projects' marginality conducted in the framework of various studies indicate lack of a unified approach and necessity to form a common methodological framework for calculating and planning marginality of housing investments.

REFERENCES

1. Balikoev V.Z. In Scientific Research Should Be Used Scientific Terminology. Tomsk State University Journal of Economy. 2019; 45:6-18. DOI: 10.17223/19988648/45/1. EDN ZDNUZF (rus.).
2. Balikoev V.Z. Terminology stubs of economic sciences. Siberian Financial School. 2016; 1(114):3-11. EDN VOTMDF (rus.).
3. Khodorovski M.Ya., Zubkova O.V. The systemic contradiction between maximizing margin income and minimizing operational risk. Economic analysis: theory and practice. 2010; 23(188):16-22. EDN MSTQFT (rus.).
4. Averina T.N. Terminological paradox of marginal income. Philosophy of economy. 2024; 5:132-144. DOI: 10.5281/zenodo.13920263. EDN YDHPDD. (rus.).
5. Filatov E.A., Merkulov A.S. A forecast model of break-even funding investment in innovation in the production activity of construction companies. Financial research. 2016; 1(50):117-127. EDN WBCWQL (rus.).
6. Vladimirova I.L., Tsygankova A.A., Kosareva Yu.Yu. Transforming housing construction: project cost management challenges. Real estate: economics, management. 2021; 1:14-19. EDN LXVCJA (rus.).
7. Bekker T.A., Buzina M.V., Tupikova O.A. Approach to assessing the effectiveness of investment project for the construction of apartment buildings. Bulletin of Baikal State University. 2022; 32(3): 543-549. DOI: 10.17150/2500-2759.2022.32(3).543-549. EDN POGGHY (rus.).

Исследование маржинальности жилищных инвестиций

Целью данной работы является исследование маржинальности инвестиционных проектов, реализуемых девелоперами на рынке жилищных инвестиций. В статье показано, что в настоящее время в экономической теории и практике отсутствует единое понимание категории «маржинальность жилищных инвестиций». Исследуя этимологию термина, авторы дают свое понимание сущности этой категории применительно к рынку жилищных инвестиций. Показано, что различия в количественных оценках уровня маржинальности проектов на рынке жилищных инвестиций, выполняемые в рамках разных исследований, свидетельствуют об отсутствии единого подхода и необходимости формирования общей методической базы для расчета и планирования маржинальности жилищных инвестиций. На основе статистического анализа показано, что с переходом к новым условиям финансирования жилищного строительства рынок жилищных инвестиций не стал менее привлекательным для девелоперов, что свидетельствует о сохранении высокого уровня маржинальности жилищных инвестиций.

Ключевые слова: *маржинальность, жилищные инвестиции, жилищное строительство, девелопер, доходность проекта*

СПИСОК ИСТОЧНИКОВ

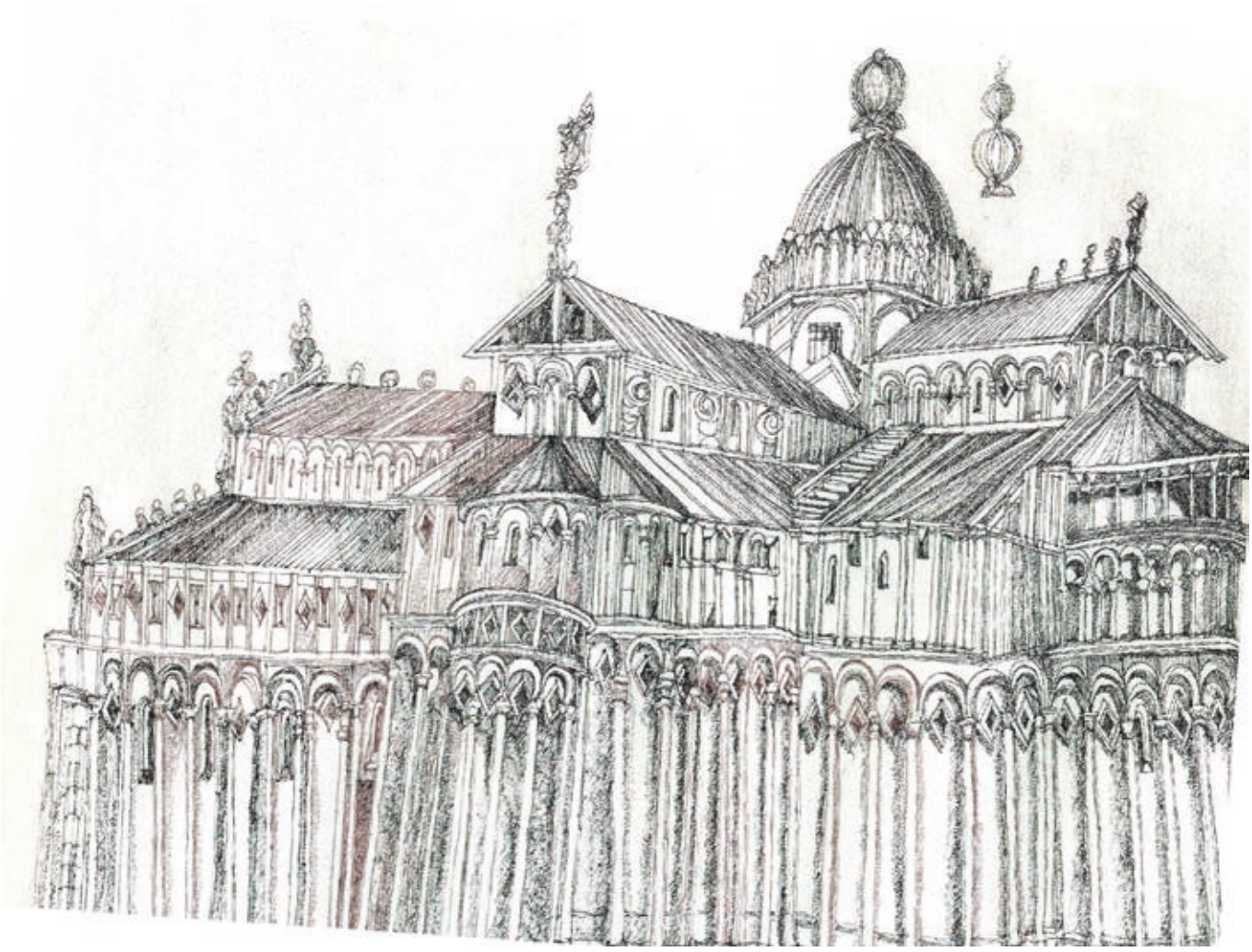
1. Баликоев В.З. В научном исследовании должна использоваться научная терминология // Вестник Томского государственного университета. Экономика. 2019. № 45. С. 6–18. DOI: 10.17223/19988648/45/1. EDN ZDNUZF.
2. Баликоев В.З. Терминологические тупики экономических наук // Сибирская финансовая школа. 2016. № 1 (114). С. 3–11. EDN VOTMDF.
3. Ходоровский М.Я., Зубкова О.В. Системное противоречие между максимизацией маржинального дохода и минимизацией операционного риска // Экономический анализ: теория и практика. 2010. № 23 (188). С. 16–22. EDN MSTQFT.
4. Аверина Т.Н. Терминологический парадокс маржинального дохода // Философия хозяйства. 2024. № 5. С. 132–144. DOI: 10.5281/zenodo.13920263. EDN YDHPDD.
5. Филатов Е.А., Меркулов А.С. Прогнозная модель безубыточности с учетом инвестиций в инновации производственной деятельности строительных компаний // Финансовые исследования. 2016. № 1 (50). С. 117–127. EDN WBCWQL.
6. Владимирова И.Л., Цыганкова А.А., Косарева Ю.Ю. Transforming housing construction: project cost management challenges // Недвижимость: экономика, управление. 2021. № 1. С. 14–19. EDN LXVCJA.
7. Беккер Т.А., Бузина М.В., Тупикова О.А. Подход к оценке эффективности инвестиционных проектов строительства многоквартирных жилых домов // Известия Байкальского государственного университета. 2022. № 32 (3). С. 543–549. DOI: 10.17150/2500-2759.2022.32(3).543-549. EDN POGGHY.

Об авторах: **Овсянникова Татьяна Юрьевна** — доктор экономических наук, профессор, заведующая кафедрой экспертизы и управления недвижимостью; **Томский государственный архитектурно-строительный университет (ТГАСУ)**; 634003, г. Томск, Соляная пл., д. 2, стр. 2; РИНЦ ID: 504255, Scopus AuthorID: 57200290377, WoS ResearcherID: E-6457-2016, ORCID: 0000-0002-0771-7114; tatovs@mail.ru;

Прокопенко Яна Юрьевна — магистр строительства, ассистент кафедры экспертизы и управления недвижимостью; **Томский государственный архитектурно-строительный университет (ТГАСУ)**; 634003, г. Томск, Соляная пл., д. 2, стр. 2; РИНЦ ID: 1221285; yana-prokopenko@internet.ru.

For citation: Ovsiannikova T.Yu., Prokopenko Ya.Yu. Research of marginality of housing investment. *Real Estate: Economics, Management*. 2025; 3:12-16.

Для цитирования: *Овсянникова Т.Ю., Прокопенко Я.Ю.* Research of marginality of housing investment // Недвижимость: экономика, управление. 2025. № 3. С. 12–16.



Пиза. Дворец (автор иллюстрации – Павлова Лия Иосифовна)

UDC 693.98

Chubarkina I.Yu.

Analysis of the effectiveness of modular construction in Russia, taking into account foreign experience

At the beginning of the twentieth century, the society faced the need for high-quality and fast construction of housing, which led to the emergence and spread of modular construction. Modular construction is an alternative method for the implementation of capital construction, while the optimization of financial and labour costs, as well as the reduction of installation time frames are achieved precisely through the use of structural elements that are standardized. It can also be noted that at the moment, domestic practice needs to adapt foreign experience, using their recommendations when arranging the technological part of these structures. Analysis of domestic sources shows that for the development of modular construction, the support provided by the state is of particular importance, allowing the creation of new and development of existing regulatory and technical documentation that can cover various methods and materials for modular construction. That is, this direction actualizes the need to improve the current regulatory framework. Correct, full-fledged use of modular construction technology at the present stage of its formation requires regulatory technical documents. Turning to the research of international experience in the segment of modular construction, it can be noted that, for example, Great Britain has extensive experience in the field of construction of modular multi-storey buildings, aimed at expanding the volume of construction for citizens who are socially vulnerable. Despite the presence of positive trends, there are also factors that have a negative impact on the use of modular technologies. The main difficulty is the lack of the required regulatory framework, highly qualified specialists. There is also a lack of support from the state. These difficulties are not the only ones. Modular construction technology is being introduced slowly, while the creation of regulatory technical documentation would increase the speed of this process.

Keywords: *modular construction, foreign experience, block modules, modular technologies, construction*



Chubarkina Irina Yuryevna,
Candidate of economic sciences, Associate Professor of department of construction organization and real estate management; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; ID RSCI: 791667, Scopus AuthorID: 57194448794, WoS ResearcherID: AAC-1685-2022, ORCID: 0000-0002-6969-6187; ChubarkinaIY@mgsu.ru

In the modern world, modular construction has become widespread due to the ease of assembly and optimal construction times. At the moment, modular structures are used not only in housing construction, but are also actively developing in the energy sector, as well as the oil and gas industry [1].

The most common are mobile (temporary) buildings, structures with block containers with easy, quick assembly using standard tools, thanks to which it becomes possible to quickly erect utility towns, temporary warehouses and other structures.

If we pay attention to domestic experience, we can note that in the USSR, there was the use of volumetric block housing construction, which acted as a promising method for ensuring high construction speed. In the Krasnodar Territory, today there is a plant "OBD", founded in 1974 for the production of volumetric-block reinforced concrete elements for the construction of residential buildings[1] (Fig. 1, 2).

The production facility produces more than 50 modular units daily, each measuring 3.4×2.5×6.0 meters and providing 19.6 square meters of functional space. The production line allows for high construction rates — for example, since 2005, the construction of a 16-story apartment building has taken just over 30 days[2].

These modular units, thanks to their flexibility, are used in a variety of applications: from boiler equipment, water treatment facilities, and gas stations to reservoirs and substations [2]. Companies that occupy leading positions in the segment offer comprehensive turnkey services for the creation and installation of complex engineering systems, covering the entire cycle — from initial design based on individual customer requirements to assembly, transportation, and work on site. Both standard and more complex modular components often include elements such as reinforced concrete panels, chimneys, facade panels and metal structures with ready-made finishing, as well as utilities, which significantly speeds up the construction process [3]. International experience also shows that modular buildings are being introduced more and more widely, especially in housing and public construction, while outpacing domestic examples. In Japan and the United States, the construction of compact housing is widespread, and capsule hotels, providing a secluded and comfortable space for relaxation, have already become part of the urban environment of many megacities, including Moscow, where such a hotel was opened at Sheremetyevo Airport in 2009 [4] (Fig. 3). Also worth noting is the Sleepbox Hotel Tverskaya, an innovative hotel for Russia, opened in 2013. It consists of modular rooms, and the interior of the hotel itself is 56 mobile capsules. The data is presented in two types — in the form of double and single rooms [5] (Fig. 4).

An interesting example of the use of modular technology is a five-star hotel in Huan, located on the shore of Lake Dongting (Fig. 5) with 30 floors and 17 thousand square meters. The construction period is 15 days. The implementation of this project involved 200 builders and 1 tower crane [6].

[1] The trend of construction of modular buildings in the world. Article in the journal "Young scientist". URL: https://moluch.ru/archive/469/103417/ (Accessed 08/22/2025).

[2] Modern modular construction. URL: https://elar.urfu.ru/bitstream/10995/66309/1/978-5-8057-1012-5-2018-11.pdf (Accessed 08/22/2025).

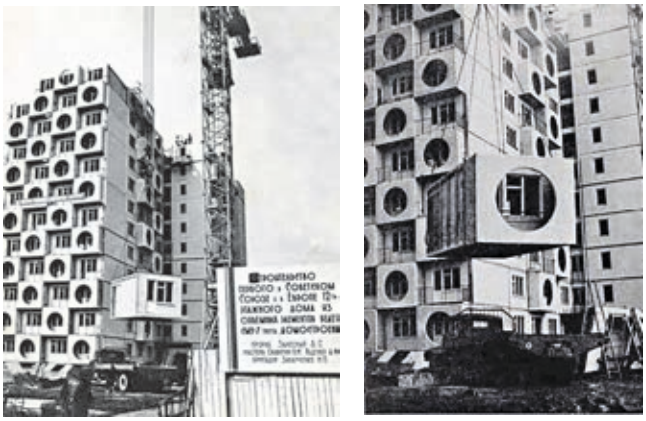


Fig. 1. The first 12-storey residential building of the BKR-2 series in the USSR and Europe. Krasnodar, Gidrostroiteley microdistrict, 1977



Fig. 2. Typical series of house BKR-2



Fig. 3. Capsule hotel at Sheremetyevo airport



Fig. 4. Sleepbox Hotel Tverskaya capsule hotel made of modular rooms — "sleepboxes"



Fig. 5. T30 Hotel in China, BROAD Group

The project was developed and implemented by BSB (Broad Sustainable Building).

The plant performed work related to the installation of communications, grooves and pins were provided to simplify the assembly process with an error of up to 2 mm, which indicated that there was no need for additional measurements or adjustments. During the construction of the building, the builders felt the need to connect the finished, fitted parts with the subsequent installation of floor slabs in place of the walls, extending electrical networks and other communications. These actions created the foundation of the building. In accordance with the installation of load-bearing structures, stairs and external walls were installed, the thickness of which was 15 cm. The technology for external wall finishing was simplified as much as possible. It was also prefabricated: fastenings on load-bearing columns for heating structures, insulation, etc. [7].

Modular units in this case are individual frame elements that were manufactured at the plant, not requiring additional actions for their installation at the corresponding construction site[3]. When analyzing different implementation principles, it becomes obvious that a volumetric element that is fully factory-ready, where there is a geometrically unchangeable metal frame, is common in other countries [8]. It is used directly in individual housing construction, construction of public medical buildings, and other public buildings with repetitive planning solutions (hotels, educational, childcare facilities, etc.).

The financial advantages of working with this technology are already quite obvious at the stage of preparation for the implementation of the project, but still the main trump card of this method of building construction is time optimization and a faster return on investment. The modular structure is created and assembled in an industrial format with parallel preparation of the site, which means that often by the time the parts of the object are manufactured, the site is already completely ready for their installation.

For example, a modular hotel can receive its first guests and begin to return the initial investment by 30–50 % earlier than a hotel built in the classical way [9]. This is due to the fact that such buildings can be erected without a foundation on a pre-prepared base. An undeniable advantage of the technology in terms of the need to carry out work quickly and in a complex location is the lack of need to use large construction equipment. Any labour-intensive processes in this case are minimized or completely absent.

In the context of the feasibility of choosing a development project implemented using modular technology, such a parameter as space limitations is often of significant importance. Therefore, a modular design is a universal solution not only when developing territories outside cities, but also in the case of dense development. Thus, in ancient European cities, sites are often limited by roads and dense development[4]. Also, the classic format of work is associated with the constant delivery of materials and workers over a long period of time, which can significantly increase the cost of the project. And in the case of prefabricated buildings, significantly fewer personnel, equipment and time are required to implement the work.

Thus, working with modular structures helps to make an investment and construction project less dependent on market conditions, which is extremely important in a complex and unpredictable economic environment. The parameters of the object are much easier to adjust after the creation of the basic infrastructure. Given that market demand may fluctuate during the development cycle, the modular design potentially simplifies the implementation of complexes without large cash outlays. The advantages of modular construction are presented in Table 1, and the disadvantages are discussed in Table 2.

Optimizing the process not only reduces the time required to complete a project, but also reduces costs. Minimizing the crew, delays, and materials during the design and construction of a building means that choosing a modular design can reduce costs by up to 20 % [10].

The transition to modular construction opens a new path to sustainable development and ecology, because this technology allows to significantly reduce the amount of waste traditionally generated during construction. The controlled and concentrated nature of the production of modules actually slows down the pollution of nature, preventing the spread of harmful substances into the environment.

[3] Materials_Practice_Guide_Modular_Construction_ru.pdf. URL: https://steel-development.ru/images/projects/downloads/Materials_Practice_Guide_Modular_Construction_ru.pdf (Date accessed: 08.22.2025).

[4] BROAD Garden A1 — Modular Building Institute. URL: https://www.modular.org/awards-broad-garden-a1/ (Accessed 22.08.2025).

Table 1. Advantages of modular construction

Advantages	Construction and installation take a minimum of time
	Savings compared to any traditional technologies. Less time to build a house helps reduce costs
	The production of modules is carried out in indoor workshops, so it does not depend on the weather. After the completion of the work, there is no need to remove construction waste from the site
	Reliable insulation circuit (since modular houses do not have bay windows and other complex architectural details, as well as curved surfaces)
	No strong foundation required
	Modular construction is also possible on sites with complex terrain
	There is no need to worry about the building settling, so finishing can begin immediately after installation is completed

Shifting the main work to closed and controlled conditions significantly reduces the likelihood of industrial injuries among workers and minimizes the public risk associated with the fall of building materials and the release of harmful fumes, increasing safety at the construction site.

However, modular construction is not without its drawbacks that cannot be ignored. One of the key disadvantages is the size restrictions of the modules, due to the difficulties of their transportation, which can become a critical problem under certain conditions.

Table 2. Disadvantages of modular construction

Flaws	Limited maximum height
	The range of available solutions in terms of architecture and planning is very limited
	There may be problems with the delivery of blocks to the site
	High cost of transporting blocks and modules
	It is necessary to equip effective supply and exhaust ventilation
	Manufacturers indicate the service life of a modular building at 50–70 years, which has not yet been confirmed by time

In addition, there is a certain concern about the quality of modular buildings, which may affect the resale price of the property. This factor sometimes affects the perception of the long-term value of such properties in the real estate market. Financial institutions are also cautious about financing modular homes, partly because the banking system may not be fully familiar with the specifics of the modular process and the prepayment required to begin construction [11].

Another feature is that the prefabricated blocks for modular construction are standardized: they are assembled on a conveyor belt. Each manufacturing company has its own prefabricated projects of modular houses with established possible options for the layout of the blocks, i.e. the organization of the interior of the building. For this reason, it is not possible to change certain characteristics, including: the area of the house, the layout, the design (for example, changing the location of the stairs, increasing the height of the ceilings, etc.) in accordance with the wishes of the customer. Thus, analyzing the advantages and disadvantages of modular technologies, one can note their positive development trend in the modern world, but one should also take into account the need to develop measures to improve the technological procedure for implementing investment and construction projects implemented using modular technology.

REFERENCES

1. Kanunnikov D.A., Bezrodnaya A.S., Borisenkov K.S. Modular construction: cost-effectiveness and speed of construction. Youth and the 21st Century – 2025 : Collection of scientific articles of the XIV International Youth Scientific Conference. Kursk, 2025; 133-137. EDN BCEUES (rus.).
2. Semenyakov D.N. Modular construction of residential buildings. Problems and prospects of development of Russia: Youth view of the future : Collection of scientific articles of the V All-Russian scientific conference. In 4 volumes. Kursk, 2022; 504-506. EDN OYYGRU (rus.).
3. Antsiferova E.O., Lotenkova M.D. Modular construction. Modern technologies in construction. Theory and practice. 2020; 2:255-258. EDN QEJAIE (rus.).
4. Krylova K.K. Advantages of modular design. Scientific research center "Technical Innovations". 2023; 10:62-67. EDN OXUIZR (rus.).
5. Rakhmetova A.Sh. Features of the construction of modular structures. Actual scientific research in the modern world. 2021; 10-4(78):10-12. EDN DPOUGR. (rus.)
6. Ostrovnoy N., Raskazov M., Yudina I. Active implementation of the technology modular construction in the people's republic of China. Student scientific journal. 2025; 12-7(308):23-27. EDN TKPMVN.
7. Zakharova M.V., Ponomarev A.B. Experience in constructing buildings and structures using modular technology. Bulletin of the Perm National Research Polytechnic University. Construction and Architecture. 2017; 1(8):148-155. DOI: 10.15593/2224-9826/2017.1.13. EDN YLXSPN (rus.).
8. Kiyanenko K.V. Housing programs Language of the housing programs: Russia and the West. Housing construction. 2007; 11:30-31. EDN KYLLDF (rus.).
9. Lacey A.W., Chen W., Hao H., Bi K. Simplified structural behaviors of post-tensioned inter-module connection for modular buildings. Journal of Constructional Steel Research. 2020; 175:106347. DOI: 10.1016/j.jcsr.2020.106347
10. Alekseeva N.A. Modular construction cost management. Scientific discussions in the context of the global crisis: new challenges, a look into the future : Proceedings of the V international scientific and practical conference. Rostov-on-Don, 2022; 278-279. EDN CEACHC (rus.).
11. Kerefov A.M. Features of modular construction of apartment buildings. Scientific aspect. 2024; 65(5):8759-8764. EDN PUGARX (rus.).

Анализ эффективности внедрения модульного строительства в России с учетом зарубежного опыта

В начале двадцатого века в обществе появилась потребность качественного и быстрого возведения жилья, что стало причиной появления и распространения модульного строительства. Модульное строительство представляется альтернативным методом для реализации капитального строительства, при этом оптимизация финансовых и трудовых затрат, а также сокращение временных рамок монтажа достигается именно за счет применения конструктивных элементов, являющихся стандартизированными. Также можно отметить, что на данный момент отечественная практика нуждается в адаптации иностранного опыта, используя их рекомендации при устройстве технологической части данных конструкций. Анализ отечественных источников показывает, что для развития модульного строительства особое значение имеет оказываемая государством поддержка, позволяющая создавать новую и развивать существующую нормативно-техническую документацию, которая сможет охватить различные методы и материалы для модульного строительства. То есть данное направление актуализирует потребность в совершенствовании действующей нормативной базы. Корректное полноценное использование технологии модульного строительства на современном этапе своего становления нуждается в нормативных технических документах. Обратившись к исследованиям международного опыта в сегменте модульного строительства, можно отметить, что, например, у Великобритании имеется богатый опыт в сфере возведения модульных многоэтажных домов, направленный на то, чтобы расширить объемы строительства для граждан, являющихся социально уязвимыми.

Несмотря на наличие положительных тенденций, имеются и факторы, оказывающие негативное влияние на использование модульных технологий. В качестве основной трудности выступает отсутствие требуемой нормативной базы, высококвалифицированных специалистов. Также отмечается наличие нехватки поддержки от государства. Указанные трудности не являются единственными. Технология по модульному строительству внедряется медленными шагами, тогда как создание нормативной технической документации позволило бы повысить скорость указанного процесса.

Ключевые слова: *модульное строительство, зарубежный опыт, блок-модули, модульные технологии, строительство*

СПИСОК ИСТОЧНИКОВ

1. Канунников Д.А., Безродная А.С., Борисенков К.С. Модульное строительство: экономичность и скорость возведения // Молодежь и XXI век – 2025 : сб. науч. ст. XIV Междунар. молодежной науч. конф. Курск, 2025. С. 133–137. EDN BCEUES.
2. Семеняков Д.Н. Модульная конструкция жилых домов // Проблемы и перспективы развития России: Молодежный взгляд в будущее : сб. науч. ст. V Всеросс. науч. конф. Курск, 2022. С. 504–506. EDN OYYGRU.
3. Анциферова Е.О., Лотенкова М.Д. Технология модульного строительства // Современные технологии в строительстве. Теория и практика. 2020. № 2. С. 255–258. EDN QEJAIE.
4. Крылова К.К. Преимущества модульной конструкции // Научно-исследовательский центр «Technical Innovations». 2023. № 10. С. 62–67. EDN OXUIZR.
5. Рахметова А.Ш. Особенности строительства модульных сооружений // Актуальные научные исследования в современном мире. 2021. № 10–4 (78). С. 10–12. EDN DPOUGR.
6. Ostrovnoy N., Raskazov M., Yudina I. Active implementation of the technology modular construction in the people's republic of China // Научный журнал «Студенческий». 2025. № 12–7 (308). С. 23–27. EDN TKPMVN.
7. Захарова М.В., Пономарев А.Б. Опыт строительства зданий и сооружений по модульной технологии // Вестник Пермского национального исследовательского политехнического университета. Строительство и архитектура. 2017. № 8 (1). С. 148–155. DOI: 10.15593/2224-9826/2017.1.13. EDN YLXSPN.
8. Кияненко К.В. Язык жилищных программ: Россия и Запад // Жилищное строительство. 2007. № 11. С. 30–31. EDN KYLLDF.
9. Lacey A.W., Chen W., Hao H., Bi K. Simplified structural behaviours of post-tensioned inter-module connection for modular buildings // Journal of Constructional Steel Research. 2020. No. 175. P. 106347. DOI: 10.1016/j.jcsr.2020.106347
10. Алексеева Н.А. Управление затратами в модульном строительстве // Научные дискуссии в условиях мирового кризиса: новые вызовы, взгляд в будущее : мат. V Междунар. науч.-практ. конф. Ростов н/Д, 2022. С. 278–279. EDN CEACHC.
11. Керефов А.М. Особенности модульного строительства многоквартирных домов // Научный аспект. 2024. № 65 (5). С. 8759–8764. EDN PUGARX.

Об авторе: **Чубаркина Ирина Юрьевна** — кандидат экономических наук, доцент кафедры ОСУН; **Национальный исследовательский Московский государственный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; РИНЦ ID: 791667, Scopus AuthorID: 57194448794, WoS ResearcherID: AAC-1685-2022, ORCID: 0000-0002-6969-6187; ChubarkinaIY@mgsu.ru.

For citation: Chubarkina I.Yu. Analysis of the effectiveness of modular construction in Russia, taking into account foreign experience. *Real Estate: Economics, Management*. 2025; 3:17-20.

Для цитирования: *Чубаркина И.Ю.* Analysis of the effectiveness of modular construction in Russia, taking into account foreign experience // Недвижимость: экономика, управление. 2025. № 3. С. 17–20.

UDC 332.1

Tsypkin Yu.A.
Orlov S.V.

Methodology for Assessing the Integrated Development of Territories: The Integral Coefficient of CDT

This paper proposes the concept of the Coefficient of Complex Development of Territories (C CDT). This coefficient is intended to serve as a tool for the quantitative assessment of the integral efficiency of complex development of territories (CDT) projects in the conditions of a megalopolis. It reflects not only economic but also social, environmental, and urban development transformations of a specific block or land plot relative to its condition before project implementation. Particular attention is paid to the integration of the public-private partnership (PPP) factor, which accounts for the ratio of investment capital from the state and private investors, enabling a comprehensive evaluation of the synergistic effect of such interactions. The paper also thoroughly analyzes how the CDT system significantly reduces corruption barriers, eliminates legislative and administrative obstacles, and simplifies the procedure for accessing investment capital to the highly limited land resources of the megalopolis, particularly in the territory of New Moscow, where new growth points are being formed.
Keywords: *Coefficient of integrated development of territories, investment capital, quantitative assessment of integrated efficiency, engineering and transport infrastructure, executive authorities, public-private partnership, integrated development of territories*



Tsypkin Yurij Anatol'evich,
Doctor of Economics, Professor, Corresponding Member of the Russian Academy of Sciences, Head of the Department of Urban Planning and Spatial Development; State University for Land Management; 15 Kazakova st., Moscow, 105064, Russian Federation; Scopus AuthorID: 57209505080, WoS ResearcherID: 8843-2017, ORCID: 0000-0002-0774-485X; tsypkinya@guz.ru



Orlov Stepan Vladimirovich,
PhD in Economic sciences, Associate Professor, Head of the Department of History of Social Movements and Political Parties; Lomonosov Moscow State University; 4 27 Lomonosovsky Prospect, Moscow, 119234, Russian Federation; Scopus AuthorID: 57216925621, WoS ResearcherID: 4519-2021, ORCID: 0000-0001-7117-5447, IstinaResearcherID: 140492043; orlov@duma.mos.ru

Modern territories face global challenges related to urbanization: a shortage of efficient land resources, outdated urban infrastructure, the need to improve the quality of life for the population, and the creation of a favorable investment environment. The programme for the complex development of territories (CDT), initiated by the Moscow Government (Law of the Russian Federation "The Status of the Capital of the Russian Federation" dated April 15, 1993, No. 4802-1, latest edition, establishes the specifics of implementing decisions on the complex development of Moscow's territories by operators of complex development, as defined by the highest executive authority of Moscow, including cases where, during the implementation of a decision on complex development, the operator no longer meets the requirements set established by Article 71 of the Urban Planning Code of the Russian Federation (as amended Federal Law No. 627-FZ dated December 25, 2023)), acts as a strategic response to the challenges of urbanization [1], offering a systematic approach to reorganizing inefficiently used, degraded, or outdated urban spaces. However, to ensure maximum effectiveness and justify the substantial investments required for such projects, clear, transparent, and multidimensional evaluation methodologies are critically important [2].

Existing approaches to assessing the effectiveness of urban development projects often focus solely on financial and economic indicators, failing to fully account for the multiplicative effect of complex development — improvements in social infrastructure, environmental conditions, transport accessibility, and, equally important, the overall increase in the capitalization of the territory. Moreover, CDT implementation increasingly relies on the public-private partnership (PPP) mechanism, which requires separate analysis of the contributions of each participant and the synergistic effect of their joint activities.

This article, the result of collaborative research, proposes the concept of a new, integrated indicator — the Coefficient of Complex Development of Territories (C CDT) — which allows for a comprehensive assessment of the effectiveness of CDT projects, considering various aspects and the role of PPP. Particular attention is given to how CDT principles, when properly implemented, transform the investment landscape by eliminating traditional bureaucratic and corruption risks, which is one of the key advantages for attracting private capital to the development of a megalopolis.

1. THEORETICAL FOUNDATIONS OF MULTIDIMENSIONAL EFFICIENCY ASSESSMENT AND THE ANTI-CORRUPTION POTENTIAL OF CDT

The effectiveness of any project, especially in urban development, is a multifaceted and complex concept to measure. Traditional evaluation approaches (such as net present value — NPV, internal rate of return — IRR, payback period — PP) are primarily focused on financial flows and commercial benefits. However, as many experts in land and property relations and urban planning emphasize, the socioeconomic and urban development effects of urban transformations extend far beyond purely financial metrics. Investments in the urban environment create long-term value that is not always directly monetizable but is critical for sustainable development.

CDT projects aim not only at new construction but also at creating a fundamentally new, higher-quality, and modern urban environment. This process includes several key effects:

- economic effect: increased tax base (property tax, land tax, personal income tax from new jobs), creation of new jobs, enhanced investment attractiveness of the territory, and growth

in the capitalization of real estate and infrastructure assets. This is reflected in increased rental rates and the cost per square meter of property;

- social effect: improved housing conditions for the population (relocation from dilapidated, obsolete, or substandard housing to new residences), development and modernization of social infrastructure (construction of modern schools, kindergartens, clinics, sports facilities, cultural centres), creation of comfortable public spaces (parks, squares, pedestrian zones), increased accessibility of social services for all population groups, and new communal and transport infrastructure;
- environmental effect: remediation and cleanup of contaminated industrial sites, riverbanks, and water channels; increased green spaces; creation of "green corridors"; implementation of energy-efficient and "green" technologies; use of renewable energy sources in new developments; and reduction of noise and air pollution levels [3];
- urban development effect: increased density and connectivity of the urban fabric, optimization of transport flows (construction of new roads, interchanges, river piers, and development of public transport), formation of a modern and functional architectural appearance of the territory, and creation of a polycentric city structure.

Significant improvements in transport and engineering infrastructure have a comprehensive impact on all components: economic, social, environmental, and urban development.

Existing evaluation methodologies often fail to aggregate these aspects into a single, comparable indicator. Therefore, there is an urgent need for a comprehensive coefficient that can reflect the integral effectiveness of transformations while accounting for the specifics of state and private sector interactions.

2. CDT AS A DRIVER OF TRANSPARENCY AND AN ANTI-CORRUPTION PLATFORM

One of the most significant and often underestimated advantages of the CDT system is its ability to significantly reduce corruption barriers, eliminate legislative and administrative obstacles, and simplify the procedure for accessing investment capital to valuable urban land plots. Historically, the process of developing territories in large cities has been associated with numerous fragmented administrative procedures, lengthy approvals across multiple authorities, and the need to interact with a large number of officials, creating fertile ground for opaque decisions and corruption [4].

The CDT system fundamentally changes this paradigm through the following key mechanisms:

"Single Window" Principle and Unified CDT Decision: Instead of disparate acts on demolition, reconstruction, zoning, or land surveying, a single CDT decision is adopted for the complex development of a territory. This document, developed and approved by authorized bodies, comprehensively defines all parameters of future development: boundaries of the territory, intended use of facilities, construction parameters, implementation stages, and the investor's obligations to create social and engineering infrastructure. This significantly reduces the number of administrative procedures and eliminates multiple decision-making points that could be exploited for lobbying or extortion [5].

Example: before the introduction of CDT, obtaining all necessary approvals for the redevelopment of a large industrial zone could take years, requiring dozens of separate applications and decisions from various city structures. Now, with a unified CDT decision, the investor receives a comprehensive "roadmap" with fixed conditions and review timelines, radically simplifying the process.

Transparent and Competitive Bidding Procedure: the selection of an investor for a CDT project is carried out exclusively through open and competitive auctions. This ensures equal access to projects for all interested investors, regardless of their connections or past achievements. All participation conditions, evaluation criteria, and project parameters are publicly available, minimizing the possibility of backroom deals and ensuring fair competition. Auction results are also public.

International Experience: the principles of open auctions for the sale of development rights have been successfully applied in megalopolises such as London (e.g., through the TfL land bank) and Singapore (Land Sales Programme), where they have become the foundation for attracting major international investments and ensuring transparency (The Government Land Sales Programme: Turning Plans into Reality | Centre for Liveable Cities Knowledge Hub).

Clear Fixation of Project Parameters and Obligations: the unified CDT decision and the subsequent contract contain precisely defined construction parameters, a complete list of social and engineering infrastructure facilities, and implementation timelines for each stage. This creates a highly predictable and stable environment for the investor, limiting the possibility of arbitrary changes to conditions during project implementation, which eliminates "manual control" by officials and significantly reduces business risks. Investors know the "rules of the game" in advance.

Unified Property Expropriation Procedure and Fair Valuation: although property expropriation is always a sensitive issue, CDT provides a standardized, regulated, and transparent procedure based on the market valuation of expropriated property. This reduces risks for property owners and minimizes opportunities for undercompensation or delays, which in the past often led to conflicts and created conditions for informal "resolutions" or project burnout. The involvement of independent appraisers and the possibility of pre-trial dispute resolution (e.g., through conciliation commissions) increases trust in the process.

Centralized Management and Coordination: The authorized body, as a key element in managing the city's land and property complex, takes on centralized coordination of many processes within CDT. This reduces the need for investors to "run between offices" to obtain separate permits and approvals, which historically has been one of the main sources of administrative barriers and corruption risks in the construction industry.

Thus, CDT serves not only as an effective urban development tool but also as a powerful anti-corruption and deregulatory mechanism, creating a more transparent, predictable, and ultimately more efficient environment for investing in the development of a megalopolis.

3. CONCEPT OF THE COEFFICIENT OF COMPLEX DEVELOPMENT OF TERRITORIES (C CDT)

The proposed Coefficient of Complex Development of Territories (C CDT) is an integral indicator that reflects the project's efficiency in transforming a specific block or land plot in the city relative to its condition before the CDT project. This coefficient is designed to serve as a unified, multicriteria indicator for assessing the success and sustainability of urban development [6].

The formula for C CDT can be expressed as [7]:

$$C_{CDT} = (V_{after}/V_{before}) \cdot F_{PPP} \cdot F_I \cdot F_S \cdot F_E \cdot F_U,$$

where V_{after} — Final value of the territory after CDT;
V_{before} — Initial value of the territory before CDT;
F_{PPP} — Public-private partnership factor;
F_I — Innovation factor;
F_S — Social effect factor;
F_E — Environmental effect factor;
F_U — Urban development potential factor.

Further scientific research plans to address the issue of zoning territories to compare C CDT values. For this purpose, typical zones similar to each other will be identified. Additionally, based on cadastral data, "Scales" will be developed for ranking C CDT.

The Final Value of the Territory after CDT (V_{after}) and Initial Value of the Territory before CDT (V_{before}) are comprehensive indicators aggregating various characteristics of the site before and after project implementation. These indicators are not limited to the market value of the land or real estate but include qualitative and quantitative parameters expressed in monetary or point-based equivalents. To calculate these comprehensive "values", a multicriteria approach is proposed, such as the Analytic Hierarchy Process (AHP) or a point-based evaluation method, where each indicator is assigned a specific weight.

Example Parameters for Calculating "Territory Value" (Hypothetical).

Economic:

- market value of all real estate objects (residential, commercial, industrial) and land rights on the site (before and after CDT), determined by independent appraisers. The valuation methodology must be standardized and comply with Federal Law "Valuation Activities in the Russian Federation" dated July 29, 1998, No. 135-FZ (as amended on February 14, 2024) and Federal Valuation Standards;
- projected annual increase in tax revenues to the city budget from the territory (personal income tax, property tax, land tax, corporate profit tax), land lease payments, and the number of new permanent jobs.

Social:

- availability of places in kindergartens (places/1,000 residents) and schools (places/1,000 residents) on the territory, meeting city standards;
- availability and accessibility (within walking or transport distance) of clinics, sports facilities, and cultural centres;
- area of new or reconstructed public spaces (parks, squares, pedestrian zones) and their quality (presence of landscaping elements, recreation areas, playgrounds).

Environmental:

- Green space area (sq. m/person or % of the total CDT territory area);
- reduction in pollution levels (air, water, soil) based on environmental monitoring data;
- application of "green" construction standards (e.g., certification under international systems like LEED/BREEAM or Russian equivalents).

Urban Development:

- land use coefficient (LUC) or building density (an indicator of land use efficiency and potential (Table 1));
- number and quality of transport facilities (new roads, metro/MCC stations, public transport stops) and improved transport accessibility (e.g., reduced travel time to the city centre);
- formation of a modern, functional, and aesthetically appealing architectural appearance of the territory:

$$\text{Value} = \sum_{i=1}^{n} \left(P_i, normalized \cdot W_i \right).$$

F_{PPP} — Public-Private Partnership Factor. This coefficient reflects the efficiency of risk and benefit distribution between partners. It is calculated as:

F_{PPP} = (State Investments + Private Investments) / State Investments [8].

State Investments** may include direct budget allocations for infrastructure (roads, networks), cadastral value of provided land plots (or market value of lease rights), compensations for expropriated property, costs of connecting to engineering networks (if covered by the state), and tax incentives provided by the state.

Table 1. Example Weight Coefficients for Calculating "Territory Value" (Hypothetical, Subject to Expert Evaluation)

Criterion	Weight, %	Subcriterion	Weight, %, within Criterion	Unit of Measurement
Economic Efficiency	35	Market value of all assets	40	Million rub
	–	Market value of all assets	30	Million rub/year
	–	Permanent jobs created	30	Units
Social Development	25	Availability of schools and kindergartens	30	Places/1,000 people
	–	Accessibility of healthcare institutions	25	Points (1–5)
	–	Area and quality of public spaces	15	Hectares/Points
	–	Housing quality	20	Points (based on satisfaction)
		Culture, sports	10	
Environmental Sustainability	20	Green and landscaped area	40	% of total area
	–	Reduction in environmental pollution	30	%
	–	Use of "green" construction technologies	30	Points (based on certification)
Urban Development Potential	20	Land use coefficient	30	Units
	–	Transport accessibility and connectivity	35	Points/Minutes
		Engineering (water, sewage, electricity, heat, gas)	15	Points
	–	Architectural and urban appearance	20	Points (1–5)
Total	100	–	–	–

Total Investment Volume includes state investments + private investments (in real estate construction, internal infrastructure, and landscaping).

Interpretation of F_{PPP}:

F_{PPP} = 1: All investments are made by the state (the project is not a PPP);

F_{PPP} > 1: State investments act as a catalyst, attracting a larger volume of private capital. The higher the value, the more effectively the state uses its funds to stimulate private investments.

Example: if the state invests 10 billion rub in infrastructure and private investors contribute 90 billion rub to construction, then:

$$F_{PPP} = (10 + 90) / 10 = 10.$$

This indicates high efficiency of state investments as a "trigger" mechanism.

F_I — innovation Factor: accounts for the implementation of advanced technologies and "green" standards. It can be evaluated on a point-based system based on the presence of "smart city" elements (intelligent lighting, security systems, smart parking, sensor networks), use of renewable energy sources, and certification under LEED/BREEAM.

F_S — Social Effect Factor: Reflects improvements in the accessibility and quality of social facilities. It can be expressed as the ratio of social facility availability per 1,000 residents before and after the project or as a point-based assessment of the quality and diversity of created social infrastructure (e.g., 0.8–1.2, where 1.0 is the norm).

F_E — Environmental Effect Factor: Reflects improvements in the environmental situation. It can be expressed as the percentage increase in green areas, reduction in pollution levels (e.g., NO_x, $PM_{2.5}$, based on monitoring data), and the presence of modern water treatment and waste management systems.

F_U — Urban Development Potential Factor: Reflects the degree of realization of the territory's potential as outlined in the general plan and land use and development regulations. It can be expressed as the ratio of the achieved land use coefficient (LUC) to the maximum permitted or as a point-based assessment of compliance with the approved architectural and urban appearance, aesthetics, and functionality.

The introduction of these additional factors shifts the focus from purely commercial benefits to a comprehensive, sustainable development effect, which is particularly important for territories.

4. METHODOLOGY FOR CALCULATION AND DATA SOURCES

For the practical application of C CDT, a unified, integrated information database is required, combining data from various city authorities and CDT participants. This database must be compatible with the city's existing geographic information systems (GIS).

Data Sources.

Executive Authorities provide:

- key data on the market value of land plots and real estate before and after project implementation (based on independent appraisals conducted by accredited organizations in accordance with Federal Valuation Standards);
- information on land plots transferred under PPP and the terms of such transfers;
- data on construction parameters (total area of commissioned residential, commercial, and industrial real estate, number of floors), number of jobs created, investment volumes in construction, and information on the implementation of innovative and energy-efficient solutions;
- information on transport infrastructure development (length of new roads, construction of bridges, interchanges, number of new public transport stops, metro/MCC/MCD stations) and improvements in transport accessibility (changes in travel time to key city points, throughput capacity);
- data on the construction and modernization of social infrastructure (number of places in schools, kindergartens, clinics, sports, and cultural facilities);
- information on environmental improvements (green area size, environmental monitoring data before and after the project, emission reductions, waste management volumes);
- data on engineering infrastructure.

Federal Tax Service: aggregated data on tax revenues from the territory before and after CDT to assess the increase in the tax base.

Private Investors/Developers: Detailed data on invested funds, the volume of commissioned facilities, compliance with implementation timelines, and fulfillment of contractual obligations.

Methodology for Calculating "Territory Value" (V before and V after).

To determine the Initial Value and Final Value of the territory, the Analytic Hierarchy Process (AHP) by T. Saaty or similar multicriteria methods is proposed, allowing for the consideration of various qualitative and quantitative indicators [9], assigning them weights based on the priorities of the city's urban development policy.

Identification of Key Criteria and Subcriterion: Detailed development of a hierarchical structure of criteria (economic, social, environmental, urban development) and their decomposition into measurable subcriterion.

Data Collection: Relevant data on the territory's condition before the project and projected/actual data after its completion are collected for each subcriterion.

Data Normalization: all indicators are converted to a dimensionless form (e.g., from 0 to 1) using appropriate normalization methods (e.g., linear scaling).

Determination of Weight Coefficients: This is the most critical stage, requiring in-depth expert evaluation. Weights for each criterion and subcriterion are determined using pairwise comparisons (characteristic of AHP).

Aggregation of Results: The "Territory Value" before and after CDT is calculated as a weighted sum of normalized indicators.

5. ROLE OF PUBLIC-PRIVATE PARTNERSHIP IN COMPLEX DEVELOPMENT

Public-private partnership is a powerful catalyst for implementing CDT projects. Given limited budget resources and the need to attract large-scale investments, PPP enables efficient risk and responsibility distribution between the state and the private sector, creating a synergistic effect. The state (represented by city or regional executive authorities) often takes on the most capital-intensive and long-term investments in main engineering and transport infrastructure, as well as the approval of urban planning documentation and land consolidation. This significantly reduces risks for private developers and increases the investment attractiveness of projects.

Example of Successful PPP Implementation in Territorial Development: Redevelopment of the Former ZIL Plant Territory [10] (Southern District of Moscow).

Table 2. Comparison of PPP Models in Urban Development (Example)

Criterion	Concession Model (Classic)	Strategic Partnership Model (e.g., ZIL)	Risk Distribution
Capital Attraction	Long-term, with guaranteed investor income	Through auctions	Investor bears main construction risks. Clearly defined by contract, often with the state taking some risks
Flexibility	Less flexible, rigid contract terms	More flexible, adjustable at stages	Flexible, with the state often taking on main infrastructure risks
Transparency	High, through public tenders	High, through public auctions and unified CDT decision	–
Anti-Corruption Effect	–	–	High, due to minimized contacts and consolidated decisions

The territory of the former ZIL plant, covering approximately 380 hectares, is a massive industrial zone relatively close to the city center. Its redevelopment is one of the most ambitious projects, considered a precursor to CDT in its modern interpretation.

Before Implementation: The territory was an outdated industrial zone, inefficiently used, with low capitalization, environmental issues, and a lack of social infrastructure. The absence of a unified redevelopment approach created high barriers to private investment.

PPP Mechanism: A strategic partnership model was applied, where the Moscow Government and major development companies (such as Etalon Group, LSR Group, etc.) divided functions and investments, minimizing corruption risks through clear role distribution and transparent procedures:

- Executive Authorities: Took on the majority of investments in key transport infrastructure (construction and modernization of the "Technopark" and "ZIL" MCC metro stations, the new "ZIL" station on the Troitskaya metro line, construction of roads, bridges, and interchanges), external engineering networks, and the development and approval of comprehensive urban planning documentation (master plan, planning projects). The city also assumed part of the obligations for creating social facilities (e.g., the CSKA Arena Ice Palace, some schools, and kindergartens). Total state investments amounted to tens of billions of rubles;
- Private Investors: Acquired land rights (through open auctions conducted by the Department of City Property) and made the main investments in residential real estate construction (millions of square meters), commercial facilities (business centres, retail spaces), internal engineering infrastructure, and landscaping. The volume of private investments in the ZIL project is estimated at hundreds of billions of rubles.

Results: if we conditionally designate the ZIL project as a CDT project, it can be considered one of the most successful examples of redeveloping former industrial zones. Modern residential quarters ("ZILART", "Park of Legends", etc.), new jobs, and actively functioning sports, cultural, and commercial facilities have been created on its territory. The capitalization of the territory has increased manifold (Table 2).

Calculation of F_{PPP} for ZIL (Hypothetical Example for Demonstration):

Assume state investments in infrastructure amounted to 100 billion rub, and private investments in construction totaled 1,000 billion rub. Then:

$$F_{PPP} = (100 + 1{,}000)/100 = 11.$$

This high F_{PPP} value indicates that each ruble of state investment attracted ten times more private capital, demonstrating the high efficiency of PPP as a development catalyst [11].

The inclusion of F_{PPP} in C CDT allows for:

- Objective assessment of the efficiency of budget fund utilization: How effectively state investments stimulate private contributions and ensure a multiplicative effect;
- Encouraging private capital attraction: High C CDT values, considering the PPP factor, can serve as a benchmark for selecting the most effective partnership models for future projects;
- Justifying the necessity of PPP: Clearly demonstrating that comprehensive and large-scale development can only be achieved with active participation from both sectors, not solely through budget funds.

6. SPECIFICS OF CDT APPLICATION IN NEW MOSCOW: EXPANDING INVESTMENT HORIZONS AND UNIQUE POTENTIAL

The territory of New Moscow (Troitsky and Novomoskovsky Administrative Districts — TiNAO), annexed to the capital in 2012, represents a unique testing ground for CDT projects [12].

Unlike the historically developed districts of "old" Moscow, New Moscow has significant undeveloped or underutilized land plots, creating unprecedented opportunities for large-scale complex development "from scratch" with minimal encumbrances. This necessitates a special approach to assessing the effectiveness and investment attractiveness of these territories.

In New Moscow, CDT enables large-scale planning and a "clean slate": the availability of large free territories allows for the creation of comprehensive master plans and land plots for truly integrated development, including not only housing but also full-fledged clusters of jobs (technoparks, logistics centres, business parks), extensive social, commercial, and recreational infrastructure. This minimizes the risks of "piecemeal development" typical of densely built-up central districts and enables the creation of self-sufficient, comfortable urban areas.

International Experience: Similar approaches were applied in creating new urban districts in Singapore (e.g., Punggol), South Korea (Songdo), and China (Shanghai Pudong). In these cases, planning "from scratch" enabled the integration of the most modern urban planning solutions, "smart" systems, and sustainable development technologies

Minimization of Encumbrance Risks: The presence of large free territories or lands with minimal encumbrances (e.g., agricultural lands or inefficient industrial zones) significantly simplifies the preparation of CDT projects. This reduces implementation timelines, lowers costs for land acquisition or resident relocation, and minimizes social risks. Investors receive "clean" plots with clear legal status, a decisive factor for long-term investments.

Attraction of New Investment Projects and Economic Diversification: The enormous potential of New Moscow for creating new industrial, logistics, high-tech, educational, and recreational clusters make it highly attractive to investors seeking large-scale projects with long-term prospects. This contributes to the diversification of the city's economy, reducing the concentration of business activity in the center.

Example: The creation of large multifunctional clusters and industrial parks ("Rumyantsevo", "Vnukovo") in New Moscow, which have become magnets for attracting high-tech companies and creating jobs outside the historical center.

Proactive Development of Social and Transport Infrastructure. The application of various CDT projects in New Moscow enables systematic and proactive development of related sectors, such as the transport network (metro extensions, new highways, public transport development) and social infrastructure, ensuring a high quality of life for the growing population. This is critical for creating a comfortable urban environment where residential and employment areas are balanced.

The introduction of C CDT, with specific factors for New Moscow (e.g., increased weights for infrastructure and job creation "from scratch" and integration of the natural landscape), will allow for the most comprehensive evaluation of the effectiveness of such projects and encourage further investments in this promising part of the megalopolis. The reduction of corruption risks inherent in the CDT system is particularly important in the context of developing new, previously undeveloped territories for complex construction, where transparency of rules plays a key role in attracting major strategic investors [13].

7. PRACTICAL APPLICATION AND ADVANTAGES OF C CDT

The implementation of the Coefficient of Complex Development of Territories (C CDT) will provide executive authorities with a powerful, multifunctional tool for managing urban development.

Making Informed Strategic Decisions: Quantitative assessment of comprehensive efficiency will enable more balanced and strategically oriented decisions on the feasibility of implementing CDT projects on specific territories, selecting those that maximize overall benefits for the city across all aspects.

Attracting Investments: a clearly defined, measurable, and publicly accessible efficiency indicator can serve as a compelling argument for investors. Demonstrating that CDT is not only profitable but also reduces bureaucratic and corruption barriers makes the investment process more predictable, secure, and attractive.

Example for Investment Presentation: "The «City Quarter N» CDT project has a projected C CDT = 3.5, significantly higher than the average for similar projects, due to an optimal PPP model (F_{PPP} = 8.0) and a high share of innovative solutions, reducing operational costs by 20 %".

Monitoring and Controlling Efficiency: C CDT will enable real-time tracking of changes in the territory before and after project implementation, assessing the achievement of set goals across all aspects (economic, social, environmental, urban development) and adjusting development plans as needed. It is a tool for strategic management of the CDT project portfolio.

Comparison and Benchmarking of Projects: The ability to compare the effectiveness of various CDT projects in Moscow (including between old and New Moscow), identify the most successful practices, analyze the reasons for their success, and replicate the best models in other territories.

Enhancing Transparency and Accountability: Publishing C CDT values for completed projects will increase the transparency of city authorities' activities and the level of trust from the public and investment community. This is a step toward more open and effective urban development management.

The introduction of the Coefficient of Complex Development of Territories (C CDT) is a timely and necessary step to enhance the efficiency, transparency, and sustainability of the CDT programme in Moscow. This integrated indicator, accounting for not only economic but also social, environmental, and urban development aspects, as well as the public-private partnership factor, will enable more informed decision-making, attract investments, and ensure the sustainable development of the city.

The CDT system, due to its comprehensiveness, predictability, and regulation, can significantly reduce traditional corruption barriers and administrative obstacles, simplifying investors' access to valuable urban territories. This effect is particularly evident in New Moscow, where CDT opens unique opportunities for large-scale and transparent development of new spaces, contributing to the creation of modern, self-sufficient urban districts.

REFERENCES

1. On the Status of the Capital of the Russian Federation : Law of the Russian Federation No. 4802-1 of April 25, 1993. URL: https://base.garant.ru/316014/ (rus.).
2. On the Integrated Development of Territories in the City of Moscow : Law of the City of Moscow. Moscow Government Decree No. 331-PP of March 23, 2021 (as amended on April 18, 2024). (rus.).
3. Urban Development Code of the Russian Federation of 29.12.2004 No. 190-FZ. URL: https://www.consultant.ru/document/cons_doc_LAW_51040/ (rus.).
4. Moscow Government Resolution No. 331-PP of March 23, 2021. URL: https://www.law.ru/npd/doc/docid/573955463/modid/80 (rus.).
5. Moscow Government Resolution No. 2035-PP of October 24, 2023. URL: https://www.law.ru/npd/doc/docid/1303675242/modid/80 (rus.).
6. Moscow Government Resolution No. 1625-PP of August 28, 2023. URL: https://www.law.ru/npd/doc/docid/1303068843/modid/99 (rus.).
7. Resolution of the Moscow Government on approval of the procedure for implementation the CDT program. Regulations on the composition, procedure for preparation and approval of territory planning projects for the purpose of integrated development of the territory, territory planning projects that include the territories of special economic zones, as well as territory planning projects prepared at the expense of the Moscow City Budget, in the city of Moscow, dated October 24, 2023, No. 2035-PP. URL: https://docs.cntd.ru/document/1303675242?ysclid=mg9fb0motd817661095
8. Federal Law of July 13, 2015 No. 224-FZ on PPP. URL: https://www.consultant.ru/document/cons_doc_LAW_182660 (rus.).
9. UN-Habitat. Public-Private Partnerships in Urban Infrastructure. URL: https://unhabitat.org/public-private-partnership-in-housing-and-urban-development
10. World Bank. Urban Land Markets. Case studies from Europe and Asia. URL: https://www.worldbank.org/en/topic/urbandevelopment
11. Tsypkin Yu.A., Orlov S.V. Integrated Indicators in Urban Policy. Urban Studies Journal. 2021.
12. Tsypkin Yu.A., Pakulin S.L., Feklistova I.S. Sustainable Development of the Agricultural Sector through innovation and promising technologies. Springer International Publishing. 2021; 105-114. DOI: 10.1007/978-3-030-73097-0_13. EDN TMNKLA.
13. PwC. Infrastructure development via PPP: Global Best Practices. 2020. URL: www.emerald.com/books/monograph/11850/chapter-abstract/81820157/Best-Practices-in-PPP-Policy-Choice-Based-on?redirectedFrom=fulltext

Методология оценки комплексного развития территорий: интегральный коэффициент КРТ

Настоящая статья предлагает концепцию коэффициента комплексного развития территорий (К КРТ). Данный коэффициент призван стать инструментом для количественной оценки интегральной эффективности проектов комплексного развития территорий (КРТ) в условиях мегаполиса. Он будет отражать не только экономическую, но и социальную, экологическую и градостроительную трансформацию конкретного квартала или земельного участка относительно его состояния до реализации проекта. Особое внимание уделено интеграции фактора государственно-частного партнерства (ГЧП), учитывающего соотношение инвестиционного капитала со стороны государства и частных инвесторов, что позволит комплексно оценить синергетический эффект от такого взаимодействия. Статья также всесторонне анализирует, как система КРТ существенно снижает коррупционные барьеры, устраняет законодательные и административные преграды, а также упрощает процедуру доступа инвестиционного капитала к весьма ограниченным земельным ресурсам мегаполиса — особенно на территории Новой Москвы, где формируются новые точки роста.

Ключевые слова: *коэффициент комплексного развития территорий, инвестиционный капитал, количественная оценка комплексной эффективности, инженерная и транспортная инфраструктура, органы исполнительной власти, государственно-частное партнерство, комплексная застройка территорий*

СПИСОК ИСТОЧНИКОВ

1. О статусе столицы Российской Федерации : Закон РФ от 15.04.1993 № 4802-1. URL: https://base.garant.ru/316014
2. О комплексном развитии территорий в городе Москве : Закон города Москвы. Постановление Правительства Москвы от 23.03.2021 № 331-ПП (ред. от 18.04.2024).
3. Градостроительный кодекс Российской Федерации от 29.12.2004 № 190-ФЗ. URL: https://www.consultant.ru/document/cons_doc_LAW_51040
4. Постановление Правительства Москвы от 23 марта 2021 года № 331-ПП. URL: https://www.law.ru/npd/doc/docid/573955463/modid/80
5. Постановление Правительства Москвы от 24 октября 2023 года № 2035-ПП. URL: https://www.law.ru/npd/doc/docid/1303675242/modid/80
6. Постановление Правительства Москвы от 28.08.2023 № 1625-ПП. URL: https://www.law.ru/npd/doc/docid/1303068843/modid/99
7. Постановление Правительства Москвы об утверждении порядка реализации программы КРТ. Положения об особенностях состава, порядка подготовки и согласования проектов планировки территории в целях комплексного развития территории, проектов планировки территории, включающих территории особых экономических зон, а также проектов планировки территории, подготавливаемых за счет средств бюджета города Москвы, в городе Москве от 24 октября 2023 года № 2035-ПП. URL: https://docs.cntd.ru/document/1303675242?ysclid=mg9fb0motd817661095
8. Федеральный закон от 13.07.2015 № 224-ФЗ о ГЧП. URL: https://www.consultant.ru/document/cons_doc_LAW_182660/
9. Public-Private Partnership in Housing and Urban Development. URL: https://unhabitat.org/public-private-partnership-in-housing-and-urban-development
10. World Bank. Urban Land Markets. Case studies from Europe and Asia. URL: https://www.worldbank.org/en/topic/urbandevelopment
11. Tsypkin Yu.A., Orlov S.V. Integrated Indicators in Urban Policy // Urban Studies Journal. 2021.
12. Tsypkin Yu.A., Pakulin S.L., Feklistova I.S. Sustainable Development of the Agricultural Sector through innovation and promising technologies // Springer International Publishing. 2021. Pp. 105–114. DOI: 10.1007/978-3-030-73097-0_13. EDN TMNKLA.
13. PwC. Infrastructure development via PPP: Global Best Practices. 2020. URL: www.emerald.com/books/monograph/11850/chapter-abstract/81820157/Best-Practices-in-PPP-Policy-Choice-Based-on?redirectedFrom=fulltext

Об авторах: **Цыпкин Юрий Анатольевич** — доктор экономических наук, профессор, член-корреспондент РАН, заведующий кафедрой градостроительства и территориального развития; **Государственный университет по землеустройству**; 105064, г. Москва, ул. Казакова, д. 15; Scopus AuthorID: 57209505080, WoS ResearcherID: 8843-2017, ORCID: 0000-0002-0774-485X; tsyp-kinya@guz.ru;

Орлов Степан Владимирович — кандидат экономических наук, доцент, заведующий кафедрой истории общественных движений и политических партий; **Московский государственный университет имени М.В. Ломоносова**; 119234, г. Москва, Ломоносовский пр-т, д. 27, стр. 4; Scopus AuthorID: 57216925621, WoS ResearcherID: 4519-2021, ORCID: 0000-0001-7117-5447, Istina ResearcherID (IRID): 140492043; orlov@duma.mos.ru.

For citation: Tsypkin Yu.A., Orlov S.V. Methodology for Assessing the Integrated Development of Territories: The Integral Coefficient of CDT. *Real Estate: Economics, Management*. 2025; 3:21-27.

Для цитирования: *Цыпкин Ю.А., Орлов С.В.* Methodology for Assessing the Integrated Development of Territories: The Integral Coefficient of CDT // Недвижимость: экономика, управление. 2025. № 3. С. 21–27.

UDC 69.003

Kulakov K.Yu.
Abdalov R.E.

Integrated development of the territory: the principle of the mechanism and its attractiveness for developers

The purpose of this scientific paper is to analyze aspects of the attractiveness of integrated development of territory (IDT) projects for developers. To this end, a phased study was conducted, which began with an examination of the basic concept of the IDT mechanism and, based on regulatory and legal provisions and applied design, described the conceptual basis of IDT, which includes functional and target vectors of action and four types of IDT through which the mechanism manifests itself. Next, assumptions are made about the prerequisites for the emergence of IDT mechanism, including, for example, growing interest in the complexity and clustering of economic systems, as well as a high demand for innovative development in all spheres of life. The authors note that the key actors in the implementation of IDT project are the developer and government representatives, which have special powers and whose joint interaction allows for positive synergy to achieve one of the most important national goals of creating a high-quality and safe living environment. The authors argue that developers should be recognized as the main actors in the IDT project, because without their resources, the high-quality transformation of the territory designated by the government is impossible. From this point of view, the authors conducted an analysis and formulated the concept of the investment attractiveness of IDT project, and based on the advantages and imperfections of the mechanism, they identified the main aspects of IDT project's attractiveness for a development company. In conclusion, the authors analyzed the multiple effects of IDT mechanism, which can improve the lives of stakeholders — investors (developers), government representatives, citizens, and businesses — by exerting a positive influence on each of them. Thus, it is assumed that further research and development of the topic of investment attractiveness assessment within the framework of pre-investment studies will increase the effectiveness of mutually beneficial partnerships between developers and the state in the field of IDT, allowing for the creation of a sustainable environment for life.

Keywords: *integrated development of territories (IDT), real estate development, developer, government, housing conditions, urban environment, land assets, investment attractiveness of the IDT project, pre-investment study*



Kulakov Kirill Yuryevich,
Doctor of Economics, Professor of the Department of Organization of Construction and Real Estate Management; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation;
ID RSCI: 360164,
ORCID: 0000-0003-2081-7045;
kkulakov@bk.ru



Abdalov Roman Evgenyevich,
Postgraduate student of the Department of Organization of Construction and Real Estate Management; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation;
SPIN-code: 2291-2191,
AuthorID: 1226983,
ORCID: 0009-0006-2366-6397;
abdalov.romain@yandex.ru

The current challenges facing the construction industry in the Russian Federation, including, for example, the inadequacy of housing conditions and related infrastructure to meet the modern needs of society and difficulties with effective and rational land use, essentially determine a single federal-level task of comprehensively improving the accessibility, quality, and safety of housing for the population [1]. In addressing this complex task, the government, in collaboration with scientific and business communities, is constantly searching for, studying and implementing effective approaches and tools that meet the advanced demands of civilization transmitted throughout the world and are aimed at even the slightest improvement in reproductive activity. Such searches for new forms and meanings gave rise to the mechanism of integrated development of territory (IDT), thereby giving a significant impetus to the expansion of the horizons of residential real estate development.

The IDT mechanism has been rapidly evolving in the Russian Federation for several years now. At the end of December 2020, following the results of reviews, Federal Law No. 494-FZ of December 30, 2020, "On amendments to the Urban Planning Code of the Russian Federation and Certain Legislative acts of the Russian Federation in order to ensure the integrated development of territories" [2] was approved and put into effect. Upon entering into force, this document introduces a number of additions and amendments to the Urban Planning Code of the Russian Federation (UPC of RF), mainly concerning the IDT mechanism [3]:

- the concept of IDT is defined as a set of measures carried out in accordance with the approved documentation on the planning of the territory and aimed at creating favorable living conditions for citizens, updating the living environment and common areas of settlements, municipal districts, and urban districts;
- four types of IDT have been identified, each with its own distinctive features and implementation procedure;
- within the framework of IDT projects, the possibilities for the expropriation of land plots and other types of real estate for the needs of the state and municipalities have been expanded;
- the procedure for adopting and implementing IDT decisions has been established, and provisions for concluding IDT agreements have been defined;
- provisions have been introduced to protect the rights of interested parties (landowners, citizens) during the implementation of IDT projects, among other things.

Since the IDT mechanism is only in the early stages of its development in the country, there is no unified information system responsible for the operational control of IDT projects. Open sources pro-

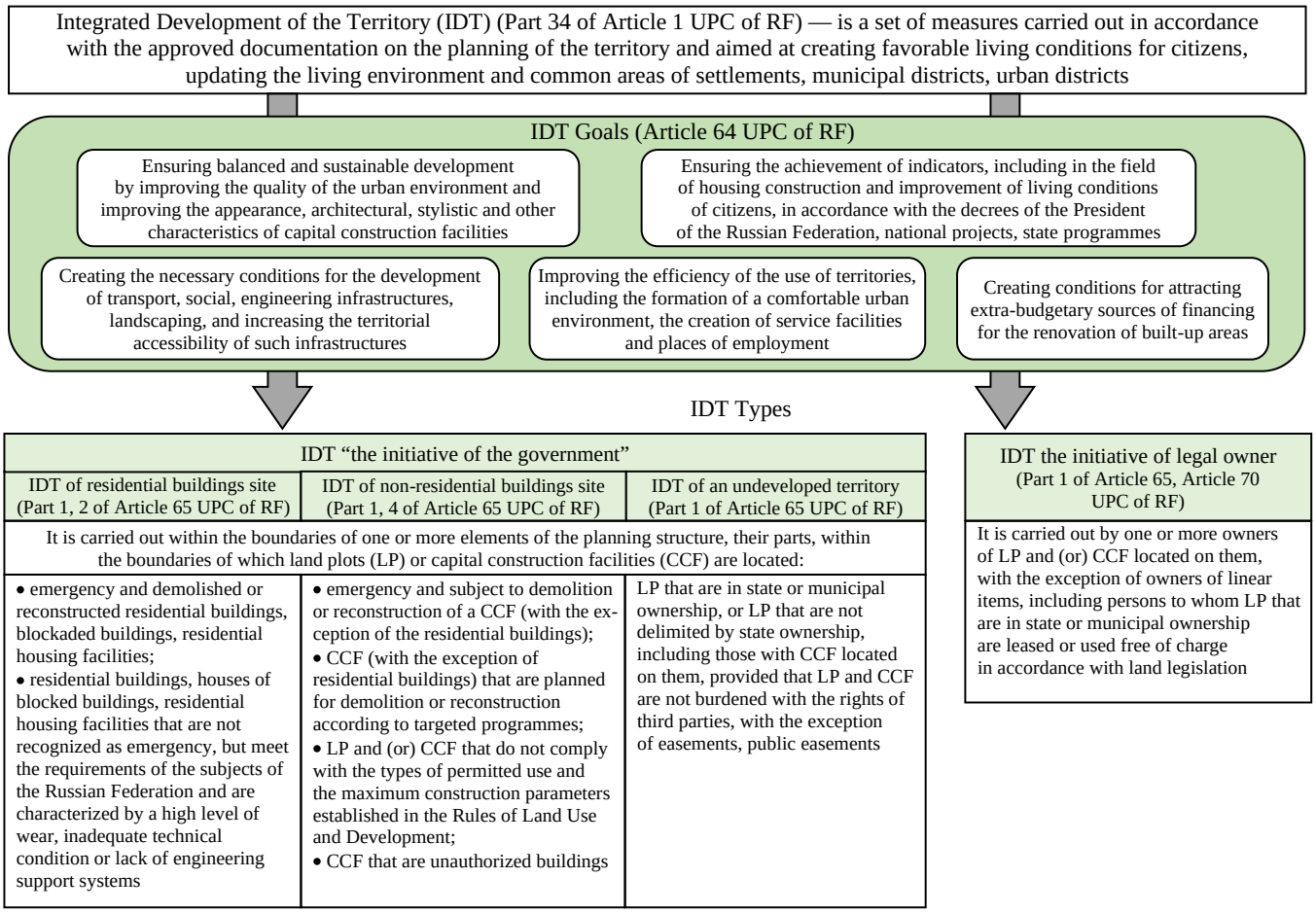


Fig. 1. The conceptual basis of the IDT mechanism (compiled by the author)

vide the following statistical data for mid-2025, characterizing business activity in the field of IDT [4]:

- in 77 constituent entities of the Russian Federation, 1,013 territories with a total area of almost 22.6 thousand hectares and an urban development potential of 165.32 million square meters, including 122.8 million square meters of residential space, are in the active stage of IDT implementation;
- 830 decisions on IDT have been adopted, including almost 40 % (308 decisions) on residential IDT, with a total area of 16.4 thousand hectares and an urban development potential of 124 million square meters, of which 86.96 million square meters are residential space;
- during the implementation of the IDT residential development programme, approximately 270,000 square meters of housing was resettled, including 230,810 square meters of housing in disrepair, thereby improving living conditions for 151.80 people.

The conceptual basis of the IDT mechanism, on which the practical implementation of integrated development projects is based, consists of its functional and target vectors of action, as well as types of IDT characterized by their specific features (Fig. 1) [3].

The target guidelines of the IDT concept, enshrined in the domestic legal framework, are the consequences of national economic tasks that need to be solved. Thus, several key prerequisites for the genesis and implementation of IDT can be identified.

Firstly, the central figures are the strategically important goals outlined in legal doctrines, mainly related to improving housing conditions and creating a high-quality and safe urban environment. To this end, the current Strategy for the development of the construction industry and housing and communal services of the Russian Federation has defined priority tasks: commissioning more than 1 billion square meters of housing stock (for the period from 2021 to 2030), a steady reduction in substandard housing and improvement of housing conditions for certain categories of citizens, improvement of the environment and urban infrastructure [1]. In this situation, where high rates of reproduction are necessary, the IDT programme has been nominated as a driver of business activity and effective productivity in the creation of real estate and related infrastructure.

Secondly, there is the separate issue of land, which consists of an acute shortage of high-quality land resources for construction in central areas of the city and the need to increase the urban development potential of settlements. Today, we are witnessing a high level of urbanization of urban areas and the irrational distribution of land in large settlements, resulting in low functionality of urban space and problems with logistics corridors, natural landscape zones and accessibility of social facilities. The IDT programme, which involves simplified land acquisition schemes, is designed to ensure the effective use of territories where it is possible to build housing and the infrastructure necessary for life support [1].

Thirdly, current approaches to urban planning and decision-making are focused on the interests of the present or immediate future (up to 5 years), with little consideration given to the potential of the territory in the longer term (10–20 years). It is believed that

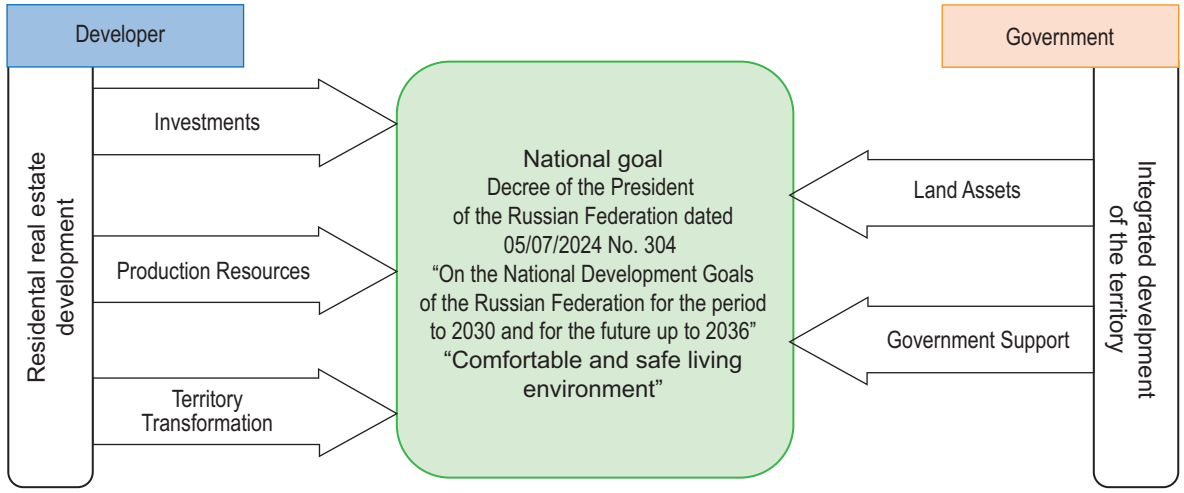


Fig. 2. Developer and government impacts and the synergy of their partnership (compiled by the author)

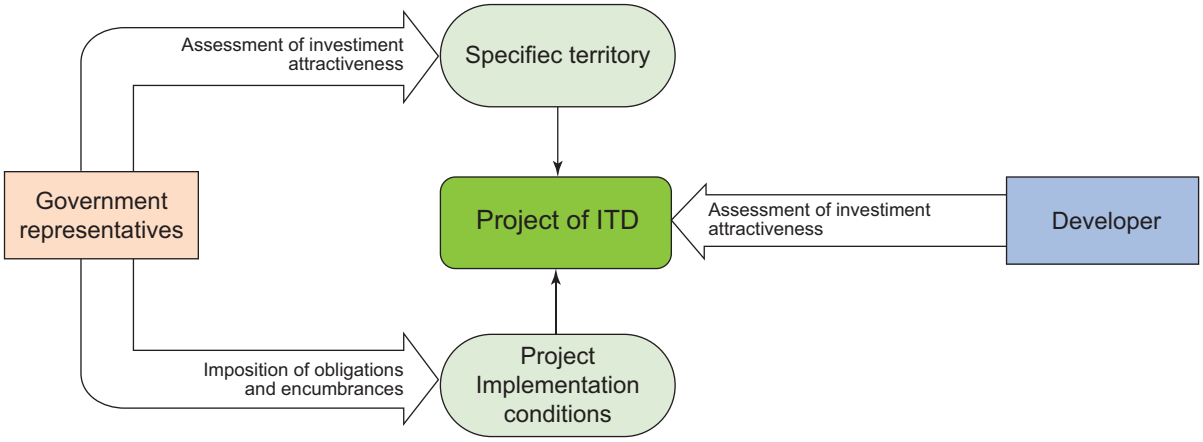


Fig. 3. Assessment of investment attractiveness within the framework of the IDT (compiled by the author)

such a conservative approach, which involves low activity in the implementation of innovative solutions, hinders territorial and spatial development. However, the direct identification of promising urban development vectors at an early stage in a complex territorial planning system would significantly reduce wasteful costs and errors in urban development activities [5, 6].

Fourthly, one of the trends in the country's economy in recent years, including in the investment and construction sector, is the complexity, consolidation and enlargement of activities and projects [7]. The increasing clustering of territories (residential, social, industrial), progressive modular construction, the formation of digital platforms and common data environments, and other integrated solutions have already taken root and are widely used in the practice of the urban development sector, increasing the pace of socio-economic and, at the same time, scientific and technological development.

Fifthly, the IDT programme, derived from the concept of the common good, correlates perfectly with the paradigms of sustainable development and ESG-concept, which assume the progressive movement of all spheres of activity towards the development of society in three directions at once: social responsibility, economic efficiency and environmental well-being [8, 9]. Both within the framework of individual IDT projects and as a cumulative result of the systematic implementation of the IDT campaign, it is assumed that the current needs of all interested parties will be met without harming the environment but, on the contrary, striving to improve the ecological situation.

IDT, which involves a project-based approach, is built on the relationships between specific subjects. Through cooperation, developers and government representatives are able to create conditions for the sustainable and harmonious development of the territory. Government structures, as the ideological drivers of the IDT programme, are responsible for strategic planning — they dispose of land assets and provide comprehensive infrastructure and regulatory support. The developer, as the key creator of residential real estate, in turn, invests resources, contributes organizational capital (both physical and intellectual) and implements a full cycle of territorial transformation. Such a mutually beneficial partnership stimulates the improvement of the urban environment, the creation of new jobs and the improvement of living conditions for the public, which together brings us closer to achieving the National goal of a "Comfortable and safe living environment" (Fig. 2).

Urban planning, which is primarily a function of the government, is designed to determine and coordinate the spatial organization of the territory, to form a balanced and rational territorial structure for land management in order to achieve planned social and economic objectives [5]. Territorial and spatial planning activities include measures for the multifaceted regulation of urban development, counteracting negative market trends and acting as an

important tool for ensuring sustainable development and improving quality of life.

Today, the regulatory and methodological support for the IDT mechanism is being systematically developed, which should clarify some of the provisions of the mechanism and eliminate existing imperfections in the regulatory framework. For example, regulatory documents are being actively developed, in particular, a set of rules entitled "Urban Development. Comprehensive Development of Territories: General Provisions for Building Urban Environment Models" which contains provisions on the formation of high-quality residential development, using the principles of organizing urban environment models in the development of urban planning documentation. For the government representatives, which is rightfully the initiator of IDT, a methodological toolkit has been accumulated for the careful selection and evaluation of territories for IDT, preparation, initiation and implementation, as well as spatial and economic modelling of IDT projects [10, 11]. This documentation allows state bodies to conduct their activities with greater confidence.

The base for project activities in the field of development planning for developers who appear as implementers of the territory development programme, methodological tools based on the results of the analysis are currently insufficient, which generates a large number of uncertainties and uncertainty on the part of developers to enter into the IDT project. As a result, this problem leads to low investor interest in the territorial transformation process and, ultimately, to a slowdown in the implementation of the IDT programme. In this case, it is fair to note that for a developer investing their financial and non-financial resources, it is important that the IDT project be attractive for investment (Fig. 3).

In the current circumstances, it seems appropriate to introduce the author's term "investment attractiveness of the IDT project" and, based on the existing conceptual framework, provide a more precise definition [12–14]. The concept of the investment attractiveness of a IDT project is proposed to be understood as an interconnected system of criteria reflecting the advisability of investing different resources to the IDT project, taking into account the cumulative potential of the developer (subject) and a comprehensive description of the characteristics of the specific IDT project (object) and the possibility of obtaining a multifaceted positive effect (both financial and non-financial) for all stakeholders in the event of a subject-object relationship.

The investment attractiveness of IDT for developers lies in the following positive aspects [15, 16]:

- the location of most of the land plots sold within the framework of IDT in already developed or developing areas, mainly in an accessible environment with socially significant infrastructure;
- assistance from government representatives at various levels in the implementation of the IDT project and an acceptable administrative burden for developers;
- a potential increase in the liquidity and margin of the investment object due to modern approaches to the organization of the territory, internal technological efficiency and the external appearance of the development product;
- relatively low cost of entering the IDT project and, consequently, obtaining a land plot for development, compared to obtaining rights to a land plot within the framework of classic point development;
- the possibility for developers to obtain preferences from the government on other projects;
- low probability of future perturbations of investment objects planned for placement or already placed within the framework of the IDT;
- potential increase in the organization's brand recognition and growth in public loyalty.

On the other hand, practical experience in implementing the programme, as well as individual studies and expert opinions, indicate the existence of shortcomings and vulnerabilities in the IDT mechanism, which, in general, predetermine the problems of the IDT programme in the Russian Federation and its unattractiveness to investors [17–19]:

- the existence of legal gaps related to imperfect legislative regulation (issues of real estate seizure for IDT purposes, participation in bidding procedures, determination of IDT boundaries, and others);
- irrational assessment by the government representatives of the terms and costs of implementation IDT projects, characterized by values that are not comparable with the real capabilities of the developer;
- unsatisfactory quality of the land plot, characterized by territorial, technical and legal encumbrances;
- high probability of a "zero cycle" burden on the developer in the IDT project — the need to use the developer's resources to resettle residents from dilapidated housing, demolish existing buildings on the site, and carry out large-scale planning of the allocated territory;
- high probability of social burden on the developer in the IDT project — the need to use the developer's resources to build social infrastructure facilities — kindergartens, schools, healthcare facilities, sports and administrative and business facilities;
- high probability of the IDT project imposing a burden on the developer in the form of obligations to create communal and transport infrastructure — the need to use the developer's resources to renovate or build new engineering and technical support networks, carry out aesthetic and architecturally expressive landscaping of the territory and construct the required street and road network infrastructure.

Thus, the IDT mechanism has both certain advantages and obvious shortcomings, creating dissonance for the developer. In such conditions, the difficult and strategically important decision to invest in the IDT project should be made on the basis of an assessment of investment attractiveness, taking into account the opportunities and risks of an individual investor and involving a thorough systematic analysis of past and present experience, as well as future market trends.

A systematic approach involves the integration of multiple process components, each of which is focused on a specific area of the project (urban planning, finance, juridical, etc.) [20]. In a changing economic environment, it is extremely important to consider these elements together in order to understand their interrelationships and influence on each other. It is advisable to implement such a systematic approach at the pre-investment stage in order to form a comprehensive and holistic understanding design feature, which will allow us to predict potential difficulties and identify the best ways to resolve them before investing funds. Based on the results of the pre-investment study, in addition to an accurate and reasonable assessment of the investment attractiveness of the IDT, in the event of a positive investment decision, the developer gains confidence in its activities at all stages of the project life cycle,

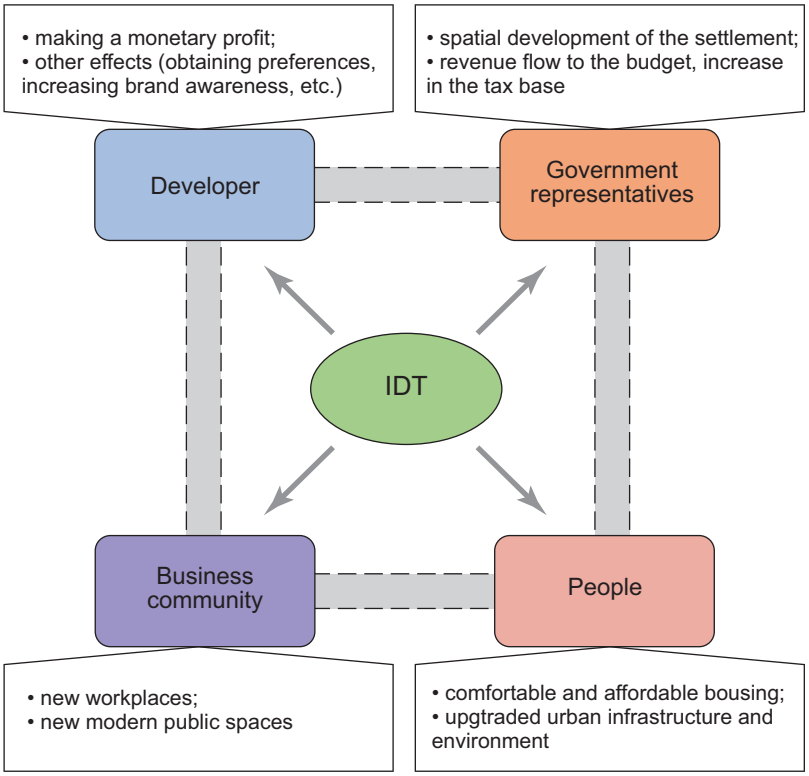


Fig. 4. Positive multiple effect of implementing the IDT mechanism on different participants (compiled by the author)

which significantly increases the likelihood of its successful completion in accordance with the planned objectives [21, 22].

Based on the above, it seems promising that, under the current conditions, the proposed concept of assessing the investment attractiveness of IDT project by a developer as part of pre-investment research will serve as a tool for forming a realistic picture of the future development of the territory within the IDT and determining the most effective scenarios for its implementation. The developer's entry into the IDT project can subsequently have a significant impact on various project participants, from state and municipal authorities and developers to citizens and business representatives. For government representatives, the IDT becomes a tool for systematic planning, allowing them to harmonize interests and ensure the sustainable development of the urban environment and the economic climate as a whole. Developers make a profit and gain new opportunities to implement large-scale projects. The population and the business community benefit from infrastructure upgrades, improved living standards and better conditions for business. Thus, the IDT has a multiple effect and thereby forms an interconnected system in which the coordinated efforts of all programme participants (stakeholders) enable them to reap positive benefits in the future (Fig. 4) [23–26].

REFERENCES

1. Approval of the Strategy for the development of the construction industry and housing and public utilities of the Russian Federation for the period up to 2030 with a forecast up to 2035 : Order of the Government of the Russian Federation of October 31, 2022 No. 3268-R. URL: http://static.government.ru/media/files/AdmXczBBUGfGNM8tz16r7RkQcsgP3LAm.pdf (date of request: 05.07.2025) (rus.).
2. On Amendments to the Urban Development Code of the Russian Federation and Certain Legislative acts of the Russian Federation in order to ensure the integrated development of territories : Federal Law No. 494-FZ of December 30, 2020. URL: https://www.consultant.ru/document/cons_doc_LAW_372677/ (rus.).
3. Urban Development Code of the Russian Federation : Federal Law No. 190-FZ of 12/29/2004: adopted by the State Duma on 22.12.2004. URL: https://www.consultant.ru/document/cons_doc_LAW_51040 (rus.).
4. Monitoring the implementation of the mechanism of integrated development of territories by the subjects of the Russian Federation. Website of the Ministry of Construction and Housing and Communal Services of the Russian Federation. URL: https://minstroyrf.gov.ru/trades/kompleksnoe-razvitie-territoriy/1-monitoring-realizatsii-mekhanizma-kompleksnogo-razvitiya-territoriy-subektami-rossiyskoy-federatsii/ (rus.).
5. Il'ina I.N. Innovative approaches in modeling complex urban investment projects for city development. Property relations in the Russian Federation. 2017; 1(184):16-25. EDN XHUNGP (rus.).
6. Jacques E., Neuenfeldt Júnior A., De Paris S., Francescatto M., Siluk J. Smart cities and innovative urban management: Perspectives of integrated technological solutions in urban environments. Heliyon. 2024; 10(4):e27850. DOI: 10.1016/j.heliyon.2024.e27850
7. Malitskaya E.A. Program and target approach in project management for complex territory development. Bulletin of the Institute of Economics of the Russian Academy of Sciences. 2016; 2:56-68. EDN VSKFGT (rus.)
8. Lai Y. Optimization of urban and rural ecological spatial planning based on deep learning under the concept of sustainable development. Results in Engineering. 2023; 19:101343. DOI: 10.1016/j.rineng.2023.101343
9. Oktay D. Sustainable urbanism and identity: A holistic perspective for future cities. Perspectives in Architecture and Urbanism. 2024; 1(2):100016. DOI: 10.1016/j.pau.2024.100016
10. Methodological recommendations for the integrated development of residential areas. Moscow, Institute of Urban Economics Foundation, 2022. URL: https://www.urbaneconomics.ru/sites/default/files/metodicheskie_rekomendacii_po_krt_zhiloi_zastroiki.pdf (date of request: 18.07.2025) (rus.).
11. Methodological recommendations for spatial and economic modelling of integrated development projects for residential areas. Moscow, Institute of Urban Economics Foundation, 2022. URL: https://www.urbaneconomics.ru/sites/default/files/metodicheskie_reko-

mendacii_po_prostranstvenno-ekonomicheskomu_modelirovaniyu_proektov_krt_zhiloi_zastroiki.pdf (rus.).
12. Lakhmetkina N.I. The concept and essence of the investment attractiveness of an enterprise. Financial Analytics: Science and Experience. 2010; 16(40):35-39. EDN MVWGTJ (rus.).
13. Zakirova E.R. The economic content of the category "investment attractiveness". Proceedings of the Voronezh State University of Engineering Technologies. 2016; 2(68):327-333. DOI: 10.20914/2310-1202-2016-2-327-333. EDN WNXOYN (rus.).
14. Snieska V., Zykiene I. City Attractiveness for Investment: Characteristics and Underlying Factors. Procedia — Social and Behavioral Sciences. 2015; 213:48-54. DOI: 10.1016/j.sbspro.2015.11.402
15. Nikolaev D.A. Integrated development of the territories as a tool for ensuring regional economic security: new opportunities and implementation mechanisms. Lomonosov Public Administration Journal. Series 21. 2025; 22(2):166-183. DOI: 10.55959/MSU2073-2643-21-2025-2-166-183 (rus.).
16. Sternik S.G. Integrated development of territories and regional economy. Studies on Russian economic development. 2023; 2(197):57-75. DOI: 10.47711/0868-6351-197-57-75. EDN LSMBKA (rus.).
17. Kukina I.V., Ryaposov I.A., Kamalova K.V., Chui Ya.V. A panacea or unregulated density of the city. Project Baikal. 2021; 18(70):140-148. DOI: 10.51461/projectbaikal.70.1903. EDN FMSZLQ (rus.).
18. Belyaev V.L. Evaluating the standardization effectiveness of integrated area development: the urban planning aspect. Vestnik MGSU. 2023; 18(3):334-345. DOI: 10.22227/1997-0935.2023.3.334-345. EDN PTPTTX (rus.).
19. Popkova A.A., Konev Yu.M., Kanyukov M.V. Integrated development of territories: current state and problems of implementation, Proceedings of Higher Educational Institutions. Sociology. Economy. Politics. 2023; 16(2):38-53. DOI: 10.31660/1993-1824-2023-2-38-53. EDN AVWSDT (rus.).
20. Belyakov S.I. Mechanisms for the formation and development of the investment portfolio of organizations realizing in the integrated development of territories. Real estate: economics, management. 2023; S3:164-167. EDN BKEDCL (rus.).
21. Abdalov R.E. Management of the pre-project stage of an investment and construction project: aspects of the implementation of normative and methodological support for the activities of organizations. Real Estate: Economics, Management. 2024; 2:54-60. EDN ZVWHWL.
22. Abdalov R.E., Kulakov K.Yu. The pre-project stage of a development project: strategic prerequisites for the formation of new management mechanisms. Real estate: economics, management. 2024; S3:66-71. EDN BYRZUX (rus.).
23. Papikyan L.M. Assessment of the multiplier impact of investment and construction projects on the development of territories : dissertation for the degree of Candidate of Economic Sciences. 2018; 243. EDN EYSQKM (rus.).
24. Bandorin L.E., Basharin A.V. On finding a balance between public and private interests in the integrated development of the territory. Law. 2023; 12:55-66. DOI: 10.37239/0869-4400-2023-20-12-55-66. EDN DZRXMI (rus.).
25. Kirsanov A.R. Integrated development of territories: results, problems, prospects. Property relations in the Russian Federation. 2025; 4(283):9-16. EDN CGOERY (rus).
26. Esteban-Narro R., Lo Iacono Ferreira V., Torregrosa-L pez J.I., Esteban-Narro R. Urban Stakeholders for Sustainable and Smart Cities: An Innovative Identification and Management Methodology. Smart Cities. 2025; 8(2):41. DOI: 10.3390/smartcities8020041

Комплексное развитие территории: принцип механизма и его привлекательность для девелоперов

Целью данной научной статьи является анализ аспектов привлекательности проектов комплексного развития территории (КРТ) для девелоперов. Для этого было проведено поэтапное исследование, в начале которого рассмотрено основное понятие механизма КРТ и на основании нормативно-правовых положений и прикладного замысла описана концептуальная основа КРТ, содержащая в себе функционально-целевые векторы действия и четыре вида КРТ, через которые механизм имеет свое проявление. Далее выдвинуто предположение о предпосылках возникновения механизма КРТ, среди которых, например, возрастающий интерес к комплексности и кластеризации экономических систем, а также высокая потребность в инновационном развитии всех сфер жизнедеятельности. Авторы отмечают, что ключевыми субъектами реализации проекта КРТ являются девелопер и государство, обладающие особенными действующими силами, и совместное взаимодействие которых позволяет добиться положительной синергии для достижения одной из наиболее важных национальных целей по формированию качественной и безопасной среды жизнедеятельности. Выдвинуто суждение о том, что именно девелопера следует признавать основным актором проекта КРТ, потому как без его ресурсов качественная трансформация выделенной государством территории невозможна. С этой точки зрения проведен авторский анализ и сформулировано понятие инвестиционной привлекательности проекта КРТ, а также на основании преимуществ и несовершенств механизма определены основные аспекты привлекательности проекта КРТ для девелоперской компании. В заключении авторами проанализирован множественный эффект механизма КРТ, который способен улучшить существование заинтересованных сторон — инвестора (девелопера), государственных структур, население, бизнес, оказывая на каждое из них свое положительное влияние. Таким образом, предполагается, что дальнейшие исследования и развитие тематики оценки инвестиционной привлекательности в рамках предынвестиционной проработки повысят эффективность взаимовыгодного партнерства девелоперов и государства в области КРТ, позволяя создавать устойчивую среду для жизнедеятельности.

Ключевые слова: *комплексное развитие территории (КРТ), девелопмент недвижимости, девелопер, государство, жилищные условия, городская среда, земельные активы, инвестиционная привлекательность проекта КРТ, предынвестиционная проработка*

СПИСОК ИСТОЧНИКОВ

1. Об утверждении Стратегии развития строительной отрасли и жилищно-коммунального хозяйства РФ на период до 2030 г. с прогнозом до 2035 г. : Распоряжение Правительства РФ от 31 октября 2022 г. № 3268-р. URL: http://static.government.ru/media/files/AdmXczBBUGfGNM8tz16r7RkQcsgP3LAm.pdf
2. О внесении изменений в Градостроительный кодекс Российской Федерации и отдельные законодательные акты Российской Федерации в целях обеспечения комплексного развития территорий : Федеральный закон от 30 декабря 2020 г. № 494-ФЗ. URL: https://www.consultant.ru/document/cons_doc_LAW_372677/
3. Градостроительный кодекс Российской Федерации : Федеральный закон № 190-ФЗ от 29.12.2004: принят Государственной Думой 22.12.2004. URL: https://www.consultant.ru/document/cons_doc_LAW_51040
4. Мониторинг реализации механизма комплексного развития территорий субъектами Российской Федерации. Сайт Министерства строительства и жилищно-коммунального хозяйства Российской Федерации. URL: https://minstroyrf.gov.ru/trades/kompleksnoe-razvitie-territoriy/1-monitoring-realizatsii-mekhanizma-kompleksnogo-razvitiya-territoriy-subektami-rossiyskoy-federatsii/
5. Ильина И.Н. Инновационные подходы к формированию моделей комплексного инвестиционного градостроительного развития городских территорий // Имущественные отношения в Российской Федерации. 2017. № 1 (184). С. 16–25. EDN XHUNGP.

6. Jacques E., Neuenfeldt Júnior A., De Paris S., Francescatto M., Siluk J. Smart cities and innovative urban management: Perspectives of integrated technological solutions in urban environments // Heliyon. 2024. No. 10 (4). P. e27850. DOI: 10.1016/j.heliyon.2024.e27850
7. Малицкая Е.А. Программно-целевой подход в управлении проектами комплексного развития территории // Вестник Института экономики Российской академии наук. 2016. № 2. С. 56–68. EDN VSKFGT.
8. Lai Y. Optimization of urban and rural ecological spatial planning based on deep learning under the concept of sustainable development // Results in Engineering. 2023. No. 19. P. 101343. DOI: 10.1016/j.rineng. 2023.101343
9. Oktay D. Sustainable urbanism and identity: A holistic perspective for future cities // Perspectives in Architecture and Urbanism. 2024. No. 1 (2). P. 100016. DOI: 10.1016/j.pau.2024.100016
10. Методические рекомендации по комплексному развитию территорий жилой застройки. М. : Фонд «Институт экономики города», 2022. URL: https://www.urbaneconomics.ru/sites/default/files/metodicheskie_rekomendacii_po_krt_zhiloi_zastroiki.pdf
11. Методические рекомендации по пространственно-экономическому моделированию проектов комплексного развития территорий жилой застройки. М. : Фонд «Институт экономики города», 2022. URL: https://www.urbaneconomics.ru/sites/default/files/metodicheskie_rekomendacii_po_prostranstvenno-ekonomicheskomu_modelirovaniyu_proektov_krt_zhiloi_zastroiki.pdf
12. Лахметкина Н.И. Понятие и сущность инвестиционной привлекательности предприятия // Финансовая аналитика: проблемы и решения. 2010. № 16 (40). С. 35–39. EDN MVWGTJ.
13. Закирова Э.Р. Экономическое содержание категории «инвестиционная привлекательность» // Вестник Воронежского государственного университета инженерных технологий. 2016. № 2 (68). С. 327–333. DOI: 10.20914/2310-1202-2016-2-327-333. EDN WNXOYN.
14. Snieska V., Zykiene I. City Attractiveness for Investment: Characteristics and Underlying Factors // Procedia — Social and Behavioral Sciences. 2015. Vol. 213. Pp. 48–54. DOI: 10.1016/j.sbspro.2015.11.402
15. Николаев Д.А. Комплексное развитие территорий как инструмент обеспечения региональной экономической безопасности: новые возможности и механизмы реализации // Вестник Московского Университета. Сер. 21. Управление (государство и общество). 2025. № 22 (2). С. 166–183. DOI: 10.55959/MSU2073-2643-21-2025-2-166-183
16. Стерник С.Г. Комплексное развитие территорий и экономика регионов // Проблемы прогнозирования. 2023. № 2 (197). С. 57–75. DOI: 10.47711/0868-6351-197-57-75. EDN LSMBKA.
17. Кукина И.В., Ряпосов И.А., Камалова К.В., Чуй Я. КРТ — панацея или нерегламентируемое уплотнение города // Проект Байкал. 2021. № 18 (70). С. 140–148. DOI: 10.51461/projectbaikal.70.1903. EDN FMSZLQ.
18. Беляев В.Л. Оценка эффективности стандартизации комплексного развития территории: градостроительный аспект // Вестник МГСУ. 2023. № 3 (18). С. 334–345. DOI: 10.22227/1997-0935.2023.3.334-345. EDN PTPTTX.
19. Попкова А.А., Конев Ю.М., Канюков М.В. Комплексное развитие территорий: современное состояние и проблемы реализации // Известия высших учебных заведений. Социология. Экономика. Политика. 2023. № 2 (16). С. 38–53. DOI: 10.31660/1993-1824-2023-2-38-53. EDN AVWSDT.
20. Беляков С.И. Механизмы формирования и развития инвестиционного портфеля организаций, осуществляющих комплексное развитие территорий // Недвижимость: экономика, управление. 2023. № S3. С. 164–67. EDN BKEDCL.
21. Abdalov R.E. Management of the pre-project stage of an investment and construction project: aspects of the implementation of normative and methodological support for the activities of organizations // Real Estate: Economics, Management. 2024. No. 2. Pp. 54–60. EDN ZVWHWL.
22. Абдалов Р.Е., Кулаков К.Ю. Предпроектная стадия девелоперского проекта: стратегические предпосылки к формированию новых механизмов управления // Недвижимость: экономика, управление. 2024. № S3. С. 66–71. EDN BYRZUX.
23. Папикян Л.М. Оценка мультипликативного воздействия инвестиционно-строительных проектов на развитие территорий : дис. … канд. эконом. наук. 2018. 243 с. EDN EYSQKM.
24. Бандорин Л.Е., Башарин А.Б. О поиске баланса между публичными и частными интересами при комплексном развитии территории // Закон. 2023. № 12. С. 55–66. DOI: 10.37239/0869-4400-2023-20-12-55-66. EDN DZRXMI.
25. Кирсанов А.Р. Комплексное развитие территорий: итоги, проблемы, перспективы // Имущественные отношения в Российской Федерации. 2025. № 4 (283). С. 9–16. EDN CGOERY.
26. Esteban-Narro R., Lo Iacono Ferreira V., Torregrosa-L pez J.I. Urban Stakeholders for Sustainable and Smart Cities: An Innovative Identification and Management Methodology // Smart Cities. 2025. No. 8. P. 41. DOI: 10.3390/smartcities8020041

Об авторах: **Кулаков Кирилл Юрьевич** — доктор экономических наук, профессор кафедры Организации строительства и управления недвижимостью; **Национальный исследовательский Московский государственный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; РИНЦ ID: 360164, ORCID: 0000-0003-2081-7045; kkulakov@bk.ru;

Абдалов Роман Евгеньевич — аспирант кафедры Организации строительства и управления недвижимостью; **Национальный исследовательский Московский государственный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; SPIN-код: 2291-2191, AuthorID: 1226983, ORCID: 0009-0006-2366-6397; abdalov.romain@yandex.ru.

For citation: Kulakov K.Yu., Abdalov R.E. Integrated development of the territory: the principle of the mechanism and its attractiveness for developers. *Real Estate: Economics, Management*. 2025; 3:28-34.

Для цитирования: *Кулаков К.Ю., Абдалов Р.Е.* Integrated development of the territory: the principle of the mechanism and its attractiveness for developers // Недвижимость: экономика, управление. 2025. № 3. С. 28–34.

UDC 696.1:658.5

Zvonov I.A.
Kashirina N.V.

Corporate registers of requirements on the path of development of technical regulation in construction

This paper examines the main changes in the normative and technical regulation of the construction industry associated with the beginning of the implementation of the register principle, digital transformation and the gradual transition to parametric standardization. Most of the ongoing changes are aimed at reducing the time and cost of surveys, design and construction, improving the quality of design and construction products. They are becoming everyday professional practice.
The paper pays special attention to the registry principle, which provides for the formation of an integrated system of regulatory documents containing general mandatory requirements applicable to all stages of the life cycle of capital construction projects. Such registries can and should contain a full volume of information and the tools necessary for working with it, which are required by a specialist. In this regard, registries are increasingly called digital technology. The paper briefly analyzes the results of the first year of operation of the digital Register of Requirements to be used in engineering surveys, design, construction and demolition. The prospects for converting this Register of Requirements into machine-readable and machine-understandable formats, lists of tasks to be solved and conditions for further development are considered. A comparison with registry tools used in Russia and foreign countries is made. The issues of updating requirements within the existing and newly created registries are raised. A rationale for the use is proposed and an assessment of the capabilities of corporate registries of requirements as part of information systems or standards of organizations is carried out. In the paper, the authors touched upon promising issues of forming automated requirements management systems. Continuing with previous publications, the authors develop issues of system integration of requirements registers and parametric standardization technologies.
Keywords: *Digital Register of Requirements, parametric standardization method, machine-readable format, machine-understandable format, organizational standard, corporate registers*



Zvonov
Ilya Alexandrovich,
Senior lecturer of the Department "Organization of Construction and Real Estate Management"; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; SPIN-code: 6197-7370, Scopus AuthorID: 57204363101, ORCID: 0000-0002-4854-9903; ZvonovIA@mgsu.ru



Kashirina
Natalia Vladimirovna,
lecturer; Moscow Polytechnic University; 38 Bolshaya Semyonovskaya St., Moscow, 107023, Russian Federation; SPIN-code: 2752-6270, ORCID: 0000-0003-1787-441X; natalia.vk90@gmail.com

A YEAR WITH THE REGISTER OF REQUIREMENTS

The Russian construction industry has been undergoing significant changes in recent years. The process of updating and revising norms and standards is underway, taking into account the transition to the register principle and parametric standardization. The information system "Register of requirements to be applied in engineering surveys, architectural and construction design, examination of design documentation and (or) examination of the results of engineering surveys, construction, reconstruction, major repairs, operation and demolition of capital construction projects" [1] has been operating for a year now (hereinafter referred to as the Register of Requirements), posted on the portal "Stroykompleks.RF". And for more than two years, tasks related to the transition to machine-readable and machine-interpretable regulatory and technical documentation have been actively discussed and implemented. Almost all organizations subordinate to the Ministry of Construction are involved in these tasks, adding to them the development of a unified classification system for building materials, products and structures, filling the classifier of construction information, and others [2].

In particular, after the entry into force of Federal Law No. 653-FZ of 25.12.2023 "Amendments to the Federal Law «Technical Regulations on the Safety of Buildings and Structures» and Certain Legislative Acts", the evidentiary base of technical regulations on the safety of buildings and structures has changed:

- the basis for compliance with the requirements of the Federal Law is now the Register of Requirements;
- international standards, international codes of practice, regional codes of practice and regional standards can be used as the evidentiary base of technical regulations by law;
- organization standards (OS) are equal in their status for the evidentiary base of technical regulations to codes of practice, GOSTs and other standardization documents [3].

As another type of document, the application of which ensures compliance with the requirements of the technical regulations in the new version of Article 6 of 384-FZ (TR on the safety of buildings and structures with amendments as of December 25, 2023), the following will be considered:

- research results;
- calculations and (or) tests;
- modelling of scenarios for the occurrence of hazardous natural processes and phenomena and (or) man-made impacts, including in the case of an unfavourable combination of hazardous natural processes and phenomena and (or) man-made impacts;
- assessment of the risk of occurrence of hazardous natural processes and phenomena and (or) man-made impacts. The Register of Requirements does not provide for a division

of requirements into “mandatory” and voluntary, and its creation and development are directly related to the process of converting regulatory and technical documentation of standards into a machine-readable and machine-interpretable format [4].

The next step in the modernization of the construction industry is the transition to parametric standardization. Since April 12, 2025, CP 555.1325800.2025 “System of regulatory documents in construction has been put into effect. Basic Provisions”. In addition to the fact that this document establishes the basic provisions of the system of regulatory documents in construction and is the basis for further updating and digitalization of regulatory and technical documentation, it also assumes the introduction of elements of the parametric method, which allows taking into account the characteristics of specific construction sites and regions [5]. The new standardization system described in the CP is aimed at stimulating the innovative development of the industry, improving the quality and safety of construction projects. “A clear hierarchy of requirements and other types of provisions of regulatory documents, ensuring the «modularity» of new generation standards, transparency and verifiability of the established parameters, as well as interdisciplinarity and consistency of regulatory requirements are the fundamental principles of the parametric method of standardization in construction”, said Alexander Neklyudov [2].

In relation to the digital transformation of the industry, the approval of the new CP assumes the possibility of translating the requirements of regulatory technical documents into a machine-readable format for further integration into digital tools (BIM, CAD, calculation complexes) and automation of checks and analytical scenarios. By 2030, it is planned to translate the Register of Requirements into a machine-readable format, eliminating double interpretations and discrepancies. It will be based on regulatory and technical documentation updated in accordance with the provisions of the new CP. As noted by the CP developers and experts, these steps are designed to automate the assessment of compliance of construction projects with safety and quality requirements, reduce the design and construction time, and increase the efficiency of control and supervisory activities [2]. Based on the information presented, it can be concluded that, firstly, in order to create a Register of Requirements in a machine-readable format, as well as to switch to using the parametric standardization method, it is necessary that the provisions of regulatory acts be clearly formulated and unambiguously interpreted by representatives of the professional community of architects, surveyors, designers and experts [5]. Secondly, methods or tools are needed to formalize clear and unambiguous provisions of regulatory acts in the structure of relevant documents, to extract them from texts, and to transform them into logical units for further integration into specialized software and for use in automation. Thirdly, methods and tools are needed for effective work with Registers of Requirements and Parameters, as well as for their use at all stages of the life cycle of capital construction projects.

ANALOGUES AND ALTERNATIVES

In connection with the above-described changes in approaches to regulatory control occurring in the construction industry, working with requirements registers should become a permanent practice. And following the new requirements for the design and use of regulatory documents, new requirements for specialists in the construction industry appear, when the introduction of new working methods in a large number of construction and design processes becomes necessary. At the moment, the Requirements Register contains about 163,600 requirements from more than 1,000 documents, but as feedback from industry specialists shows, this is quite a few. In this regard, individual IT sector companies have begun developing their own registers. In particular, JSC “Kodeks” is developing the “TechExpert Requirements Register: Construction”. As the developers note, the register already contains more than 270,000 requirements extracted from more than 1,300 regulatory documents, including mandatory requirements from the Register posted on the Stroykompleks.RF portal, as well as the designer's requirements for voluntary application from various regulatory documents [6]. It should be noted that the developers aim not only to identify requirements from as many documents as possible required by specialists, but also to ensure that these requirements are updated. At the same time, the task of updating is implemented in different ways.

What can foreign experience tell us about these issues? Most often, such solutions are related to the automation of verification of compliance of construction projects with the requirements of standards in BIM models and involve the creation of a system of rules, knowledge graphs and ontologies (automated compliance checking, ACC or Automated Compliance Checking) [7]. It should be noted that information models of buildings are used as a source of structured data in many countries. ACC consists of 4 stages: conversion of the standard into machine-readable formats, preparation of data for design (based on BIM), analysis and justification of compliance, presentation of results and reporting. Similar solutions exist in the USA — CodeComply [8], in the EU [9], and in China — Intelligent Project Verification [10]. The check is carried out on the basis of translating the standards into xml format, and then entered into a graph database to generate various intelligent scenarios. Some of the listed solutions are aimed at transforming building codes and regulations described in plain text into machine-readable documents using a domain-specific rule language, as well as automating the process of checking compliance with regulatory requirements using a semantic structure that combines processes, regulations, data and digital tools for issuing building permits. In a similar form, Registries of Requirements exist abroad. For example, in the form of codes — the International Residential Code (IRC). This is a comprehensive code that includes requirements for construction, plumbing, mechanics, gas fuel and electricity for one- and two-family homes and townhouses up to three stories high [11].

The main problems both in Russia and abroad, when developing such solutions, are high labor intensity and complexity. These include: problems with terminology, inconsistency and difficulty in finding a balance between human control and algorithmic solutions, lack of machine-interpretable norms and formalization of regulatory texts, the need for manual processing of information and its formalization, frequent changes in regulations. Therefore, the first and important steps to solve these problems are called: cooperation of regulators, developers and industry companies, parallel development and formalization of regulatory documents (creation of methods and algorithms for automation of various parts of this process), quality and uniformity of terminology.

CORPORATE REQUIREMENTS REGISTERS

The problems described are typical for developers: government agencies that create registers and IT companies that create the corresponding software. At the same time, the methods for applying registers that suit them are often not suitable for specialists on the ground. The designer is not interested in the specifics of digital document markup, semantic analysis, etc. In this regard,

a logical question arises: does a specialist need to wait until all the requirements necessary for his work are entered into the registers, and a method for their application is developed, or any IT tools are created for further work with requirements on the ground. If we allow this option, then the time required to implement the tools in work will consist of the time of waiting for a ready-made solution, as well as the time required to acquire skills in working with ready-made tools. All this lengthens the time lag and reduces the opportunities for quick implementation in work and for building your own convenient work algorithms within your company to solve specific problems. This is becoming especially important for large players who want to be innovative and to lead in their industry, as well as for small companies where there are resource constraints. At the same time, the described problems concern work with the Register of Requirements already today, and the regulator is already requiring a further transition to parametric standardization. After all, a standardization system reformatted in this way will be able to more successfully solve the problems facing construction and ensure increased safety of construction products, their reliability and quality, improve the energy efficiency of buildings, working conditions and life of citizens [12].

Therefore, it seems possible and more suitable to start working with the requirements registers in a more specific way, for example, by creating Corporate Requirements Registers, without waiting for ready-made solutions. The authors of the article offer the following definition of the Corporate Requirements Register: it is a database in which the regulatory requirements that the company applies and implements within the framework of its specific activities are structured and systematized. The Corporate Requirements Register can be part of the OS. And as was indicated above, the OS, in connection with changes in legislation, can be used as an evidence base for technical regulations. Construction OS today is a tool for a succinct and accessible presentation of the system of characteristics, requirements, parameters in relation to manufactured products or services rendered. They ensure transparency and efficiency of quality control procedures for products and processes [13].

The purpose of the Corporate Requirements Registry is to automate the control and management of requirements and facilitate the transition to parametric standardization. The tasks of the Corporate Registry:

- sorting and uploading checklists with requirements for relevant objects, processes, works, etc.;
- monitoring and updating requirements in accordance with changes in legislation in automatic or semi-automatic mode;
- assessment of compliance of completed works with requirements in automatic or semi-automatic mode;
- connection with the source of the requirement (with the relevant requirement in the Registry on the Stroykompleks.RF portal, with the requirement (document) in the professional reference system or the internal documentation fund of the company);
- relationship of the requirement with the documents to which it refers (if any);
- elimination of duplications, contradictions between requirements;
- simplification of the process of transferring the necessary requirements between company employees;
- assistance in integrating requirements into the company's internal documents, as well as into information models and specialized software;
- systematization of alternative solutions and the company's accumulated experience, research results, calculations, tests, scenario modelling, etc.

Since the Corporate Register can be supplemented with requirements reflected in the OS, the achievement of which will ensure compliance with the key requirements for functional and (or) operational characteristics, the creation and maintenance of such a register can become a step towards the transition to the parametric method of standardization. According to CP 555.1325800.2025 [14]: “Parametric method of standardization in construction: a method for establishing regulatory requirements, in which the establishment of key requirements is applied only to the functional and (or) operational characteristics of the standardization object, including in the form of requirements for quantitative parameters, regardless of its design and execution. In this case, the methods for achieving the key requirements are established with the possibility of using acceptable and (or) alternative solutions not established by regulatory documents”. It is assumed that the requirements in the Corporate Registers can be associated with any source documents. Also, the Corporate Registers can have preliminary settings for typical tasks and generated collections.

CONCLUSIONS

According to the developers, the Requirements Register is still a prototype, and the inconveniences of working with it are just imperfections, and only by 2030 will it acquire the planned functionality and capabilities. Four years is a decent waiting period for a dynamically developing industry, and perhaps IT company registries, foreign analogues, or Corporate registries will have time to find and occupy certain niches in construction. This may especially concern the field of individual and non-capital construction, which is experiencing a deficit of regulatory and technical regulation even at the document level.

REFERENCES

1. Register of requirements to be applied when performing engineering surveys, carrying out architectural and construction design, conducting an expert review of project documentation and (or) an expert review of the results of engineering surveys, construction, reconstruction, major repairs, operation, and demolition of capital construction facilities in accordance with the Decree of the Government of the Russian Federation dated 31.08.2023 No. 1417. URL: https://стройкомплекс.рф/rntd (rus.).
2. Shirinova E. The Ministry of Construction has outlined the priorities of technical regulation in construction: the parametric method, digitalization, and a machine-readable register. 18.04.2025. URL: https://www.all-sro.ru/news/minstroy-oboznachil-prioritety-tekhnicheskogo-regulirovaniya-v-stroitelstve-parametricheskiy-metod-ts (rus.).
3. Question-Answer: Changes in the Technical Regulations on the Safety of Buildings and Structures. Igor Alekseyev, Deputy Director of the State Expertise of the Republic of Tatarstan, answers the applicants' questions. 20.05.2025. URL: https://gosekspertiza-rt.ru/press-center/news/vopros-otvet-izmeneniya-v-tekhnicheskom-reglamente-o-bezopasnosti-zdaniy-i-sooruzheniy/ (rus.).
4. Materials of the website of the Federal Autonomous Institution “FCC”. URL: https://faufcc.ru/deiatelnost/ (rus.).
5. The basic set of rules “System of Regulatory Documents in Construction has been approved. Basic Provisions”. 18.03.2025. URL: https://minstroyrf.gov.ru/press/utverzhden-bazovyy-svod-pravil-sistema-normativnykh-dokumentov-v-stroitelstve-osnovnye-polozheniya/ (rus.).
6. Construction Requirements Registers: How to Adapt to the New Reality. 28.07.2025. “Construction.ru”. URL: https://rcmm.ru/tehnika-

i-tehnologii/70631-reestry-trebovanij-v-stroitelstve-kak-adaptirovatsja-k-novoj-realnosti.html (rus.).
7. Fuchs S., Fauth J., Boden M., Amor R. The challenge of automated compliance checking: a regulatory view. European Conference on Computing in Construction CIB W78 Conference on IT in Construction Porto, Portugal July 14–17, 2025. URL: https://mediatum.ub.tum.de/doc/1782110/q3a2hqyaxrf4aagu0iqb0x8zu.2025_Fuchs_ChallengeOfACC.pdf
8. Materials of the website codecomply.ai. URL: https://codecomply.ai/
9. Costa G., Vakaj E., Lavikka R., Lefran ois M., Zimmermann A., Mecharnia Th. et al. Formalization of building codes and regulations in knowledge graphs. Digital Building Permit Conference 2024: Book of Abstracts. 2024; 120-125. DOI: 10.5281/zenodo.12760551
10. Lin Jia-rui, Zhou Yu-cheng, Zheng Zhe, Lu Xin-zheng. Research and application of intelligent design review. Engineering Mechanics. 2023; 40(7):25-38. DOI: 10.6052/j.issn.1000-4750.2021.11.0908
11. Materials of the site codes.iccsafe.org. URL: https://codes.iccsafe.org/content/Irc2021p1
12. Zvonov I.A., Kashirina N.V. Prospects for the application of the parametric method of standardization in the context of the register principle of developing technical requirements. Real estate: economics, management. 2024; 2:73-77. DOI: 10.22337/2073-8412-2024-2-73-77. EDN LFQSQR. (rus.).
13. Zvonov I.A., Romanova G.R., Zvonova L.V., Pluzhnik A.A. Actual problems of transition of the construction industry to the application of the organization's standards system in new conditions. Real estate: economics, management. 2024; S3:218-222. EDN VMUVQQ. URL: https://n-eu.iasv.ru/index.php/neu/issue/view/31/40. (rus.).
14. CP 555.1325800.2025. System of regulatory documents in construction. Basic provisions, Ministry of Construction of Russian Federation. URL: https://www.minstroyrf.gov.ru/docs/422272/ (rus.).

Корпоративные реестры требований на пути развития технического нормирования в строительстве

В настоящей статье рассмотрены основные изменения в нормативно-техническом регулировании строительной отрасли, связанные с началом реализации реестрового принципа, цифровой трансформацией и поэтапным переходом к параметрическому нормированию.

Большинство происходящих изменений направлено на сокращение сроков и стоимости изысканий, проектирования и строительства, повышение качества проектной и строительной продукции. Они становятся повседневной профессиональной практикой.

Особое внимание в статье уделено реестровому принципу, предусматривающему формирование целостной системы нормативных документов, содержащих общие обязательные требования, применительно ко всем этапам жизненного цикла объектов капитального строительства. Такие реестры могут и должны содержать полный объем информации и необходимые для работы с ней инструменты, требующиеся специалисту. В связи с этим реестры все чаще называют цифровой технологией.

Кратко проанализированы результаты первого года работы цифрового Реестра требований, подлежащих применению при выполнении инженерных изысканий, проектировании, строительстве и сносе. Рассмотрены перспективы перевода данного Реестра требований в машиночитаемый и машинопонимаемый форматы, перечни решаемых задач и условия дальнейшего развития. Проведено сравнение с реестровыми инструментами, применяемыми в России и зарубежных странах. Подняты вопросы актуализации требований в рамках существующих и создаваемых реестров. Предложено обоснование применения и проведена оценка возможностей корпоративных реестров требований в составе информационных систем или стандартов организаций. В статье авторы коснулись перспективных вопросов формирования автоматизированных систем управления требованиями. В продолжение предыдущих публикаций авторы развивают вопросы системной интеграции реестров требований и технологий параметрического нормирования.

Ключевые слова: *Цифровой Реестр требований, параметрический метод нормирования, машиночитаемый формат, машинопонимаемый формат, стандарт организации, корпоративные реестры*

СПИСОК ИСТОЧНИКОВ

1. Реестр требований, подлежащих применению при выполнении инженерных изысканий, осуществлении архитектурно-строительного проектирования, проведении экспертизы проектной документации и (или) экспертизы результатов инженерных изысканий, строительстве, реконструкции, капитальном ремонте, эксплуатации и сносе объектов капитального строительства в соответствии с постановлением Правительства Российской Федерации от 31.08.2023 № 1417. URL: https://стройкомплекс.рф/rntd
2. Ширинова Э. Минстрой обозначил приоритеты технического регулирования в строительстве: параметрический метод, цифровизация и машиночитаемый реестр. 18.04.2025. URL: https://www.all-sro.ru/news/minstroy-oboznachil-prioritety-tekhnicheskogo-regulirovaniya-v-stroitelstve-parametricheskiy-metod-ts
3. Вопрос-ответ: изменения в техническом регламенте о безопасности зданий и сооружений. На вопросы заявителей отвечает заместитель директора Госэкспертизы РТ Игорь Алексеев. 20.05.2025. URL: https://goseksрertiza-rt.ru/press-center/news/vopros-otvet-izmeneniya-v-tekhnicheskom-reglamente-o-bezopasnosti-zdaniy-i-sooruzheniy/
4. Материалы сайта ФАУ «ФЦС». URL: https://faufcc.ru/deiatelnost/
5. Утвержден базовый свод правил «Система нормативных документов в строительстве. Основные положения». 18.03.2025. URL: https://minstroyrf.gov.ru/press/utverzhden-bazovyy-svod-pravil-sistema-normativnykh-dokumentov-v-stroitelstve-osnovnye-polozheniya/
6. Реестры требований в строительстве: как адаптироваться к новой реальности. 28.07.2025 // «Строительство.ru». URL: https://rcmm.ru/tehnika-i-tehnologii/70631-reestry-trebovanij-v-stroitelstve-kak-adaptirovatsja-k-novoj-realnosti.html
7. Fuchs S., Fauth J., Boden M., Amor R. The challenge of automated compliance checking: a regulatory view // European Conference on Computing in Construction CIB W78 Conference on IT in Construction Porto, Portugal July 14–17, 2025. URL: https://mediatum.ub.tum.de/doc/1782110/q3a2hqyaxrf4aagu0iqb0x8zu.2025_Fuchs_ChallengeOfACC.pdf
8. Материалы сайта CodeComply.Ai. URL: https://codecomply.ai/
9. Costa G., Vakaj E., Lavikka R., Lefran ois M., Zimmermann A., Mecharnia Th. et al. Formalization of building codes and regulations in knowledge graphs // Digital Building Permit Conference 2024: Book of Abstracts. 2024. Pp. 120–125. DOI: 10.5281/zenodo.12760551
10. Lin Jia-rui, Zhou Yu-cheng, Zheng Zhe, Lu Xin-zheng. Research and application of intelligent design review // Engineering Mechanics. 2023. No. 40 (7). Pp. 25–38. DOI: 10.6052/j.issn.1000-4750.2021.11.0908
11. Материалы сайта codes.iccsafe.org. URL: https://codes.iccsafe.org/content/Irc2021p1
12. Звонов И.А., Каширина Н.В. Перспективы применения параметрического метода нормирования в условиях реестрового принципа разработки технических требований // Недвижимость: экономика, управление. 2024. № 2. С. 73–77. DOI: 10.22337/2073-8412-2024-2-73-77. EDN LFQSQR.
13. Звонов И.А., Романова Г.Р., Звонова Л.В., Плужник А.А. Актуальные проблемы перехода строительной отрасли к применению системы стандартов организации в новых условиях // Недвижимость: экономика, управление. 2024. № S3. С. 218–222.

EDN VMUVQQ. URL: https://n-eu.iasv.ru/index.php/neu/issue/view/31/40
14. СП 555.1325800.2025 «Система нормативных документов в строительстве. Основные положения». Минстрой России. URL: https://www.minstroyrf.gov.ru/docs/422272/

Об авторах: **Звонов Илья Александрович** — старший преподаватель кафедры «Организации строительства и управления недвижимостью»; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; SPIN-код: 6197-7370, Scopus AuthorID: 57204363101, ORCID: 0000-0002-4854-9903; ZvonovIA@mgsu.ru;

Каширина Наталья Владимировна — преподаватель; **Московский политехнический университет**; 107023, г. Москва, Большая Семеновская, д. 38; SPIN-код: 2752-6270, ORCID: 0000-0003-1787-441X; kashirina@kodeks.ru.

For citation: Zvonov I.A., Kashirina N.V. Corporate registers of requirements on the path of development of technical regulation in construction. *Real Estate: Economics, Management*. 2025; 3:35-39.

Для цитирования: *Звонов И.А., Каширина Н.В.* Corporate registers of requirements on the path of development of technical regulation in construction // Недвижимость: экономика, управление. 2025. № 3. С. 35–39.



Игнолина. Деревянная церковь. Офорт (автор иллюстрации – Павлова Лия Иосифовна)

UDC 624.014:620.193

Kushchenko I.V.

Problem of restoring the reproduction of housing stock in a complex emergency situation

Introduction. The paper reveals the main theoretical and methodological aspects of the formation and development of management methods for construction and restoration work in a complex emergency situation (CES). The paper considers modern principles and practices of the federal state programme for the support of liberated regions, which require adaptation and synchronization of production and investment planning to overcome crisis phenomena in the housing sector.
Materials and methods. The object of the study is a management system for restoring the reproduction of urban housing stock and the quality of the urban environment in Donbass and Novorossiya. It is indicated that the restoration of the housing stock in CES conditions is a complex, limited in resources, time and territory process that requires adjustments, improvements and updates of regulatory, technical, social and economic provisions in order to stimulate the revival and sustainable development of liberated regions. The author's paradigm of scientific and technological support of investment and production processes is proposed, including flexible planning and problem-oriented management of spatial and resource development of urban real estate.
Results. Based on the structuring of the problem space of damage and destruction of housing stock, a scenario approach to modeling territorial multifunctional complexes and updating cluster development territories is proposed. Resource-intensive, motivational and balanced situational models are substantiated, allowing for the coordination of construction and restoration work in the life cycle system of urban real estate revitalization and redevelopment.
Conclusions. The theoretical and methodological substantiation of the principles of the construction and restoration works management system makes it possible to redistribute resources, identify hidden opportunities and ensure the sustainability of the implementation of programme goals in the restoration of urban real estate reproduction in conditions of uncertainty and CES risks.
Keywords: *reproduction of housing stock, emergency situations, urban environment, scientific and technical support, problem-oriented management, revitalization, life cycle, redevelopment*



Kushchenko Igor Vladimirovich,
Candidate of Technical Sciences, Acting Rector; Pryazovskyi State Technical University (PSTU); 7 Universitetskaya St., Mariupol, 287642, Donetsk People's Republic, Russian Federation;
ORCID: 0000-0002-3338-6793;
kigorvlad@yandex.ru

INTRODUCTION

The implementation of the tasks of the state programme "Restoration and socio-economic development of the Donetsk People's Republic, Luhansk People's Republic, Zaporizhia region and Kherson region" requires the formation of organizational and technological management models and coordination of construction and restoration work, allowing to offset the negative consequences of a complex emergency situation[1]. Reproduction processes within the framework of urban planning activities include the entire complex of repair and reconstruction measures in the life cycle of a real estate object: current repairs, major repairs, modernization, reconstruction, restoration, renovation and improvement of the urban environment in accordance with modern safety and comfort requirements [1].

Housing reproduction is an economic activity aimed at stimulating social production, attracting significant investment and capital growth, forming regional priorities for spatial and resource real estate development and creating an appropriate level of urban environment quality [2, 3]. It is necessary to systematize the results of multidimensional research, problem-oriented to identify resource-organizational elements:

- development of the theory of sustainability of reproductive processes in the investment, construction, housing and communal services in the market [4];
- regulatory and legal framework of organizational and managerial aspects as a system for regulating the transformation of property relations and the development of the real estate market [5, 6];
- strategies for the reproduction of housing stock in the post-crisis period in conditions of limited resources during new construction, restoration and maintenance of facilities, taking into account premature wear [7, 8];
- system for regulating the development of innovative activities in the field of construction and reconstruction of housing stock, reflecting market statistics and markets in the investment and construction sector [9, 10];
- influence of technical, technological, economic, social, urban planning, sanitary, environmental, historical, architectural and other factors [11, 12];
- strategies and tools for the formation of territorial systems of constantly renewable processes of production, distribution, consumption

[1] The State programme "Restoration and socio-economic development of the Donetsk People's Republic, Lugansk People's Republic, Zaporizhia region and Kherson region". URL: https://постановление-правительства.рф/gosudarstvennaya-programma-vosstanovlenie-i-soczialno-ekonomicheskoe-razvitie-doneczkoj-narodnoj-respubliki-luganskoj-narodnoj-respubliki-zaporozhskoj-oblasti-i-hersonskoj-oblasti/

and exchange of housing based on the risks of supply and demand [13, 14];

- sustainability and long-term balanced development of territorial reproduction systems of the development business based on strategic focus and synchronization of investment, production and financial activities, taking into account the tasks of territorial and sectoral development [15, 16];
- revitalization in the field of construction, planning, economics and social policy of urbanized territories in a complex emergency situation (CES) [17–19];
- overcoming the degradation consequences of real estate related to the deterioration of the life cycle of operational indicators of technical condition in terms of reliability, operational suitability and quality of life [20];
- formation of information-commutative opportunities for the promotion of innovative and investment solutions for the restoration of reproduction in the housing sector [21, 22].

It is known that when restoring housing and urban infrastructure, special attention must be paid not only to the renovation and replacement of real estate objects that are being disposed of as a result of physical and moral deterioration, but also to the economic development of methods for managing existing resources in accordance with changing information, technological, environmental and social needs. The result of many years of generalization of the global experience of housing rehabilitation in emergency situations caused by post-crisis events and natural disasters is a guidance document in the field of planning and implementation of large-scale technical assistance [23].

Analysis of research results and publications of works [2, 7, 8, 13, 15, 19] He points out the need to distinguish between the concepts of “reproduction” and “restoration of reproduction”, which is due to problematic issues of programmatic measures aimed at eliminating the consequences of CES during a local military conflict.

The purpose of the paper is to substantiate and develop methodological provisions of a strategy for problem-oriented management of spatial and resource development in the restoration of housing stock reproduction and urban environment quality based on institutional mechanisms and a flexible planning system in Donbass and Novorossiya.

The restoration of housing reproduction is a complex, coordinated, limited in resources, time and territory process of regulatory, technical, social and economic changes initiated in order to stimulate sustainable development in the liberated historical regions of Russia.

The housing stock, as a renewable resource of urban real estate, functions in a unity of social, economic, material and legal circumstances caused by a set of interrelated stages of creation and successive changes in technical condition, the needs of growing competition and changing market requirements. Thus, the principles of flexible planning of the resource base for new construction, modernization, reconstruction, renovation, revitalization and redevelopment for the reconstruction of renovated urban real estate are the basis of the strategy for restoring housing reproduction and improving the quality of the urban environment in CES conditions.

The following tasks are considered as the priorities of this study, forming a strategy for restoring reproduction and socio-economic development of Donbass and Novorossiya in the housing sector:

- analyze the features of flexible planning and management of reproduction processes during construction and restoration work;
- substantiate a problem-oriented approach to the renewal of cluster territories in the urban real estate revitalization life cycle system;
- develop information and switching support for the cluster of the project “Promotion of digital technologies and platform solutions for managing the lifecycle of real estate objects based on parametric regulation of target criteria for quality, reliability and safety”.

Housing is the foundation for sustainable development and meeting basic human needs. In CES conditions caused by various combinations of political, economic, environmental, conflict factors and crisis phenomena, housing is the most important component of the total damage resulting from damaged or completely destroyed many thousands of construction sites. The use of flexible planning and problem-oriented management methods opens up additional opportunities for the theoretical and methodological formation and development of organizational models for construction and restoration work, which can significantly increase the sustainability and profitability of urban real estate.

MATERIALS AND METHODS

The study of the housing reproduction management system is becoming acutely relevant in connection with the structuring of the problem space of restoration, construction and development of housing real estate funds in large cities of Donbass and Novorossiya. The restoration of housing reproduction in CES conditions has many more aspects than new construction or reconstruction in an existing building [24]. This applies, first of all, to the need to adapt the regulatory framework for construction, the development of a state strategy, approaches to restoration, spatial and resource development of urban real estate, including monitoring, assessment, quality assurance and risk management systems. The multifactorial nature and high degree of uncertainty of investment and construction processes during the restoration of reproduction in CES conditions undoubtedly increases the risks when compared with investment projects in the field of housing stock reproduction in the post-crisis period. Thus, the realization of the purpose and objectives of this study is determined by the effectiveness of flexible planning and problem-oriented management as tools of the organizational and economic mechanism of government authorities, building customers with the participation of scientific and public organizations, professional associations and the population in the restoration of reproduction of urban real estate funds.

The federal state programme to support the liberated regions[2] includes the restoration of housing, communal and transport infrastructure, the development of the social sphere, the creation of a favorable investment climate and the achievement of average Russian quality of life indicators by 2030. The set goals will be achieved through direct government support from the federal budget, as well as through the growth of entrepreneurial activity. Subsidies are provided for the development of housing construction, the completion of the construction of multi-family residential buildings, the developers or owners of which have not been identified, and the formation of a modern urban environment. The subsidy funds will be allocated on a co-financing basis. An important tool for investor support will be the development of a free economic zone created in new regions[3].

[2] URL: http://government.ru/docs/50567/

[3] URL: https://www.kp.ru/money/lichnye-finansy/lgotnaya-ipoteka-dlya-novykh-regionov/

The PPP Law[4] defines public-private, municipal-private partnership as cooperation, within a specified period, by pooling resources, distributing risks in order to attract private investment into the economy, ensuring the availability of goods, works, and services by public authorities and local governments and improving their quality. Starting in 2023, a programme of housing loans with state support is being implemented. The preferential mortgage for the recipient in the new regions is only 2 %, with an additional payment from the state to banks on market terms[5].

Government support measures for small and medium-sized businesses include preferential loans, preferential leasing, the operation of "My Business" centres, social and technical consultations on business activities, product promotion and sales, etc. This allows entrepreneurs to receive preferential microloans and guarantees to attract credit funds[6]. At the territorial level, a draft pilot programme has been developed for the restoration of private housing in municipal and urban districts through the use of ready-made housing kits. Factory-made building structures and products are intended for the prefabricated construction of individual housing.

The multilevel management system in the field of housing stock restoration is based on the theoretical and methodological basis of research in the field of investment and construction activities of residential real estate, management decisions and risk management theory, as well as the patterns of behavioral economics. The author's hypothesis of this work reveals the methods of problem-oriented management of cycles of sustainable development of the territorial spatial and resource development of the building complex, allowing to offset the negative effects of CES. For this purpose, the organizational and technological principles of the cluster model for the restoration of viable housing and a comfortable urban environment, balanced indicators of innovation and investment attractiveness and business mobility, adaptive mechanisms of technical and economic protection in conditions of uncertainty and risk, as well as information modeling of the life cycle of urban real estate objects are used.

Problem-oriented management includes the adaptation of the principles, methods and formats of synchronization of production and investment planning to the basic requirements of construction and restoration work to renovate the cluster territory in the context of the revitalization of the existing urban development. Problem-oriented management allows an enterprise to quickly respond to changes in the external and internal environment, as well as optimize its resources.

Special attention is paid to the models of software solutions for the formation of a management structure and flexible planning in conditions of uncertainty of various factors of the internal and external environment. Flexible planning makes it possible to effectively manage construction and restoration work, which is especially important in conditions of limited resources and time. Following the principles of adaptability, priority of tasks, continuous improvement and openness, a situational scenario approach is applied that takes into account the initial possibilities of restoring the cluster-territory through renovation, resource base and housing and communal services, investment attractiveness of real estate revitalization and redevelopment projects. For this purpose, the MoSCoW methodology is used, which helps to prioritize critical (Must), desirable (Should), possible (Could) and deferred (Won't) tasks, taking into account plans for the implementation of investment programs for the restoration, reconstruction and development of urban real estate.

The described approaches are implemented using a set of initial data for a variant justification of the project goals of sustainable development:

Scenario-based approach to the study of promising solutions. Several alternative strategies (scenarios) for the development of the system (object) in question over time are being developed. Scenarios can be based on the predicted possible situations mentioned above. The combination of scenarios and the presence of critical points is a possible range of reasonable solutions to the problem. Scenarios are developed independently from each other. For each of them, a complete list of the most important indicators is calculated (criteria, volumes of finished construction products, various economic indicators, necessary material, energy and labor resources, environmental impacts, consumer basket of the population, etc.). Scenarios are not rejected without special reasons; their comparison and analysis are carried out for all the most important indicators.

"Rocking constraints" involves analyzing the stability of a solution in relation to specified constraints. Almost always, when restrictions on resources and on the volume of finished construction products are introduced into the model, the magnitude of the restrictions cannot be accurately predicted for the long term. In these cases, after finding the optimal option for the initially set constraints, you should begin to consistently "swing" them, changing the constraints up or down with a certain step within reasonable limits. For each combination of numerical constraints, the optimal variant is found (according to the same model). Next, the stability of the system's results is analyzed in relation to the magnitude of each of the constraints. The analysis makes it possible to identify a reasonable range of restrictions for the purpose of effective implementation of investment projects.

Varying the criterion involves analyzing the stability of the solution based on the results of parametric programming. It makes it possible to determine the stability intervals of the optimal solution for all parameters of the objective function, as well as to find optimal production plans for deviations in the parameters of the objective function that violate the boundaries of the stability intervals of the solution.

RESULTS

The priority of restoring the reproduction of housing stock and urban renewal is their harmonious and multifaceted development by properly adapting existing resources to current needs.

Taking into account the conditions of CES, three calculated scenarios for modeling the development of the housing stock of the territorial multifunctional complex (TMFC) have been identified:

The *socio-market scenario* is focused on development with minimal opportunities. Municipal government bodies act "by inertia", i.e. according to the situation, making decisions in order to promptly eliminate problems if there is financial support from regional or federal budgets.

The *evolutionary breakthrough scenario* is associated with the minimal participation of budget funds and city-forming enterprises in the socio-economic development of the city, creating conditions for the development of small and medium-sized businesses.

The *innovative scenario* includes the formation of an organizational and economic territory — a cluster of historically developed buildings, which provides for the implementation of priority investment and innovation projects as part of a strategy to restore the reproduction of the housing sector.

[4] URL: https://www.consultant.ru/document/cons_doc_LAW_182660/

[5] URL: https://www.kp.ru/money/lichnye-finansy/lgotnaya-ipoteka-dlya-novykh-regionov/

[6] URL: https://pravdnr.ru/news/minstroj-razrabotal-proekt-pilotnoj-programmy-po-vosstanovleniyu-chastnyh-domostroenij-v-municzipalnyh-i-gorodskih-okrugah-respubliki/

The effectiveness of the decisions taken is assessed according to integral criteria derived from the cost-benefit ratio for all periods of the urban real estate revitalization life cycle. The formation of organizational models for flexible planning of construction and restoration works provides design conditions for three situations:

Resource-intensive situation: a cluster-territory is created in a socio-market type of city, where there are no building resources for its construction. All resources are supplied to the construction site from the main residential and production base of the general contractor organization. In this case, conditions are created to reduce the time of commissioning of the facility, which ($T_b \rightarrow$ min); the level of mobility of the system increases ($Y_m \rightarrow$ max), which leads to additional work; the estimated cost of the facility increases ($K_{bc} \rightarrow$ max) due to the cost of improving mobile systems (pessimistic option).

Motivational situation: a cluster is a territory of an evolutionarily breakthrough type of city being created in a region where it is planned to create industrial and social spheres of appropriate capacity. All the work included in the components of the system lifecycle is performed sequentially. In this case, the minimum level of mobility of the country's system is achieved ($Y_m \rightarrow$ min); the minimum amount of investment is directly in the cluster facilities ($K_{bc} \rightarrow$ min) and additional investments are required in the production and social spheres of the system ($K_{vo} \rightarrow$ max). This leads to an increase in the time required for the commissioning of urban real estate revitalization facilities ($T_b \rightarrow$ max) (a pessimistic option).

Balanced situation: the cluster-territory is being created in an innovative type of city, which provides a rational combination of the use of head-mounted stationary, mobile and regional residential production facilities during the implementation of the investment megaproject (optimistic option).

Based on the results of scenario modeling of the TMFC housing stock development and the choice of organizational models for flexible planning of construction and restoration work, activities are being built to strategically focus all participants in the process of updating cluster territories in the life cycle system of urban real estate revitalization and redevelopment.

The process of housing stock reproduction is influenced by the requirements for buildings that must have sufficient durability, ensure resource conservation, life safety and environmental standards. When making decisions on a specific residential facility, it is necessary to use innovative solutions that reflect the current state of world achievements and scientific developments in the field of urban real estate restoration and reproduction. Therefore, the information and switching component is of crucial importance, providing scientific and technical support for the problem of housing renovation in CES conditions.

Solving the problems of reviving new regions is associated with the creation of scientific and educational foundations, the development of equipment and technologies for the restoration of buildings and structures, strengthening damaged structures and components, reducing construction time and reducing costs. Currently, NRU MGSU is headed by the Construction and Architecture industry consortium, which includes Russia's leading construction universities and industry organizations. The Consortium serves as a platform for cooperation in educational, scientific, and analytical fields. The Consortium's activities will strengthen the human resources potential of the construction industry, ensure digital transformation and solve current problems[7].

[7] URL: https://mgsu.ru/universityabout/Programma_razvitia/programma-prioritet-2030-/33/suverenitet/suverenitet/

A comprehensive approach to the implementation of technical and economic protection measures and to increase the durability of reproducible objects in urbanized territories is represented by the developments of the Azov State Technical University [25]. The formation of a system of parametric regulation of the conditions of "green" construction based on frame technologies using light steel thin-walled structures (LSTS) creates wide opportunities for the prefabricated construction of multi-apartment[8] and individual[9] housing structures. Competitive technical, technological, environmental and organizational aspects should be identified among the main priorities for the restoration of urban real estate using LSTS technologies, which make it possible to improve the criteria of usefulness, safety, durability and cost-effectiveness of the use of materials, energy, space and the ecosystem as a whole.

CONCLUSIONS

A methodology for restoring the reproduction of housing stock is proposed based on a scenario approach to modeling the development of a territorial multifunctional complex and updating cluster territories, taking into account social, economic and environmental standards, an increase in the rate of restoration, and the volume of housing reproduction in the liberated regions. The conditions of problem-oriented management are formulated, scenarios for modeling the cycle of the reproductive system of urban real estate revitalization are defined.

The practical significance of the research results lies in the fact that they can be used to implement the programmatic goals of spatial and resource development of housing stock and the quality of the urban environment based on institutional mechanisms and flexible planning systems in Donbass and Novorossiya. Resource-intensive, motivational and balanced situational models are substantiated, allowing for the coordination of construction and restoration work in the life cycle system of urban real estate revitalization and redevelopment.

As the main tool for implementing innovative solutions, the possibilities of the information and switching component of the activities of the industry consortium "Construction and Architecture" with the participation of leading scientific and industry organizations in the field of restoration and renovation of housing stock in CES conditions are considered. The priorities of technical and economic protection and ensuring the durability of urban real estate related to minimizing the risks of negative impact on the ecosystem of construction of urbanized territories are considered.

REFERENCES

1. Grabovyy P.G., Volgin V.V., Kushchenko I.V., Sezemin D.E., Tkachenko V.B. Technology of organizing territorial-spatial renewal of urban real estate, concentration and specialization of industrial production. Moscow, Publishing House "Prosvetitel", 2024; 289. EDN MIWUJI. (rus.).
2. Sirotkin V.A. Theoretical and methodological foundations of housing stock reproduction as a condition for population life support. Moscow, Economic education, 2013; 156. (rus.).
3. Belyakov S.I., Volkov R.V., Grabovyy P.G., Nezhnikova E.V. Real Estate Management: Theory and Practice : monograph; 2nd ed., revised and enlarged under the general scientific editorship of prof. P.G. Grabovyy. Moscow, Publishing House ASV, Publishing House

[8] GOST R 70346–2022. "Green" Standards. Multi-Apartment Residential Buildings "Green". Assessment Methodology and Criteria for Design, Construction, and Operation.

[9] GOST R 71392–2024. "Green" standards. "Green" single-family houses. Assessment method and criteria for design, construction and maintenance.

"Prosvetitel", 2023; 204. URL: https://search.rsl.ru/ru/record/01011669285 (rus.).
4. Balashov E.B. Study of the structural sustainability of the development and functioning of the construction and housing and communal services system. Real estate: economics management. Appendix, 2023; 3:28-31. (rus.).
5. Engincan P. Theory and Method in Analysis of Regeneration Process of Residential Areas. ABACUS. 2010; 5(1):1-7. URL: https://www.researchgate.net/publication/310456009; https://www.academia.edu/29914418/Theory_and_Method_in_Analysis_of_Regeneration_Process_of_Residential_Areas
6. Dmitrieva E. Performance and problems of the housing sphere in Russia. MATEC Web of Conferences. 2018; 251(06029):6. DOI: 10.1051/matecconf/201825106029
7. Kushchenko I.V., Volgin V.V. Spatial and resource development in creating a quality framework for the urban environment of the Donetsk People's Republic. Real estate: economics, management. 2023; 4:6-12. DOI: 10.22337/2073-8412-2023-4-6-12. EDN LGBPWK.
8. Bugaenko I.S. Transformation of housing and utilities sector in conditions of war and post-conflict reconstruction : Collection of scientific papers of the international scientific-practical conference "Integration of humanities and natural sciences: New horizons of knowledge". Belgorod, the Agency for Advanced Scientific Research, LLC, 2025. EDN WNTFZD. (rus.).
9. Seljutina L.G. The innovative approach to managing investment processes in the sphere of reproduction of the housing fund. Modern management technologies. 2014; 11(47):37-41. EDN TEDSWX. (rus.).
10. Demianov K.V. Methodological solution to the problem of residence reproduction in the country. Proceedings of Universities. Investment. Construction. Real estate. 2015; 2(13):11-21. EDN TYWMFH. (rus.).
11. Volgin V.V., Dekhtyar E.V. Methodological approach to calculating the integral indicator of organizational and technological reliability of repair and restoration processes of apartment buildings. Real Estate: economics, management. 2025; 1:34-37. EDN NQULAX.
12. Sandu D. Housing as a social reproduction system, Housing Sociology in times of change. CIB, The National Swedish Institute for Building Research CIB-W69, Research report, SB29, 1990; 135-148. URL: https://www.researchgate.net/publication/242654656_Housing_as_a_social_reproduction_system
13. Abakumov R.G. Formulation of the problems of theory and practice of the system of managing the reproduction of housing stock at the regional level. Bulletin of BSTU named after V.G. Shukhov. 2018; 2:94-103. DOI: 10.12737/article_5a816be3258849.57744978. EDN YQZBMH. (rus.).
14. Matveev I.Y. Model of the steady condition of system of the available housing of region. Bulletin: INJEKON, Economics. 2010; 2:445-448. EDN LDMDNH. (rus.).
15. Sitdikov S.A. Life cycle and the reproduction system of the city's housing stock. Problems of modern economics. 2007; 1(21):221-224. EDN IBGBZN. (rus.).
16. Belyakov S.I., Vishnyakova M.I. Implementation of a project-oriented approach to management at enterprises in the investment and construction sector. Science, education and culture. 2018; 4(28):25-28. EDN XPCJTN. (rus.).
17. Romanenko M.I., Khrustalev B.B. Resource opportunities as a condition for the creation of cluster formation. Modern economics: problems and solutions. 2015; 3(63):112-119. DOI: 10.17308/meps.2015.3/1119. EDN UGLBAV. (rus.).
18. Revitalization and renovation in construction. Construction managers' library. ERASMUS+. Germany, Great Britain, Poland, Warszawa, 2017; 131.
19. Kushchenko I.V., Grabovyy P.G. Cluster model of construction and economic development in the conditions of urban housing stock restoration in DPR. Real estate: economics, management. 2024; 1:6-13. EDN ALHQOQ.
20. Shultz V.L., Kulba V.V., Shelkov A.B., Chernov I.V. Methods of planning and managing technogenic safety based on a scenario approach. National security/Nota Bene. 2013; 2(25):198-216. EDN PZOBGN. (rus.).
21. Grigoriev N.M. Problem-oriented control systems: methodology and construction technologies. Moscow, Internet University of Information Technologies, 2016; 384. (rus.).
22. Valuy A.A. The process of reproduction and expansion of housing stock in the region as an object of economic research. Journal of Applied Research. 2023; S3:10-17. EDN NXJEGE. (rus.).
23. Supporting Safer Housing Reconstruction After Disasters: Planning and Implementing Technical Assistance at Large Scale, UN-Habitat/AXA. 2019. URL: https://urbanresiliencehub.org/housingreconstruction/
24. Grabovyy P.G., Kushchenko I.V. Urban regeneration policy. Real estate: economics, management. 2024; S3:10-13. EDN WOGWVK. (rus.).
25. Korolev V.P., Kushchenko I.V., Bocharova E.A. Sustainable development of the practice of coastal construction using light steel thin-walled structures. Socio-economic space of the regions. 2024; 18(3):173-184.

Проблема восстановления воспроизводства жилого фонда в сложной чрезвычайной ситуации

Введение. Статья раскрывает основные теоретико-методологические аспекты формирования и развития методов управления строительно-восстановительными работами в условиях сложной чрезвычайной ситуации (далее — СЧС). Рассмотрены современные принципы и практики федеральной госпрограммы поддержки освобожденных регионов, требующие адаптации и синхронизации производственного и инвестиционного планирования для преодоления кризисных явлений в жилищной сфере.

Материалы и методы. Объект исследования представляет систему управления восстановлением воспроизводства городского жилищного фонда и качества городской среды Донбасса и Новороссии. Обозначено, что восстановление жилого фонда в условиях СЧС является сложным, ограниченным по ресурсам, времени и территории процессом, требующим корректировки, улучшения и обновления нормативно-правовых, технических, социальных и экономических положений с целью стимулирования возрождения и устойчивого развития освобожденных регионов. Предложена авторская парадигма научно-технологического сопровождения инвестиционных и производственных процессов, включающая гибкое планирование и проблемно-ориентированное управление пространственно-ресурсным девелопментом городской недвижимости.

Результаты. На основе структуризации проблемного пространства повреждений и разрушений жилищного фонда предложен сценарный подход к моделированию территориальных многофункциональных комплексов и обновления кластер-территорий развития. Обоснованы ресурсно-затратная, мотивационная и сбалансированная ситуационные модели, позволяющие выполнять координацию строительно-восстановительных работ в системе жизненного цикла ревитализации и редевелопмента городской недвижимости.

Выводы. Теоретико-методологическое обоснование принципов системы управления строительно-восстановительными работами позволяет перераспределять ресурсы, выявлять скрытые возможности и обеспечивать устойчивость реализации программных целей при восстановлении воспроизводства городской недвижимости в условиях неопределенности и рисков СЧС.

Ключевые слова: *воспроизводство жилого фонда, чрезвычайные ситуации, городская среда, научно-техническое сопровождение, проблемно-ориентированное управление, ревитализация, жизненный цикл, редевелопмент*

СПИСОК ИСТОЧНИКОВ

1. *Грабовый П.Г., Волгин В.В., Кущенко И.В., Семин Д.Е., Ткаченко В.Б. Технология организации территориально-пространственного обновления городской недвижимости, концентрации и специализации промышленного производства. М. : Изд-во «Просветитель», 2024. 289 с. EDN MIWUJI.*
2. *Сироткин В.А. Теоретические и методологические основы воспроизводства жилищного фонда как условия жизнеобеспечения населения. М. : Экономическое образование, 2013. 156 с.*
3. *Беляков С.И., Волков Р.В., Грабовый П.Г., Нежникова Е.В. Управление недвижимостью: теория и практика : монография; 2-е изд., перераб. и доп. под общ. науч. ред. проф. П.Г. Грабового. М. : Издательство АСВ: «Просветитель», 2023. 201 с. URL: https://search.rsl.ru/ru/record/01011669285*
4. *Балашов Е.Б. Исследование структурной устойчивости развития и функционирования строительной и жилищно-коммунальной системы // Недвижимость: экономика управление. Приложение. 2023. № 3. С. 28–31.*
5. *Engincan P. Theory and Method in Analysis of Regeneration Process of Residential Areas // Abacus. 2010. No. 5 (1). Pp. 1–7. URL: https://www.researchgate.net/publication/310456009_; https://www.academia.edu/29914418/Theory_and_Method_in_Analysis_of_Regeneration_Process_of_Residential_Areas*
6. *Dmitrieva E. Performance and problems of the housing sphere in Russia // MATEC Web Conf. 2018. No. 251 (06029). P. 6. DOI: 10.1051/matecconf/201825106029*
7. *Kushchenko I.V., Volgin V.V. Spatial and resource development in creating a quality framework for the urban environment of the Donetsk People's Republic // Real estate: Economics, Management. 2023. No. 4. Pp. 6–12. DOI: 10.22337/2073-8412-2023-4-6-12. EDN LGBPWK.*
8. *Бугаенко И.С. Трансформация ЖКХ в условиях войны и постконфликтного восстановления : сб. науч. тр. Междунар. науч.-практ. конф. «Интеграция гуманитарных и естественных наук: новые горизонты познания». Белгород, ООО «Агентство перспективных научных исследований», 2025. EDN WNTFZD.*
9. *Селютина Л.Г. Инновационный подход к управлению инвестиционными процессами в сфере воспроизводства жилищного фонда // Современные технологии управления. 2014. № 11 (47). С. 37–41. EDN TEDSWX.*
10. *Демьянов К.В. Методологическое решение проблемы восстановления жилья в стране // Известия вузов. Инвестиции. Строительство. Недвижимость. 2015. № 2 (13). С. 11–21. EDN TYWMFH.*
11. *Volgin V.V., Dekhtyar E.V. Methodological approach to calculating the integral indicator of organizational and technological reliability of repair and restoration processes of apartment buildings // Real estate: Economics, Management. 2025. No. 1. Pp. 34–37. EDN NQULAX.*
12. *Sandu D. Housing as a social reproduction system // Housing Sociology in times of change. CIB, The National Swedish Institute for Building Research CIB-W69, Research report, SB29, 1990. Pp. 135–148. URL: https://www.researchgate.net/publication/242654656_Housing_as_a_social_reproduction_system*
13. *Абакумов Р.Г. Постановка проблем теории и практики системы управления воспроизводством жилищного фонда на региональном уровне // Вестник БГТУ им. В.Г. Шухова. 2018. № 2. С. 94–103. DOI: 10.12737/article_5a816be3258849.57744978. EDN YQZBMH.*
14. *Матвеев И.Ю. Модель устойчивого состояния системы жилого фонда региона // Вестник ИНЖЭКОНа. Серия: Экономика. 2010. № 2 (37). С. 445–448. EDN LDMDNH.*
15. *Ситдиков С.А. Жизненный цикл и система воспроизводства жилищного фонда города // Проблемы современной экономики. 2007. № 1 (21). С. 221–224. EDN IBGBZN.*
16. *Беляков С.И., Вишнякова М.И. Внедрение проектно-ориентированного подхода к управлению на предприятиях инвестиционно-строительной сферы // Наука, образование и культура. 2018. № 4 (28). С. 25–28. EDN XPCJTN.*
17. *Романенко М.И., Хрусталев Б.Б. Ресурсный потенциал как условие создания кластерного образования // Современная экономика: проблемы и решения. 2015. № 3 (63). С. 112–119. DOI: 10.17308/meps.2015.3/1119. EDN UGLBAV.*
18. *Revitalisation and refurbishment in construction // Construction managers' library. ERASMUS+. Germany, Great Britain, Poland, Warszawa, 2017. 131 p.*
19. *Kushchenko I.V., Grabovyy P.G. Cluster model of construction and economic development in the conditions of urban housing stock restoration in DPR // Real estate: Economics, Management. 2024. № 1. Pp. 6–13. EDN ALHQOQ.*
20. *Шульц В.Л., Кульба В.В., Шелков А.Б., Чернов И.В. Методы планирования и управления техногенной безопасностью на основе сценарного подхода // Национальная безопасность/Nota Bene. 2013. № 2 (25). С. 198–216. EDN PZOBGN.*
21. *Григорьев Н.М. Проблемно-ориентированные системы управления: методология и технологии построения. М. : Интернет-Университет Информационных Технологий, 2016. 384 с.*
22. *Валуй А.А. Процесс воспроизводства и расширения жилого фонда в регионе как объект экономических исследований // Журнал прикладных исследований. 2023. № S3. С. 10–17. EDN NXJEGE.*
23. *Supporting Safer Housing Reconstruction After Disasters: Planning and Implementing Technical Assistance at Large Scale // UN-Habitat/AXA. 2019. URL: https://urbanresiliencehub.org/housingreconstruction/*
24. *Грабовый П.Г., Кущенко И.В. Политика городского восстановления // Недвижимость: экономика, управление. 2024. № S3. С. 10–14. EDN WOGWVK.*
25. *Королёв В.П., Кущенко И.В., Бочарова Е.А. Устойчивое развитие практики прибрежного строительства с использованием легких стальных тонкостенных конструкций // Социально-экономическое пространство регионов. 2024. № 18 (3). С. 173–184.*

Об авторе: **Кущенко Игорь Владимирович** — кандидат технических наук, и.о. ректора; **Приазовский государственный технический университет (ПГТУ)**; 287642, Донецкая Народная Республика, г. Мариуполь, ул. Университетская, д. 7; ORCID: 0000-0002-3338-6793; kigorvlad@yandex.ru.

For citation: Kushchenko I.V. Problem of restoring the reproduction of housing stock in a complex emergency situation. *Real Estate: Economics, Management*. 2025; 3:40-45.

Для цитирования: *Кущенко И.В.* Problem of restoring the reproduction of housing stock in a complex emergency situation // Недвижимость: экономика, управление. 2025. № 3. С. 40–45.

UDC 332.12

Mirgorodskaya E.O.
Medvedeva L.S.

Balanced spatial development of the Southern macroregion: strategic context

The paper presents the results of the analysis of macroeconomic indicators of territories, which allow assessing the contribution of regions to the socio-economic development of the southern macroregion and identifying directions for the development of the territorial administration system in order to achieve balance in the strategic context. For the analysis, three regions were selected-the Rostov Region, the Krasnodar and Stavropol Territories — as basic territories that form the space of the southern macroregion and are capable of building interterritorial interaction in achieving national goals. The problem of forming a single territorial space is acute for all subjects, and the achievement of economic connectivity, which is manifested in the establishment of transport and logical routes, trade and economic, institutional and socio-infrastructural ties, is possible through the creation of a supporting framework, that is, the fundamental structure of territorial development. The results of the macroeconomic analysis based on the methodology presented in the study form the basis for scenario planning of socio-economic development of territories aimed at achieving the goals of sustainability, connectivity and balanced development.

Keywords: *basic territorial framework, macroeconomic indicators, territorial connectivity, socio-economic development, spatial economy*



Mirgorodskaya Elena Olegovna,
Doctor of Economic Sciences, Professor, Head of the Department of Public and Municipal Administration; Don State Technical University (DSTU); 1 Gagarin Sq., Rostov-on-Don, 344000, Russian Federation;
ID RSCI: 674907, Scopus AuthorID: 57196469449, WoS ResearcherID: ADD-9717-2019,
ORCID: 0000-0002-0708-5524;
emirgorod@mail.ru



Medvedeva Lyudmila Sergeevna,
PhD in Economic sciences, Associate Professor, Associate Professor of the Department of Economics and Management; Don State Technical University (DSTU); 1 Gagarin Sq., Rostov-on-Don, 344000, Russian Federation;
ID RSCI: 622255, Scopus AuthorID: 57218106885, WoS ResearcherID: ABC-1063-2021,
ORCID: 0000-0002-4853-0065;
milla1988@mail.ru

For modern Russia, spatial development is not only an economic problem for the development and development of territories, but also a concept of its balanced development, taking into account the economic specialization of regions, their saturation with assets and the corresponding working-age population, the development of cities and small settlements, the organizational ability of regions to form an optimal economic complex, as an integral part of In this context, the problem of the unity of the Russian national economic complex as a set of geographically isolated regions, which at the same time act as part of larger territorial communities-macro — regions, becomes particularly important.

The economic development of the country should be based on an effective territorial organization, which can be implemented within the framework of the allocation of macroregions, which are the basic elements of the territorial and economic organization of the country, due to which contradictions between the volume of centralization and decentralization of powers and responsibilities of territories are eliminated. The expediency of conducting a territorial analysis and planning of a macroregion is proved by the fact that such territorial and economic units of Russia are distinguished both taking into account their functionality and their role in the socio-economic development of Russia, with a focus on determining the optimal territorial proportions of the country's economy. However, the uncertainty of the legal status of the macroregion and the misconception that this element of territorial planning is identified with the federal district do not allow it to be widely used in public administration practice. Therefore, it is extremely important that today, when making state decisions in the context of Russia's spatial development, the mainstay is the grid of macroregions, which demonstrates a completely different approach, more rational and less dependent on administrative restrictions.

The updated Strategy of Spatial Development of the Russian Federation for the period up to 2030 with a forecast up to 2036[1] attempts to abstract from the administrative borders of the subjects of the Russian Federation in the process of planning technological development and rely specifically on the grid of macroregions. The rationality of this approach lies in the fact that the opportunities of macro-regions are wider, including due to the unification of markets, industrial and scientific cooperation, the absence of a closed procurement system and limited economic functionality. In the long-term strategy of spatial development, it is the emphasis on the diversity of the territorial complex and the availability of favorable living conditions in all the constituent entities of the Russian Federation that will allow achieving national goals in all their diversity.

At the same time, the problem remains a poorly developed mechanism and system for implementing the spatial development strategy, which is manifested in the lack of fixing responsible bodies, activities, resources, institutional changes and steps related to the concretization of the territorial framework. In the future, the entire territory of the country should become a space of points of growth and balanced development that can meet the needs of complementarity and strengthening of each other's regions.

Conceptually, the term balance and balanced development should be distinguished in relation to the economic system, since the former implies the presence of components that contribute to reducing the cost of achieving development goals and means a certain equilibrium state, and the latter includes the process of transition of the system from

[1] The Strategy for Spatial Development of the Russian Federation for the Period up to 2030 with a Forecast up to 2036 was approved by the Order of the Government of the Russian Federation of December 28, 2024; 4146-r. URL: http://government.ru/news/53917 (rus.).

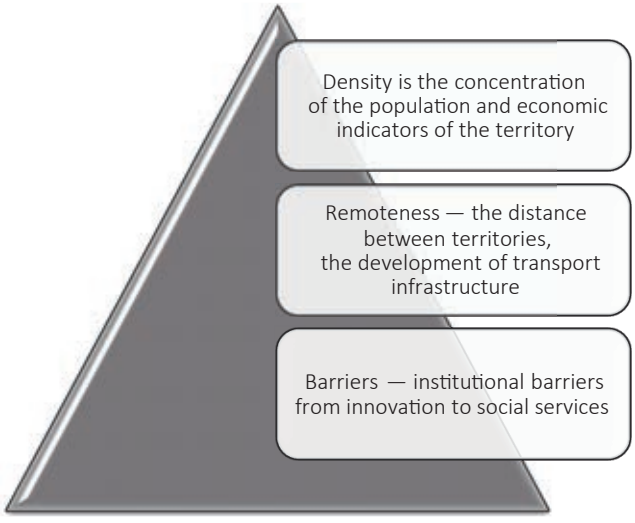


Fig. 1. Factors influencing spatial territorial development

one state to another, characterized by a level of sustainability, under the influence of external and internal factors. That is why today the priority of balanced development of the territory within the framework of its interaction with other regions and connectivity in the macroregion space, as well as a special socio-economic role in general for the national economic complex of the country becomes obvious and accepted thesis, and, accordingly, a guide to the implementation of program documents and institutional transformations.

According to the authors, the development of strategic scenarios for spatial development of territories in order to form a reference territorial framework is based on data from a macroeconomic analysis of socio-economic indicators of territorial development [1]. However, it is important not only to analyze the available indicators for a particular region-subject of the Federation, but also to understand the processes of interconnection of regions within the national space in the grid of macroregions, to see development points and complementary economic processes more broadly, linking the development goals of a particular region with the goals and specialization of other similar or nearby territories. This will allow us to decide on a set of measures aimed at achieving a balanced development of the entire territory of the macroregion, taking into account special attention in the framework of territorial administration to aspects of the functioning of individual territories that may or may negatively affect the integrity of this macroeconomic space.

That is why the authors allowed us to offer an elementary analysis of the main macroeconomic indicators for three basic regions of the southern macro-region-the Rostov Region, the Krasnodar Territory and the Stavropol Territory. These regions within the entire Southern macro-region can be assessed as basic, as supporting subjects that determine development opportunities, and sometimes directly affect the economic activities of subjects in other regions. Although their economic specialization differs, there are many similar socio-economic, geographical and spatial characteristics, which make it possible to recognize their leading position throughout the south of Russia. At the same time, it should be recognized that the typology of specializations of territories, of course, does not correspond to the real structural economic diversity, does not fully demonstrate the multiplicity of characteristics of Russian regions, which leads to the primitivization of the typology associated with their narrow specialization, previously extremely fashionable doctrine of regional economic development.

Let us consider in Fig. 1 a grouping of factors affecting the spatial development of the territory, which will be reflected in the analytical set of indicators formed in the study (grouped according to data from [2, 3]).

Consideration of these factors should be reflected in new models of regional planning that meet modern challenges and threats, as well as in the mechanisms of interaction between the centre and regions, government, business and citizens. At the same time, the macroeconomic analysis of territorial development indicators, taking into account spatial aspects, as one of the stages of the territorial management system, should include the following blocks:

- key economic indicators;
- indicators of social inequality;
- infrastructure indicators.

It should be noted that in addition to classical socio-economic indicators, special attention is also paid to relative indicators that allow us to assess the contribution of a particular region to the formation of the basic territorial framework of a macroregion. A dynamic assessment of the presented blocks, reflecting a sample of

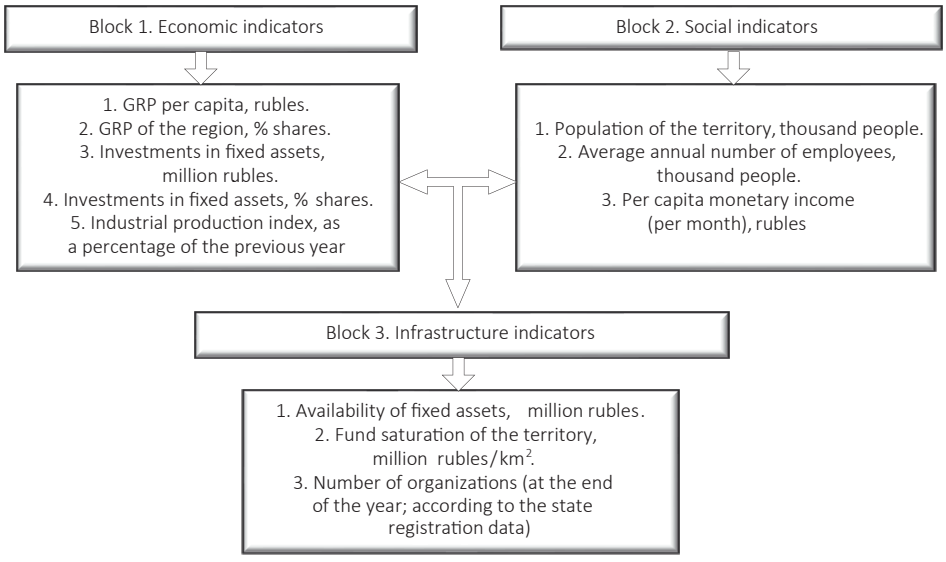


Fig. 2. Details of analytical blocks by indicators [4]

Table 1. Main characteristics of the territories forming the southern macroregion

Name of the indicator	Unit of measurement	Note
Rostov region		
Territory area	101 thousand km^2	The territory of the Rostov Region is 22.6 % of the territory of the Southern Federal District, has a pronounced industrial and agricultural structure
Population as of January 1, 2024	4,152.5 thousand of people	In the Rostov region, the share of the urban population prevails — 67.8 %, and the rural population only 32.2 %
The number of municipal entities	463	In the Rostov region, rural settlements predominate among municipalities — 391
Stavropol Territory		
Area	66.2 thousand km^2	This region belongs to the North Caucasus Federal District, but the territorial proximity to the south, logistics routes and economic structure allow us to state that this region is included in the southern macro
Population as of January 1, 2024	2,886.1 thousand of people	In the Stavropol Territory is dominated by the urban population, however, the share of the rural population is very high
Number of municipalities	33	The ratio of municipal and urban districts is 16 to 17
Krasnodar Territory		
The area of the territory	75.5 thousand km^2	The territory of Krasnodar is 16.8 % of the territory of the Southern Federal District
Population as of January 1, 2024	5,833 thousand of people	In the Krasnodar Territory the share of urban population is 57.3 %, and rural 42.7 %
Number of municipalities	426	There are 351 rural settlements in the Krasnodar Territory

indicators at the state level with details for three regions, will help to find out the causes of spatial inequality in the macroregion, conduct a comparative analysis, and propose a set of territory-specific measures (Fig. 2).

For conducting a macroeconomic analysis, it is necessary to reflect the characteristics of the territories selected as basic in the formation of the Southern macroregion space (Table 1).

We will present analytical tables based on previously schematized blocks of analysis. Information sources for compiling tables are official statistics data, analytical information from the website of the Main Directorate of the Bank of Russia, and information from the forecast of socio-economic development of the Russian Federation [5].

The analysis of the block of economic indicators reflecting the level of territorial development is presented in Table 2. It is important to conduct a dynamic analysis over a number of periods in order to identify trends in indicators, which should form the basis for drawing up forecast scenarios for territorial development.

Management decision-making in the process of developing a development strategy is based on conclusions on the dynamics of GRP in the regions. Analysis of the dynamics of GRP per capita shows a positive trend, while all three regions have a strong growth trend, showing built-in regional relationships. To study the spatial aspect, it is important to assess the contribution of regions to the GRP of the Russian Federation, and here, according to the analyzed territories, it can be noted that all three regions are dynamically increasing their contribution to the development of the national economy. At the same time, it is the Krasnodar Region, where the economy is more diversified and has a developed tourism sector, as well as extremely favorable climatic conditions for farming, that is ahead of the growth of the other two analyzed regions. In this context, the Rostov and Stavropol Regions have different roles in Russia's macroeconomic development. If you look at the Rostov region, its geographical position and industrial development in recent years within the framework of import substitution-oriented industries clearly demonstrates its high-tech orientation and transport and logistics specialization. Regarding the Stavropol Territory, it should be noted that the agricultural and medical-tourist orientation of this territory will only increase as part of its connection with the subjects of the North Caucasus, form a single economic complex with a diverse agricultural sector and powerful service and tourism enterprises [6–11].

The analysis of fixed capital investments in all the regions studied confirms that the regional policy is aimed at significant investments in the purchase and renovation of buildings, structures, and equipment, since the dynamics of the indicator for all three years in all regions is only positive and there is a steady growth trend. This fact should lead to the development of industrial clusters in the regions, but according to the index of industrial production, a positive trend is observed in the Krasnodar and Stavropol Territories, despite the fact that agriculture prevails in the industry specialization here. The strategy of primary economic diversification is inherent in each of the analyzed regions, but it is clearly expressed in the Krasnodar Territory, whose development is also characterized by rather specific social indicators. Let us consider in Table 3 an analytical sample of indicators of social orientation.

Based on the results of the analysis of social indicators for three territories, it should be noted:

- the population is declining in the Rostov Region and Stavropol Territory, which negatively affects the indicators in the macro-region, but the influx of the population of the Krasnodar Territory as a whole contributes to the stabilization of the indicator;
- the employed population in the regions is increasing, which reflects the high labour potential of regional development;
- with the growth of labour potential, the population's monthly income also increases, with an average increase of 10–13 % in each region.

At the same time, it is also necessary to assess the involvement of the working-age population in the functioning of certain

Table 2. Analysis of the dynamics of economic indicators of territorial development[2]*

Indicator	2021	2022	2023	Abs. dev. (+, –) 2023 from 2022	Growth rate, % 2023 to 2022
GRP per capita Rostov Region, rubles	485,902	556,629	647,600	90,971	116.34
GRP per capita Stavropol Territory, rubles	357,475	414,255	464,150	49,895	112.04
GRP per capita Krasnodar Territory, rubles	563,372	738,801	819,100	80,299	110.87
GRP Rostov Region as a percentage of the Russian Federation, %	1.67	1.72	1.74	0.02	–
GRP of the Stavropol Territory as a percentage of the data for the Russian Federation, %	0.85	0.86	0.88	0.02	–
GRP of the Krasnodar Territory as a percentage of the data for the Russian Federation, %	2.68	2.9	2.9	–	–
Investments in fixed assets Rostov region, million rubles	393,753	470,546	643,711	173,165	136.8
Investments in fixed assets Stavropol Territory, million rubles	254,164	286,449	334,690	48,241	116.8
Investments in fixed assets Krasnodar Region, million rubles	558,590	753,059	860,631	107,572	114.28
Investments in fixed assets in the Rostov region, share in % of data for the Russian Federation	2.4	2.65	2.56	–0.09	–
Fixed capital investment in the Stavropol Territory, percentage % share of the Russian Federation	1.01	1.01	0.95	–0.06	–
Investments in fixed assets in the Krasnodar Region, percentage of the Russian Federation	1.69	1.66	1.9	0.24	–
Index of industrial production Rostov Region, %	110	109.3	103.5	–5.8	–
Index of industrial production Stavropol Territory, %	113.5	103.1	106.4	3.3	–
Industrial Production Index Krasnodar Region, %	108.3	103.8	106	2.2	–

*Note: * — Grouped by data from the Statistical compendium of the Russian Region, research by the Stolypin Institute for Growth Economics, and analytical data from the Main Directorate of the Bank of Russia.*

*Table 3. Analysis of social indicators of territorial development**

Indicator	2021	2022	2023	Abs. dev. (+, –) 2023 from 2022	Growth rate, % 2023 to 2022
Population, thousand, hours of fir trees					
Rostov region	4,192.3	4,162.5	4,152.5	–10	99.76
Stavropol Territory	2,902.5	2,891.2	2,886.1	–5.1	99.8
Krasnodar Region	5,832	5,819.3	5,833	13.7	100.24
Annual number of employees, thousand people					
Rostov Region	1,984.6	2,017.2	2,092.1	74.9	103.71
Stavropol Territory	1,271.1	1,294.1	1,344.4	50	103.9
Krasnodar Region krai	2,703.1	2,739	2,908	169	106.17
Per capita monetary income (per month), rubles					
Rostov Region	34,743	41,377	46,840	5,463	113.2
Stavropol Territory	25,133	30,100	32,930	2,830	109.4
Krasnodar Territory	42,228	48,684	54,627	5,943	112.21

*Note: * — Grouped according to the statistical compendium of the Russian Region 2024.*

industries (Fig. 3). Let's present the top 5 industries in the region in terms of the number of employees of the organization.[2]

Industrial specialization of the employed population in the region is an important indicator of socio-economic development and can help identify the causes of population decline in specific localities. So, for example, in the Krasnodar Territory, it is agriculture that prevails in the sectors with the highest employment of the population, and if we consider the ratio of the urban and rural population of this territory, then here, in fact, the urban population is equal to the rural population. Thus, the highest per capita monetary incomes out of the three analyzed regions are observed in the Krasnodar Territory, which suggests that this particular region is characterized by a well-structured strategy of socio-economic development. The Rostov region, which has a huge potential in the development of agricultural sectors, adheres to the policy of technological leadership, and also acts as the largest transport and logistics hub, which requires the development of a more specialized strategic scenario for territorial management. The Stavropol Territory is the most important transport corridor to the Caucasus, and has a huge natural resource potential, which should be used in the strategy of territorial administration and take these factors into account [12–14].

[2] Regions of Russia. Socioeconomic Indicators. 2024 : Stat. collection. Rosstat. Moscow, 2024; 1081. URL: https://rosstat.gov.ru/folder/210/document/13204 (rus.).

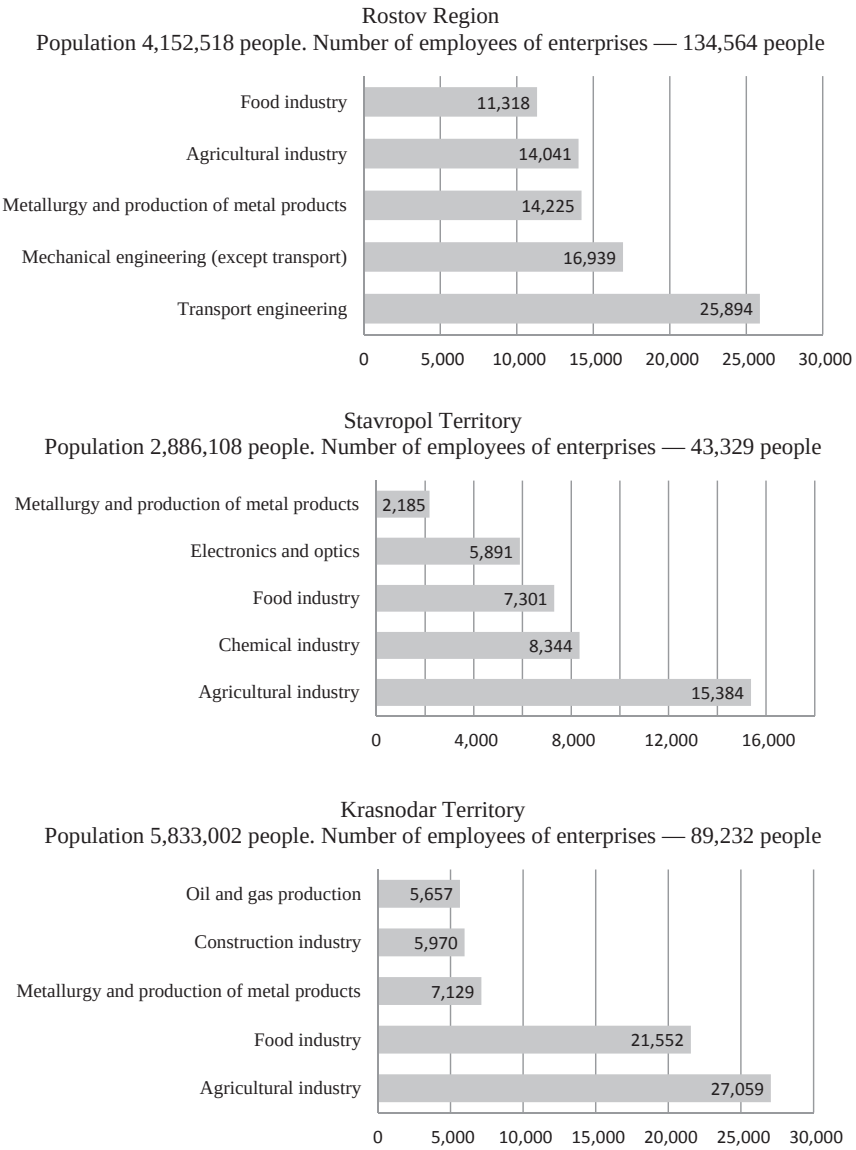


Fig. 3. Assessment of the industrial specialization of the employed population, detailed by region (compiled according to the Map of Industry of the Russian Federation — Urbanik project)

Table 4. Analysis of infrastructure indicators

Indicator	2021	2022	2023	Abs. dev. (+, –) 2023 from 2022	Growth rate, % 2023 to 2022
Availability of fixed assets Rostov region, million rubles/ km^2	7,460,101	7,658,598	8,280,586	621,988	108.12
Availability of fixed assets Stavropol Territory, million rubles/ km^2	3,637,184	3,685,383	3,857,823	172,440	104.7
Availability of fixed assets Krasnodar Territory, million rubles/ km^2	1,3970,321	14,670,743	16,105,257	1,434,514	109.78
The territory Rostov region, million rubles/ km^2	73,862.4	75,827.7	81,986	6,158.3	108.12
The territory Stavropol Territory, million rubles/km^2	54,942.4	55,670.4	58,275.3	2,604.9	104.7
Fund saturation of the territory Krasnodar Territory, million rubles/km^2	185,037.4	194,314.5	213,314.7	19,000.2	109.78
Number of organizations (at the end of the year; according to state registration data)					
Rostov Region	70,966	66,538	65,600	–938	98.59
Stavropol Territory	34,427	32,696	32,518	–178	99.5
Krasnodar Territory	107,721	105,233	102,927	– 2,306	97.81

We will analyze the third block of indicators, namely infrastructure data (Table 4). The set of indicators has an estimated coefficient-the territory's fund saturation, million rubles/km^2, which is determined by dividing the value of fixed assets by the area of the region's territory and characterizes the infrastructure potential of the area [15].

The analyzed regions have a huge infrastructure potential, as the fund saturation indicator is growing every year.

Thus, the analysis suggests that there are factors of spatial inequality in the Southern macroregion, which are manifested in the focus of the resource base and growth factors in specific economic centres, inequality in key socio-economic growth indicators, significant differences in intraregional quality of life, weak interregional interaction and the use of complementary resources for cluster interregional development. The scenario planning approach aimed at forming a basic territorial framework, integrated into the socio-economic development programmes developed in the regions and implemented taking into account the assessment of structural regional specifics, will allow achieving balanced spatial development.

When developing scenarios for the strategic development of territories, taking into account a single spatial framework, special attention should be paid to:

- industry specifics of the regional economy and the size of enterprises in the region;
- the size of the average per capita income of the population;
- sources of income and intraregional income inequality;
- differences of households in the marginal propensity to save and consume in the region;
- the quality of life and the level of economic development of the region as a whole [18].

Scenario planning of territorial development with the formation of a reference framework should become the basis of programmes for socio-economic development of territories and include a number of stages: analysis of macroeconomic indicators, identification of cause — effect relationships, formulation of conclusions, construction of maps detailing problem areas and growth points. The success of balanced spatial development is the presence of a system of cooperation and interaction at all levels with the improvement of federal relations, both vertically and horizontally.

REFERENCES

1. Gorodnichev A.V., Skrebkova E.V. The uneven development of Moscow in the current spatial structure of the modern metropolis. Urban Studies and Practice. 2022; 7(1):85-105. DOI: 10.17323/usp 71202285-105 (rus.).
2. Shirov A.A., Porfiryev B.N., Shokin I.N., Korolev I.B., Rutkovskaya E.A., Kuznetsova O.V. et al. Russia 2035: Towards a New Quality of the National Economy : Research report of the IEF RAS; ed. by Corresponding Member of the Russian Academy of Sciences Shirov A.A. Moscow, Artik Print, 2024; 264. DOI: 10.47711/sr1-2024. EDN QITVMS. (rus.).
3. Shirov A.A., Porfiryev B.N., Petrikov A.V., Kuznetsova O.V., Ksenofontov M.Yu., Kuvalin D.B. et al. Russia 2035: development space : Scientific report. Moscow, Dinamik Print, 2025; 364. DOI: 10.47711/sr1-2025. EDN DKVIKY. (rus.).
4. Plisetsky E.L., Eremeeva L.N., Ivanova N.V., Ilyina I.N., Kurnyshev V.V., Lopatnikov D.L. et al. Regional Economics : a textbook for universities; 4th ed., revised and enlarged. Moscow, Yurait Publishing House, 2025; 554. URL: https://urait.ru/book/regionalnaya-ekonomika-560252. EDN YEASWM. (rus).
5. Kim V.V. Macroregions and Federal districts: a sign of equality? Advances in Law Studies. 2019; 7(1):36-40. DOI: 10.29039/article_ 5d1290f2ecb6f8.06310026. EDN AXFIUP.
6. Bondarenko N.E., Gubarev R.V. The problem of regional inequality in the social and economic development of the Russian Federation. Bulletin of the Plekhanov Russian University of Economics. Vestnik of the Plekhanov Russian University of Economics. 2020; 17:5(113):56-68. DOI: 10.21686/2413-2829-2020-5-56-68. EDN VCVDKJ. (rus.).
7. Dovlatova G.P., KarashchenkoV.V. Spatial analysis of indicators of socio-economic and innovative development of the Rostov region. MIR (Modernization. Innovations. Development). 2023; 14(2):277-293. DOI: 10.18184/2079-4665.2023.14.2.277-293. EDN JUYEWM. (rus.).
8. Tarasova O.B., Goncharova N.Z. Statistical analysis of the results of the implementation of the strategy for the spatial development of the Russian region for the period up to 2025. Journal of Economics, Entrepreneurship and Law. 2025; 15 (5):3503-3520. DOI: 10.18334/ epp.15.5.123188. EDN HRNQSC. (rus.).
9. Sheina S.G., Fedorovskaya A.A., Wiegand D. Cluster policy as a basic element of regional economic development (on the example of the Rostov region). Real Estate: Economics, Management. 2021; 3:61-66. DOI: 10.22337/2073-8412-2021-3-61-66. EDN PTCXYD.
10. Sheina S.G., Mirgorodskaya E.O., Novoselova I.V. Formation of the rental housing market in Russia: potential of the institutional experience of Western European countries (part 1). Real estate: economics, management. 2018; 2:90-93. EDN XZDQNF (rus.).
11. Semushina I.A. Practical application of methodical recommendations for identifying key settlements: a case study of the European north of Russia, determining communities. The North and the market: forming the economic order. 2023; 2:160-174. DOI: 10.37614/2220-802X.2.2023.80.011. EDN NMYLHL. (rus.).
12. Mikheeva N.N. Adaptation of the spatial structure of the Russian economy to external shocks. Studies on Russian Economic Development. 2023; 6(201):207-219. DOI: 10.47711/0868-6351-201-207-219. EDN VMTSGI. (rus.).
13. Gilmundinov V.M., Pankova Yu.V. Spatial development of Russia in the conditional of external and internal challenges. Studies on Russian Economic Development. 2023; 4(199):82-93. DOI: 10.47711/0868-6351-199-82-93. EDN MOCDSN. (rus.).
14. Batrakova L.G. Regional inequality in the socio-economic development of Russia. Social and political researches. 2021; 4(13):61-84. DOI: 10.20323/2658-428X-2021-4-13-61-84. EDN LFWYAB (rus.).
15. Plisetsky E.L., Plisetsky E.E. Infrastructure potential of Russian regions as a factor of sustainable regional development. Public administration issues. 2020; 3:165-186. DOI: 10.17323/1999-5431-2020-0-3-165-186. EDN WBNREP. (rus.).
16. Zakshevsky V.G., Ulez'ko A.V. Balanced rural development as spatial systems: the essence and nature of imbalances. Russian Journal of Management. 2025; 13(4):1-12. DOI: 10.29039/2500-1469-2025-13-4-1-12. EDN SZMFDP. (rus.).

Сбалансированность пространственного развития южного макрорегиона: стратегический контекст

В статье представлены результаты анализа макроэкономических показателей территорий, которые позволяют оценить вклад регионов в социально-экономическое развитие южного макрорегиона и выявить направления развития системы территориального управления с целью достижения сбалансированности в стратегическом контексте. Для проведения анализа отобраны три региона: Ростовская область, Краснодарский и Ставропольский края как базовые территории, формирующие пространство южного макрорегиона и способные к выстраиванию межтерриториального взаимо-

действия в достижении национальных целей. Проблема формирования единого территориального пространства остро стоит перед всеми субъектами, и достижение экономической связанности, проявляющейся в налаживании транспортно-логических путей, торгово-экономических, институциональных и социально-инфраструктурных связей, возможно через создание опорного каркаса, т.е. основополагающей структуры территориального развития. Результаты макроэкономического анализа по представленной в исследовании методике ложатся в основу сценарного планирования социально-экономического развития территорий, направленного на достижение целей устойчивости, связанности и сбалансированного развития.

Ключевые слова: *опорный территориальный каркас, макроэкономические показатели, территориальная связанность, социально-экономическое развитие, пространственная экономика*

СПИСОК ИСТОЧНИКОВ

1. Городничев А.В., Скребкова Е.В. Неравномерное развитие Москвы в контексте сложившейся пространственной структуры постсоциалистического мегаполиса // Городские исследования и практики. 2022. № 7 (1). С. 85–105. DOI: 10.17323/usp71202285-105
2. Широв А.А., Порфирьев Б.Н., Шокин И.Н., Королев И.Б., Рутковская Е.А., Кузнецова О.В. и др. Россия 2035: к новому качеству национальной экономики : научный доклад ИПН РАН; под ред. чл.-корр. РАН А.А. Широва. М. : Артик Принт, 2024. DOI: 10.47711/sr1-2024. EDN QITVMS.
3. Широв А.А., Порфирьев Б.Н., Петриков А.В., Кузнецова О.В., Ксенофонтов М.Ю., Кувалин Д.Б. и др. Россия 2035: пространство развития : науч. доклад. М. : Динамик Принт, 2025. 364 с. DOI: 10.47711/sr1-2025. EDN DKVIKY.
4. Плисецкий Е.Л., Еремеева Л.Н., Иванова Н.В., Ильина И.Н., Курнышев В.В., Лопатников Д.Л. и др. Региональная экономика : уч. для вузов.; 4-е изд., перераб. и доп. М. : Юрайт, 2025. 554 с. URL: https://urait.ru/book/regionalnaya-ekonomika-560252. EDN YEASWM.
5. Ким В.В. Макрорегионы и Федеральные округа: знак равенства? // Advances in Law Studies. 2019. № 7 (1). С. 36–40. DOI: 10.29039/article_5d1290f2ecb6f8.06310026. EDN AXFIUP.
6. Бондаренко Н.Е., Губарев Р.В. Проблема регионального неравенства в социально-экономическом развитии Российской Федерации // Вестник Российского экономического университета им. Г.В. Плеханова. 2020. Т. 17. № 5 (113). С. 56–68. DOI: 10.21686/2413-2829-2020-5-56-68. EDN VCVDKJ.
7. Довлатова Г.П., Каращенко В.В. Пространственный анализ показателей социально-экономического развития Ростовской области // МИР (Модернизация. Инновации. Развитие). 2023. № 14 (2). С. 277–293. DOI: 10.18184/2079-4665.2023.14.2.277-293. EDN JUYEWM.
8. Тарасова О.Б., Гончарова Н.З. Статистический анализ итогов реализации Стратегии пространственного развития Российской Федерации на период до 2025 года // Экономика, предпринимательство и право. 2025. № 15 (5). С. 3503–3520. DOI: 10.18334/epp.15.5.123188. EDN HRNQSC.
9. Шеина С.Г., Федоровская А.А., Виганд Д. Кластерная политика как базовый элемент развития экономики региона (на примере Ростовской области) // Недвижимость: экономика, управление. 2021. № 3. С. 61–66. DOI: 10.22337/2073-8412-2021-3-61-66. EDN PTCXYD.
10. Шеина С.Г., Миргородская Е.О., Новоселова И.В. Формирование рынка арендного жилья в России: потенциал институционального опыта западноевропейских стран (ч. 1) // Недвижимость: экономика, управление. 2018. № 2. С. 90–93. EDN XZDQNF.
11. Секушина И.А. Возможности практического применения методических рекомендаций по определению опорных населенных пунктов (на примере Европейского Севера России) // Север и рынок: формирование экономического порядка. 2023. Т. 26. № 2 (80). С. 160–174. DOI: 10.37614/2220-802X.2.2023.80.011. EDN NMYLHL.
12. Михеева Н.Н. Адаптация пространственной структуры российской экономики к внешним шокам // Проблемы прогнозирования. 2023. № 6 (201). С. 207–219. DOI: 10.47711/0868-6351-201-207-219. EDN VMTSGI.
13. Гильмундинов В.М., Панкова Ю.В. Пространственное развитие России в условиях внешних и внутренних вызовов // Проблемы прогнозирования. 2023. № 4 (199). С. 82–93. DOI: 10.47711/0868-6351-199-82-93. EDN MOCDSN.
14. Батракова Л.Г. Региональное неравенство в социально-экономическом развитии России // Социально-политические исследования. 2021. № 4 (13). С. 61–84. DOI: 10.20323/2658-428X-2021-4-13-61-84. EDN LFWYAB.
15. Плисецкий Е.Л., Плисецкий Е.Е. Инфраструктурный потенциал территории как фактор устойчивого регионального развития // Вопросы государственного и муниципального управления. 2020. № 3. С. 165–186. DOI: 10.17323/1999-5431-2020-0-3-165-186. EDN WBNREP.
16. Закшевский В.Г., Улезько А.В. Сбалансированность развития сельских территорий как пространственных систем: сущность и природа дисбалансов // Russian Journal of Management. 2025. № 13 (4). С. 1–12. DOI: 10.29039/2500-1469-2025-13-4-1-12. EDN SZMFDP.

Об авторах: **Миргородская Елена Олеговна** — доктор экономических наук, профессор, заведующая кафедрой «Государственное и муниципальное управление»; **Донской государственный технический университет (ДГТУ)**; 344000, г. Ростов-на-Дону, Площадь Гагарина, д. 1; РИНЦ ID: 674907, Scopus AuthorID: 57196469449, WoS ResearcherID: ADD-9717-2019, ORCID: 0000-0002-0708-5524; emirgorod@mail.ru;

Медведева Людмила Сергеевна — кандидат экономических наук, доцент, доцент кафедры «Экономика и менеджмент»; **Донской государственный технический университет (ДГТУ)**; 344000, г. Ростов-на-Дону, Площадь Гагарина, д. 1; РИНЦ ID: 622255, Scopus AuthorID: 57218106885, WoS ResearcherID: ABC-1063-2021, ORCID: 0000-0002-4853-0065; milla1988@mail.ru.

For citation: Mirgorodskaya E.O., Medvedeva L.S. Balanced spatial development of the Southern macroregion: strategic context. *Real Estate: Economics, Management*. 2025; 3:46-52.

Для цитирования: *Миргородская Е.О., Медведева Л.С.* Balanced spatial development of the Southern macroregion: strategic context // Недвижимость: экономика, управление. 2025. № 3. С. 46–52.

ZHOU Zhibo
WANG Yan
XU Jiawei
LI Bo

Preliminary experimental scheme for two–dimensional heat and moisture transfer in porous building materials

To investigate the two-dimensional heat and moisture transfer behaviour in building porous materials and analyze the influence of edge sealing conditions on their thermophysical and hygric properties, this study proposes a new experimental scheme. Three typical construction materials — rock wool board, extruded polystyrene (XPS) board, and foam concrete — were selected as test specimens. By monitoring real-time temperature and humidity variations inside and outside the experimental setup, the coupled heat and moisture transfer characteristics of different materials were examined. The results demonstrate that materials with high water vapour resistance and effective air tightness significantly enhance thermal and hygric stability. Furthermore, for loosely structured porous materials, moisture loss through lateral edges leads to non-uniform humidity distribution within the material. Based on experimental data, this study quantitatively determined the water vapour permeability coefficients of the three materials and elucidated the underlying mechanisms. The proposed experimental method establishes a new approach for measuring 2D coupled heat and moisture transfer in building materials, providing a scientific framework for studying heat and moisture transport mechanisms in architectural applications.
Keywords: *porous materials, heat and moisture transfer, experimental protocol*

INTRODUCTION

Against the backdrop of increasingly prominent climate change and environmental pollution, building energy efficiency has become a critical issue for governments worldwide. As the largest energy consumer, China faces significant challenges in improving building energy performance. Porous building materials, characterized by their unique solid-gas two-phase structure, are widely used in building envelopes, insulation systems, and decorative materials. The pore characteristics and physical properties of these materials play a decisive role in heat and moisture transfer, impacting not only the durability of buildings but also indoor thermal and hygric environments and human comfort [1]. Consequently, extensive research has been conducted on the heat and moisture transfer properties of porous building materials, aiming to optimize material performance for reduced energy consumption and improved indoor environmental quality. In this context, developing convenient and reliable experimental methods for heat and moisture transfer is of great theoretical and practical value for revealing the underlying mechanisms of heat and moisture migration in porous building materials [2].

Domestic and international standards for testing the heat and moisture transfer performance of porous building materials have formed a relatively comprehensive system, gradually evolving toward dynamic, intelligent, and micro-scale characterization. In China, the cup method (GB/T 17146–2019) serves as the core testing technique, supplemented by the desiccant and wet-dish methods for measuring water vapour transmission rates. Recently, the China Academy of Building Research developed a dynamic climate chamber method to simulate temperature and humidity cycles for comprehensive performance evaluation [3, 4] Internationally, ISO 12572 employs the dry-wet cup method to determine moisture permeability coefficients[1], ASTM E96 is suitable for grading tests of thin-film materials[2], and the Nordic NT BUILD 428 quantifies liquid water transport coefficients in cement-based materials through capillary absorption tests.

Technological innovations in this field include the use of scanning electron microscopy (ESEM) by Academician Liu Jiaping to reveal the hydration kinetics and microstructural evolution of ultra-high-performance cement-based composites under low to moderate curing temperatures [5]. Professor Meng Qinglin developed a thermal-hygric climate wind tunnel test bench combined with infrared thermography and optical fiber sensing for dynamic monitoring of moisture resistance in building envelopes [6]. The Fraunhofer Institute for Building Physics (IBP) employs high-precision climate chambers with multi-field coupling control and dynamic climate simulation to address gaps in traditional testing methods for complex environmental conditions.

Current cutting-edge research integrates multidisciplinary technologies, such as CT scanning and numerical simulation for analyzing the influence of pore structures on heat and moisture transfer in aerogels [7], infrared thermography and spectral analysis (e.g., FTIR) for real-time monitoring of surface temperature and humidity distributions in smart materials, AI image recognition and infrared thermography for non-destructive testing and real-time monitoring of material defects [8], and digital twins combined with reinforcement learning (e.g., LSTM

[1] ISO 12571:2013. Hygrothermal performance of building materials and products — Determination of hygroscopic sorption properties [S]. 2013.

[2] ASTM C1498-04a. Standard Test Method for Hygroscopic Sorption Isotherms of Building Materials [S]. 2016.



ZHOU Zhibo,
Ph.D., Lecturer; School of Architecture and Design, Harbin Institute of Technology; Harbin, 150006, China; Key Laboratory of Cold Region Urban and Rural Human Settlement Environment Science and Technology, Ministry of Industry and Information Technology; Harbin, 150090, China; zhibo_zhou@hit.edu.cn



WANG Yan,
Master's Student; School of Architecture and Design, Harbin Institute of Technology; Harbin, 150006, China; Key Laboratory of Cold Region Urban and Rural Human Settlement Environment Science and Technology, Ministry of Industry and Information Technology; Harbin, 150090, China; suncheng@hit.edu.cn



XU Jiawei,
Master; School of Architecture and Design, Harbin Institute of Technology; Harbin, 150006, China; Key Laboratory of Cold Region Urban and Rural Human Settlement Environment Science and Technology, Ministry of Industry and Information Technology; Harbin, 150090, China; suncheng@hit.edu.cn



LI Bo,
Master's Student; School of Architecture and Design, Harbin Institute of Technology; Harbin, 150006, China; Key Laboratory of Cold Region Urban and Rural Human Settlement Environment Science and Technology, Ministry of Industry and Information Technology; Harbin, 150090, China; suncheng@hit.edu.cn

YU Wenrui
Abramova E.V.



YU Wenrui,
Master's Student; School of Architecture and Design, Harbin Institute of Technology; Harbin, 150006, China; Key Laboratory of Cold Region Urban and Rural Human Settlement Environment Science and Technology, Ministry of Industry and Information Technology; Harbin, 150090, China; suncheng@hit.edu.cn



Abramova Elena Vyacheslavovna,
Doctor of Technical Sciences, Professor; Scientific Research Institute of Building Physics of the Russian Academy of Architecture and Building Sciences; 21 Lokomotivny proezd, Moscow, 127238, Russian Federation; Bauman Moscow State Technical University; 2 5 Baumanskaya st., Moscow, 105005, Russian Federation, e.v.abramova11@yandex.ru

neural networks) for machine learning-assisted optimization of long-term hygrothermal performance predictions [9, 10].

Despite these advancements, existing testing methods often require high-end instruments and platforms, resulting in elevated costs that hinder large-scale daily experimentation. Therefore, this study improves upon the traditional cup method by systematically testing three typical building materials — rock wool board, XPS board, and foam concrete — under controlled variables. The results demonstrate that the new scheme not only qualitatively and quantitatively measures water vapour transmission but also enables real-time monitoring of 2D heat and moisture transfer dynamics via embedded sensors, offering a cost-effective and practical solution for fundamental research.

EXPERIMENTAL DESIGN

Materials

1. Rock wool board.

Thermal conductivity of 0.035–0.045 W/m·K, a thermal insulation material formed by high-temperature melting and spinning of natural rocks. It exhibits strong water absorption but maintains long-term weather resistance and stability with proper waterproofing.

2. Foam concrete.

Thermal conductivity of 0.12–0.18 W/m·K, a lightweight insulation material made from cement, quartz sand, and foaming agents. Its porous structure reduces thermal conductivity while allowing vapour transmission to prevent moisture accumulation.

3. Extruded polystyrene (XPS) board.

Thermal conductivity of 0.028–0.035 W/m·K, a rigid foam plastic board with excellent insulation, moisture resistance, and compressive properties.

Methods

1. Experimental Apparatus.

The main components of our experimental setup include a Z-shaped white plastic container, EBS temperature and humidity sensors, an electronic balance accurate to 0.001 g, a black enclosure, a camera recorder, a wax-based sealing compound, and syringes.

The Z-shaped white polyurethane container functions as the primary testing device. It's designed to maintain stable liquid flow and ensure accurate water vapour permeability measurements. At the front, there's a precisely measured 100 × 100 × × 40 mm slot for inserting building material specimens. At the back of the device, there are three evenly spaced circular openings, each 15 mm wide, aligned vertically. This setup divides the interior into four equal parts, making it easier to study how vapour passes through at different heights. The container's bottom holds the liquid that evaporates, while a small 2 mm injection port on the side allows us to carefully add or remove liquid with a syringe. This feature helps control the evaporation process precisely. Overall, this design gives us better management of liquid input and makes the device more reusable.

To keep everything stable during tests, the Z-shaped component is made from lightweight, waterproof, and corrosion-resistant materials, produced through 3D printing. It seals tightly to prevent vapour leaks and remains effective even after long periods of use, helping shield the setup from external environmental factors. Both the top opening and the liquid reservoir feature an equal surface area of 10,000 mml, providing a sufficient evaporation surface and helping to minimize measurement errors caused by inadequate evaporation areas. The structural layout of the apparatus is depicted in Fig. 1.

During the process of installing specimens, to ensure the data are accurate and reliable, all specimens must be fully embedded into the standardized front opening of the apparatus following the specified procedure strictly, and the dimensional deviation of the specimen edges must be controlled within ±3 mm. This is because warping, shrinking, or protrusions could alter the water vapour transmission pathway and lead to measurement inaccuracies.

Before testing, all building material specimens must undergo a drying process to remove free water from their surfaces and interiors, ensuring the validity of subsequent vapour transmission measurements. Once the specimens are dry, gently place them into the front slot of the apparatus. Make sure to seal any gaps completely using a wax-based sealing compound. It's important that the sealing material is waterproof and remains stable over time, without affecting how moisture moves inside the material or disrupting the vapour pressure balance nearby.

Choosing and applying the right sealing agent carefully is essential because using the wrong method could lead to errors in the experiment and result in inaccurate findings. The installation configuration of the specimen is shown in Fig. 2.

2. Assembly and Procedure.

During the experiment, the BES temperature and humidity sensors are first connected to a computer, with the appropriate measurement intervals and sampling frequencies configured to ensure accurate and continuous data acquisition. To ensure the reliability of the measurements, three identical BES sensors are inserted into the three circular probe ports located on the rear of the apparatus. During installation, the front end of each sensor must make full contact with the inner surface of the building material to accurately monitor the dynamic changes in temperature and humidity at the moisture-exposed side. The diameter of each probe hole is matched to the sensor dimensions to ensure a secure fit and minimize measurement errors caused by poor contact.

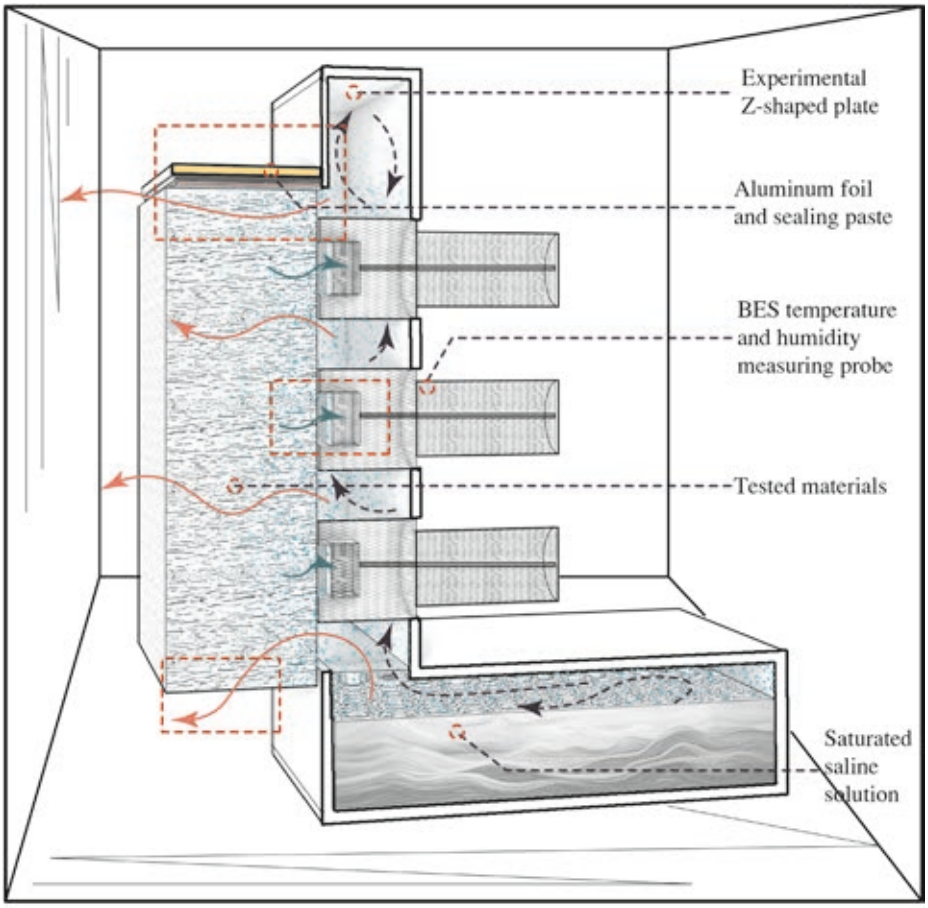


Fig. 1. Structural diagram of the experimental apparatus

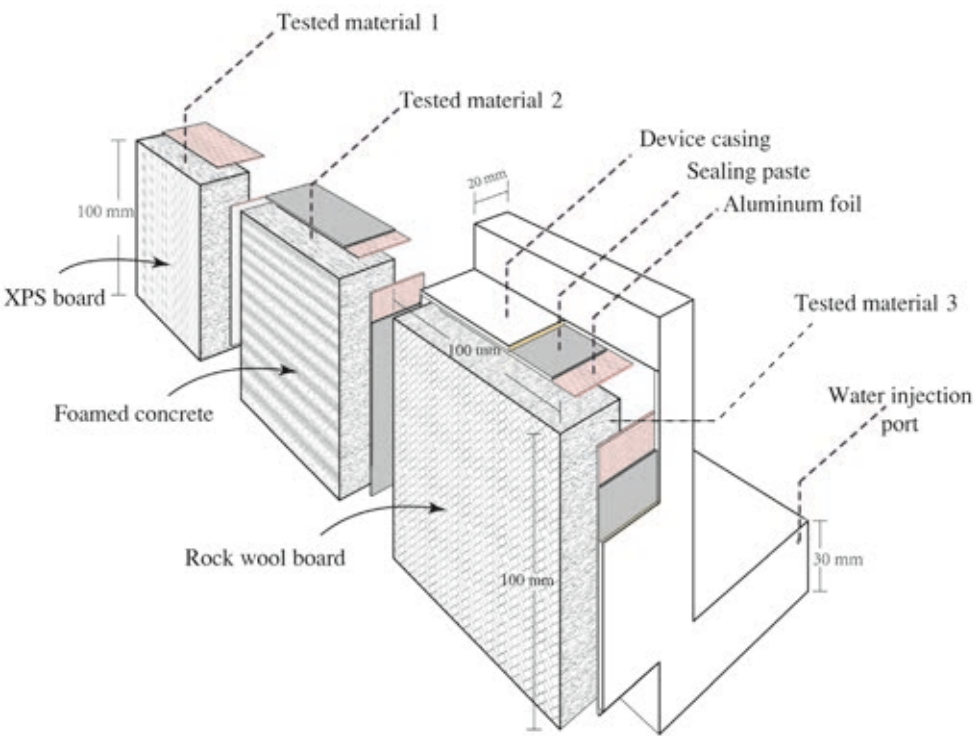


Fig. 2. Illustration of specimen installation

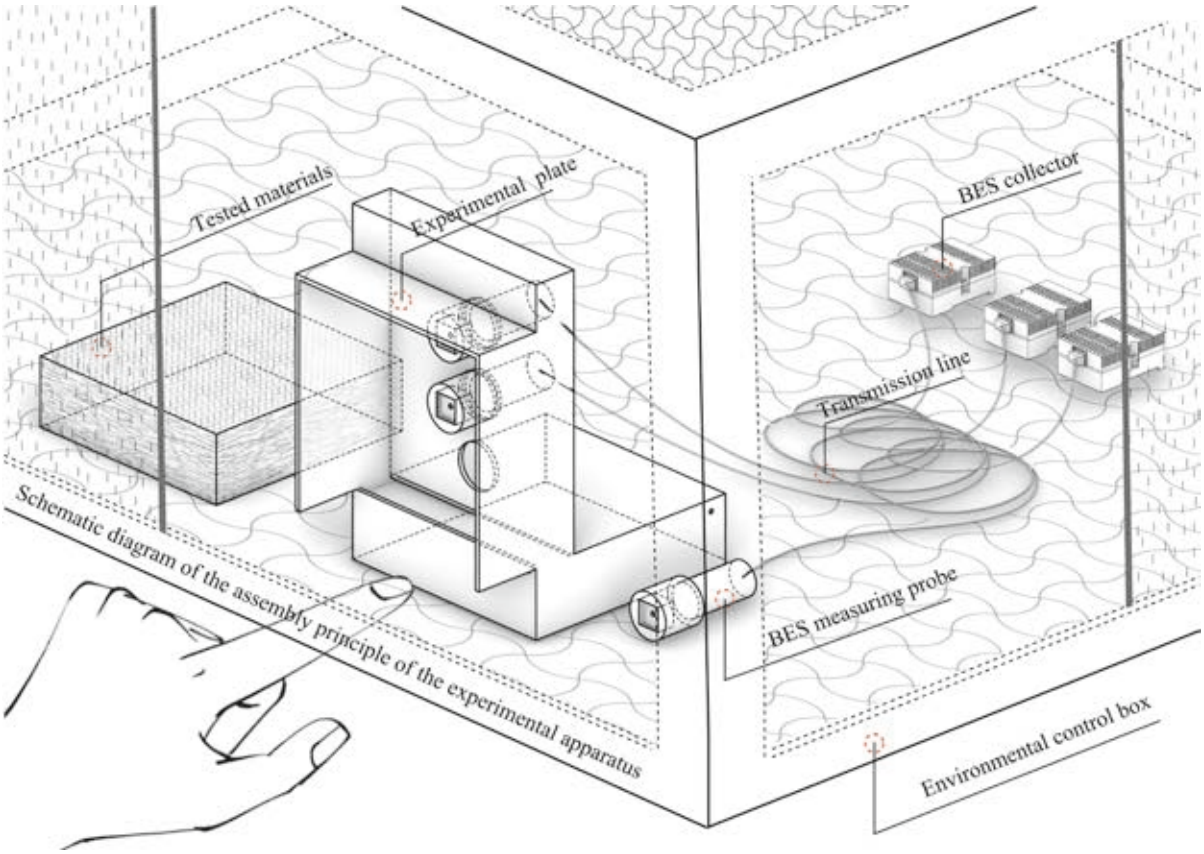


Fig. 3. Schematic diagram of specimen setup and environmental control system

After the building materials are installed, a syringe is used to extract a fixed volume of saturated salt solution, which is slowly injected through the side injection port of the apparatus. The injection process should be carefully controlled in terms of flow rate, and the syringe should be held at a 45° angle to prevent splashing and contamination of the specimen surface. Once the solution is injected, the port is sealed with waterproof adhesive to ensure a stable and airtight test environment inside the apparatus. At this point, the assembly of the core measurement device is complete, providing a reliable foundation for subsequent testing.

For the external testing system, an analytical balance with 1000-g capacity and 0.001-g accuracy is calibrated and zeroed using standard weights. The fully assembled apparatus is then placed centrally and steadily on the weighing platform. Once stabilized, the power is turned on to enable real-time monitoring of mass changes in the Z-shaped apparatus, allowing for precise tracking of transient mass variations.

After assembling the entire system, the setup, which includes the primary testing unit and BES monitoring components, is placed inside an environmental control black box, as shown in the figure. The black box provides a stable ambient environment, where both temperature and relative humidity variations are precisely monitored, providing a comprehensive basis for subsequent data analysis. The principle of specimen setup and system configuration is illustrated in Fig. 3.

This test method is applicable to various types of multi-layer porous building materials and composite wall specimens. When the specimen mass exceeds the standard capacity, counterbalancing weights should be added to the apparatus and an electronic balance with appropriate weighing range must be selected. For specimens exceeding 40 mm in thickness, the front-end structure of the Z-type apparatus should be extended to accommodate dimensional variations. The testing procedure controls humidity conditions on both sides of the specimen to establish water vapour transmission along the path from the high-humidity side to the low-humidity side, thereby obtaining measurements of the material's water vapour permeability characteristics.

ROCK WOOL MATERIAL OBSERVATION TEST

The experiment involved continuous monitoring of water evaporation from rock wool materials. Over a period of 400 hours, periodic measurements were conducted to capture the complete evaporation cycle. In the initial phase, the internal humidity increased rapidly from approximately 10 to 45 %, followed by fluctuations, indicating an unstable equilibrium. During this stage, a dynamic balance was observed between water evaporation from the solution and moisture diffusion from the material surface, suggesting a steady evaporation process.

After approximately 200 hours, as the majority of the water had evaporated, the surface humidity exhibited more pronounced fluctuations, reflecting the transition to a drying-dominated phase. Following about 15 hours of high-amplitude oscillations, the relative humidity decreased rapidly and gradually converged with the ambient humidity level, marking the completion of the first full evaporation cycle in the rock wool material. The data acquisition and monitoring process are illustrated in Fig. 4.

1. Experimental results analysis.

Based on the dynamic characteristics of relative humidity changes on the moisture-exposed surface during water vapour

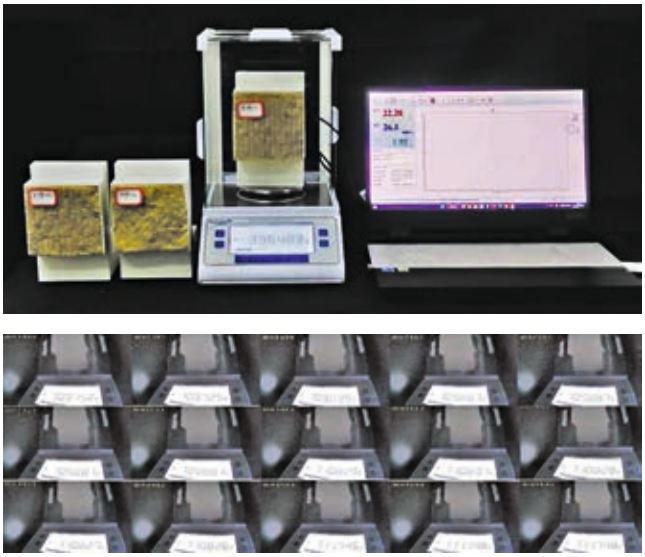


Fig. 4. Schematic diagram of the experimental setup for rock wool evaporation monitoring

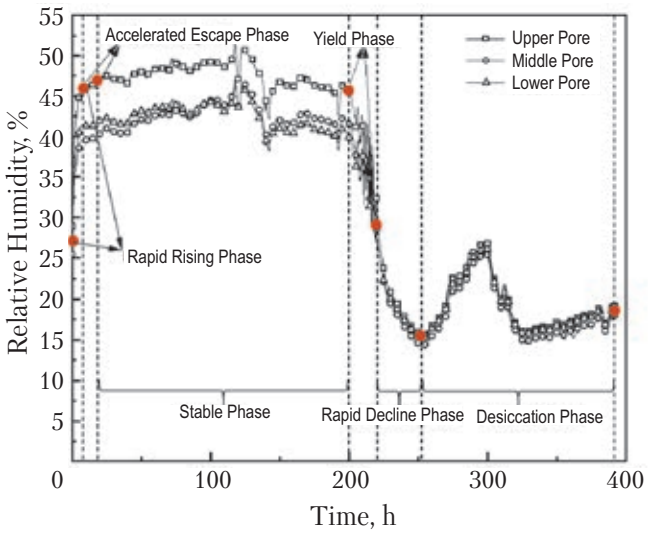


Fig. 5. Rock Wool Moisture-Exposed Surface Humidity Variation Curve

evaporation, the evaporation cycle was divided into six typical stages: rapid rising phase, accelerated escape phase, stable phase, yield phase, rapid decline phase, and dry phase. This staging method helps systematically analyze the water vapour penetration mechanism in building porous materials. In addition, comparative analysis of relative humidity changes at three monitoring points (upper, middle, and lower) on the moisture-exposed surface of porous materials revealed that the upper point maintained the highest relative humidity, averaging about 5 % higher than the middle and lower points during the stable phase. In the initial test stage, the lower point showed slightly higher relative humidity than the middle point, but as the test progressed, the middle point gradually surpassed the lower point, with both exhibiting an alternating upward trend.

Notably, when the solution was nearly evaporated, all monitoring points experienced significant high-amplitude fluctuations before eventually converging to similar humidity levels, as shown in Fig. 5.

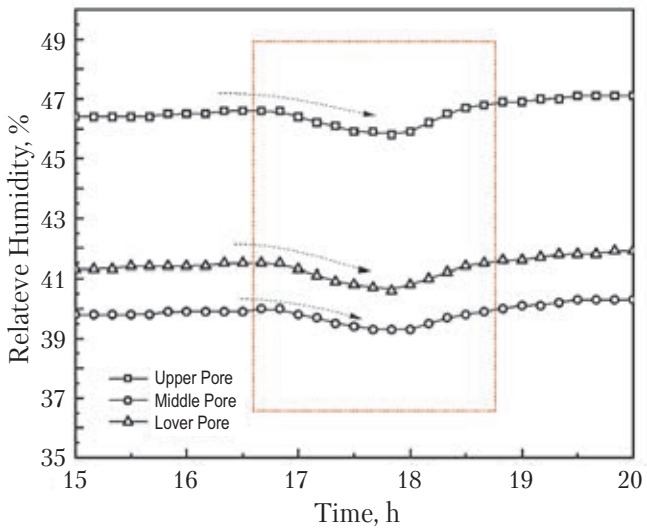


Fig. 6. Detailed view of the accelerated escape phase in rock wool testing

During the monitoring of the accelerated escape phase at the moisture-exposed surface of rock wool, the relative humidity (RH) rapidly decreased by approximately 2 % within 60 min from a previously stable state. Notably, this transient characteristic was also observed in tests involving foam concrete and extruded polystyrene (XPS) boards. However, due to differences in material permeability, the duration of the accelerated escape phase varied among these materials, as illustrated in Fig. 6.

Through continuous 15-hour observation of the yield phase in rock wool's moisture-exposed surface humidity variation, experimental data revealed significant periodic fluctuations in relative humidity (RH), with peak-to-trough differences of 5–10 %. Throughout the monitoring period, the RH curve exhibited an overall decreasing trend. The three detection points (upper, middle, and lower) on the moisture-exposed surface showed highly consistent RH variations while maintaining distinct vertical gradients: the upper point consistently recorded the highest RH, followed by the middle and then the lower point. Quantitative analysis demonstrated that the absolute RH difference between the upper and middle points persistently exceeded that between the middle and lower points.

Toward the end of the yield phase, the RH curves from all three points gradually converged. Correlated with electronic balance measurements and solution replenishment mass analysis, the yield phase was identified as corresponding to the final stage of solution evaporation. During this phase, decreased evaporation rates caused reduced water vapour partial pressure within the apparatus, triggering the observed periodic RH fluctuations at rock wool's moisture-exposed surface, as detailed in Fig. 7.

2. Supplementary test analysis.

This study systematically analyzed the water vapour permeability characteristics of rock wool by comparing its performance changes after experiencing a complete evaporation cycle. After refilling the evaporated apparatus with saturated salt solution, performance comparison tests were conducted under identical environmental conditions. Comparative analysis of temperature and humidity change curves at the moisture-exposed surface of rock wool in both dry and wet states revealed that the entire humidity variation process could still be divided into six typical stages, although significant data fluctuations were observed during

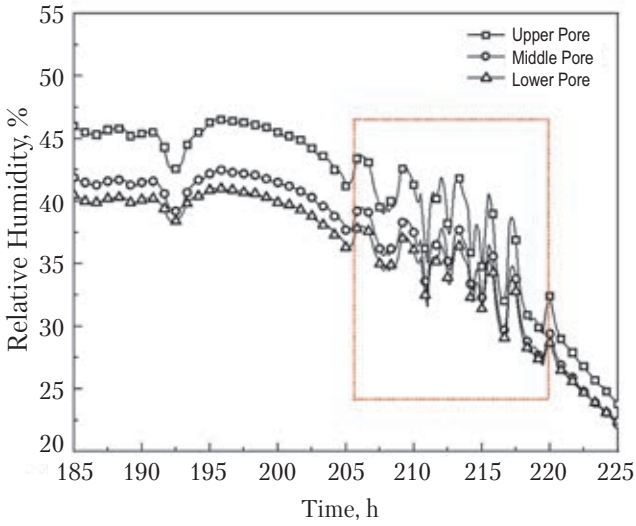


Fig. 7. Detailed view of the yield phase in rock wool testing

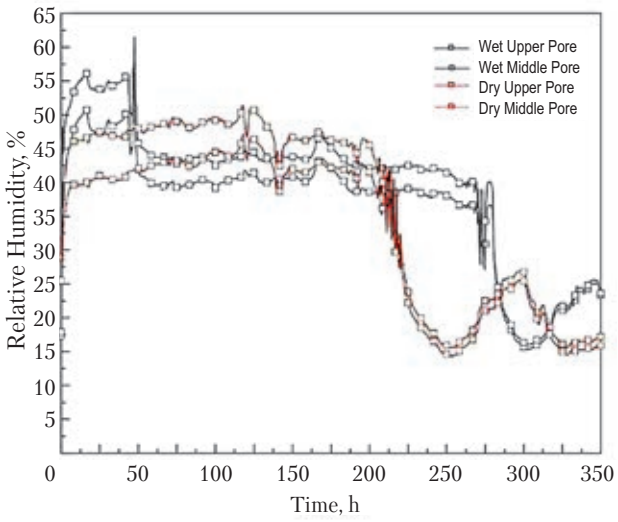


Fig. 8. Detailed view of the yield phase in rock wool testing

the stable phase. Experimental data showed that due to the increased mass of saturated solution, the duration of stable evaporation phase was significantly prolonged.

Specifically, during the rapid rising phase of relative humidity, the internal surface humidity of wet-state rock wool panels was higher than that of dry-state specimens, with more pronounced fluctuation amplitudes during the accelerated escape phase. After undergoing a yield phase similar to the dry state, the wet-state specimens entered a comparable drying phase with minimal humidity value differences, as shown in Fig. 8.

Analysis indicates that after undergoing a complete evaporation cycle, the rock wool material exhibits significantly different drying characteristics compared to its initial state. The reduced moisture gradient within the material slows down water vapour diffusion to some extent, decreasing vapour permeability. Consequently, during the rapid rising phase, the relative humidity near the interior surface reaches higher values than previously observed. This phenomenon creates an enhanced vapour pressure differential between the apparatus's inner and outer surfaces, leading to more vigorous vapour dissipation during the accelerated escape phase. Following this intensified dissipation, the system enters a stabilization period with fluctuations similar in magnitude to the dry-state condition, albeit within a narrower range.

Experimental results demonstrate that after completing a full evaporation cycle, the primary effect observed in rock wool panels — whether in dried or re-wetted conditions — is altered vapour accumulation characteristics during the initial phase, with no significant material performance degradation detected. Regarding the pronounced curve fluctuations during the stabilization phase, these anomalies may potentially stem from instrumentation measurement errors, though current evidence remains insufficient to establish definitive theoretical explanations.

Due to the relatively low overall evaporation rate of the materials — particularly the significantly prolonged evaporation cycles observed in materials with higher vapour permeation resistance — this study was unable to conduct complete evaporation cycle observations for foam concrete and extruded polystyrene (XPS) boards within the experimental timeframe. The investigation was limited to recording the relative humidity variation process from the rapid rising phase through the stabilization phase. Experimental results are presented in Fig. 9–12.

Under identical saturated solution mass injection conditions, foam concrete and extruded polystyrene (XPS) boards exhibited significantly prolonged evaporation cycles compared to rock wool. The moisture-exposed surfaces of these materials maintained higher relative humidity levels: foam concrete showed a gradual decline from an initial 85 % high, while XPS boards sustained persistent high-level fluctuations without observable decreasing trends. In contrast, rock wool completed its entire evaporation cycle within 300 hours, demonstrating approximately 35 % lower relative humidity during the stable evaporation phase than the other two building materials. These observations align with the anticipated water vapour permeability characteristics of the three materials, as illustrated in Fig. 13.

Experimental results of water vapour permeation rates generally corresponded with theoretical predictions. Rock wool displayed superior vapour permeability, whereas XPS boards — due to their lower evaporation rates — produced data with greater fluctuations that somewhat compromised measurement reliability. Nevertheless, the obtained water vapour transmission rates effectively

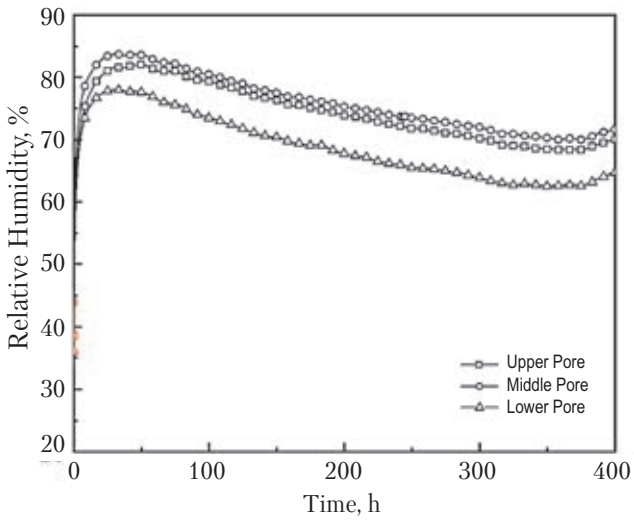


Fig. 9. Humidity variation curve at the moisture-exposed surface of foam concrete

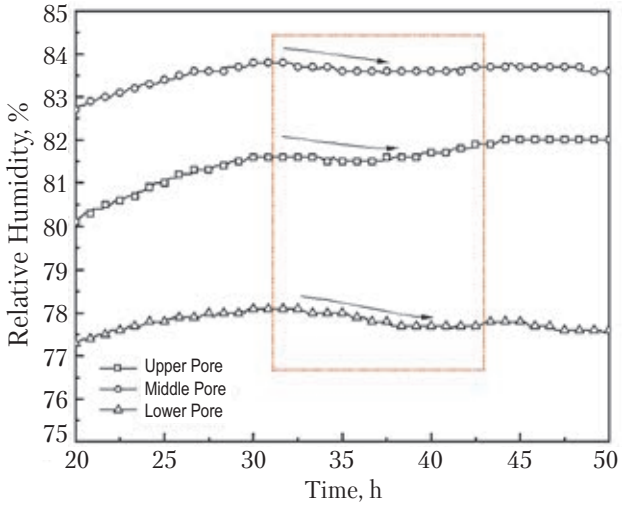


Fig. 10. Detailed view of the accelerated escape phase in foam concrete testing

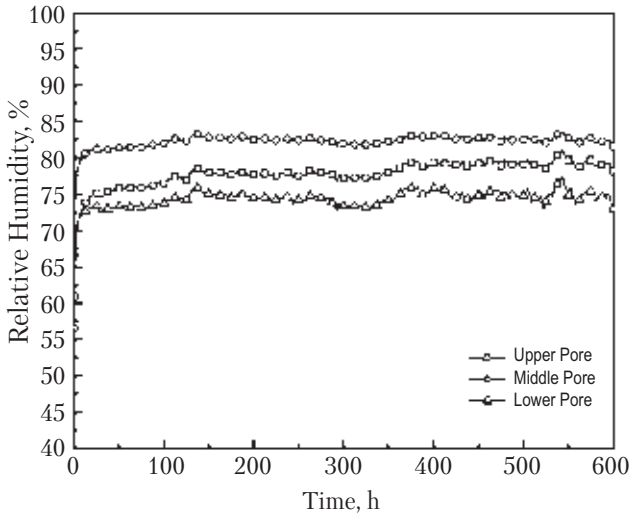


Fig. 11. Humidity variation curve at the moisture-exposed surface of XPS board

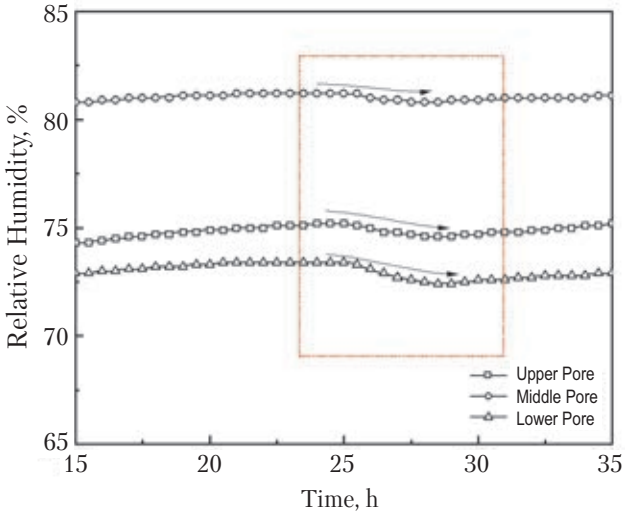


Fig. 12. Detailed view of the accelerated escape phase in XPS board testing

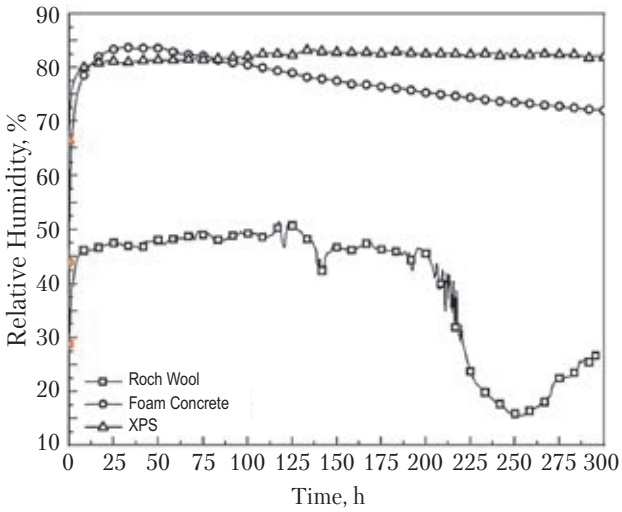


Fig. 13. Comparative analysis of humidity variation curves across materials

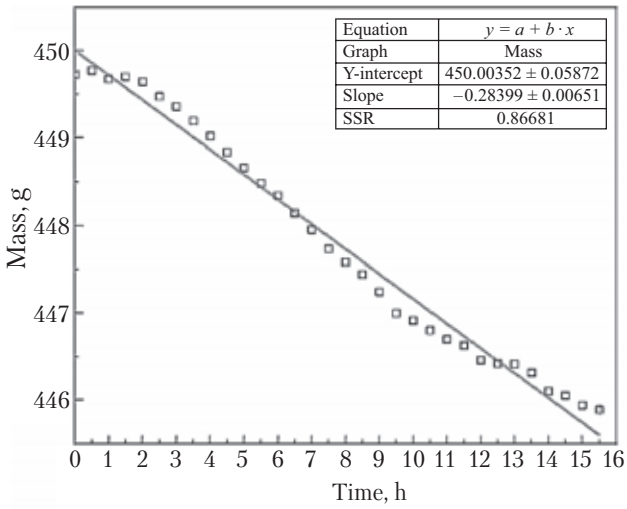


Fig. 14. Water vapour permeability fitting curve for rock wool board

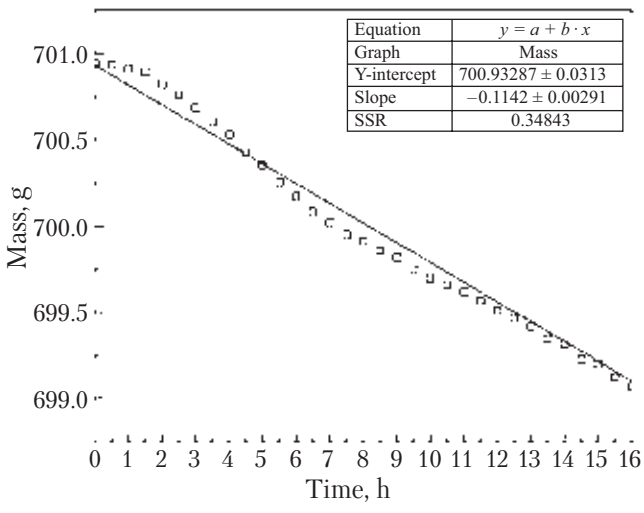


Fig. 15. Water vapour permeability fitting curve for foam concrete

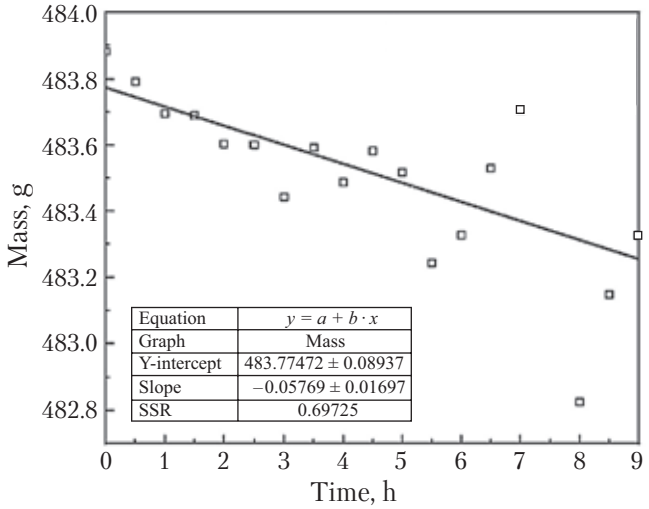


Fig. 16. Water vapour permeability fitting curve for XPS board

represent each material's intrinsic properties. Quantitative permeability results are presented in Fig. 14–16.

CONCLUSION

This study investigated rock wool boards, extruded polystyrene (XPS) panels, and foam concrete through an improved two-dimensional heat-moisture transfer experimental protocol, revealing dynamic hygrothermal migration patterns in porous building materials. The experiments demonstrated that material vapour permeability significantly influences evaporation cycles and humidity distribution: foam concrete and XPS panels exhibited prolonged evaporation cycles with moisture-exposed surface relative humidity maintained at 85 % due to their high vapour resistance, while rock wool›s loose structure resulted in a shorter 300-hour evaporation cycle with 35 % lower humidity during stabilization, confirming theoretical vapour permeability predictions.

The research further identified an accelerated escape phenomenon occurring when vapour breached the material-environment interface barrier, causing abrupt vapour pressure differential reduction. Distinct humidity distribution patterns were observed: rock wool showed highest humidity at upper monitoring points due to unsealed bottom edges, whereas foam concrete and XPS panels exhibited mid-point and upper-mid-point dominance respectively, reflecting their dense structures› impact on vapour pathways. These findings provide empirical evidence for building envelope sealing design.

The experimental protocol achieved dynamic 2D monitoring through embedded sensors, balancing cost-efficiency with operability. However, time constraints limited complete evaporation mechanism analysis for high-resistance materials, warranting longer-term observation. Future studies could integrate numerical modeling or micro-imaging to examine pore structure and interface effects on coupled heat-moisture transfer. These results establish both theoretical and practical foundations for optimizing energy-efficient materials and hygrothermal environment control.

REFERENCES

1. Balaji N.C., Mani M., Reddy B.V.V. Discerning Heat Transfer in Building Materials. Energy Procedia. 2014; 54:654-668.
2. Lei Y., Yang H., Zhang Y. et al. Review of test methods and current status of hygrothermal physical properties of porous building materials. Building Science. 2021; 37(2):165-173+184. DOI: 10.13614/j.cnki.11-1962/tu.2021.02.23
3. Feng C., Zhong H., Feng Y. et al. Advances in testing hygric properties of porous building materials. Proceedings of the 12th National Conference on Building Physics. 2016; 44-48.
4. Feng C., Yu X., Wang D. Determination of hygric properties of aerated concrete. Journal of Civil, Architectural & Environmental Engineering. 2016; 38(2):125-131.
5. Zeng H., Jin M., Li W. et al. Performance evolution of low heat cement under thermal cycling fatigue: A comparative study with moderate heat cement and ordinary Portland cement. Construction and Building Materials. 2024; 412:134863.
6. He J., Li Q., Meng Q. et al. Experimental study on hygroscopic behaviour of salt-containing aerated concrete. Building Science. 2023; 39(6):10-17. DOI: 10.13614/j.cnki.11-1962/tu.2023.06.02
7. Jin M., Ma Y., Li W. et al. Multi-scale investigation on composition-structure of C-(A)-S-H with different Al/Si ratios under attack of decalcification action. Cement and Concrete Research. 2023; 172:107251.
8. Guimarães A.S., Ribeiro I.M., Freitas T.S. TRHUMIDADE — A water diffusivity model to predict moisture content profiles. Cogent Engineering. 2018; 5(1):1459007.
9. Yin X., Li X., Huang Z. et al. Prediction of concrete hydration heat temperature by integrating digital twin and LSTM neural network. Journal of Xi'an University of Architecture & Technology (Natural Science Edition). 2025; 57(2):167-173+316. DOI: 10.15986/j.1006-7930.2025.02.002
10. Yang G., Ye T., Wang G. Prediction analysis of foundation pit deformation based on genetic algorithm optimized LSTM neural network. Anhui Architecture. 2025; 32(4):116-118+176. DOI: 10.16330/j.cnki.1007-7359.2025.4.35

Предварительная экспериментальная схема двумерного тепло- и влагопереноса в строительных пористых материалах

Для исследования двумерного процесса тепло- и влагопереноса в строительных пористых материалах и анализа влияния условий уплотнения кромок на их теплофизические и гигроскопические свойства в данном исследовании предлагается новая экспериментальная схема. В качестве образцов для испытаний были выбраны три типичных строительных материала — плита из минеральной ваты, экструдированный полистирол (ЭППС) и пенобетон. С помощью мониторинга изменений температуры и влажности в режиме реального времени внутри и снаружи экспериментальной установки были изучены взаимосвязанные характеристики тепло- и влагопередачи различных материалов. Результаты показывают, что материалы с высокой паропроницаемостью и эффективной воздухонепроницаемостью значительно повышают термическую и гигроскопическую стабильность. Кроме того, в пористых материалах со слабой структурой потеря влаги через боковые кромки приводит к неравномерному распределению влажности внутри материала. Основываясь на экспериментальных данных, в этом исследовании были количественно определены коэффициенты паропроницаемости трех материалов и выяснены лежащие в их основе механизмы. Предлагаемый экспериментальный метод устанавливает новый подход к измерению двумерного сопряженного тепло- и влагопереноса в строительных материалах, обеспечивая научную основу для изучения механизмов переноса тепла и влаги в архитектурных приложениях.

Ключевые слова: *пористые материалы, тепло-влагоперенос, протокол эксперимента*

СПИСОК ИСТОЧНИКОВ

1. Balaji N.C., Mani M., Reddy B.V.V. Discerning Heat Transfer in Building Materials // Energy Procedia. 2014. No. 54. Pp. 654–668.
2. Lei Y., Yang H., Zhang Y. et al. Review of test methods and current status of hygrothermal physical properties of porous building materials // Building Scienc. 2021. No. 37 (2). Pp. 165–173+184. DOI: 10.13614/j.cnki.11-1962/tu.2021.02.23
3. Feng C., Zhong H., Feng Y. et al. Advances in testing hygric properties of porous building materials // Proceedings of the 12th National Conference on Building Physics. 2016. Pp. 44–48.
4. Feng C., Yu X., Wang D. Determination of hygric properties of aerated concrete // Journal of Civil, Architectural & Environmental Engineering. 2016. No. 38 (2). Pp. 125–131.
5. Zeng H., Jin M., Li W. et al. Performance evolution of low heat cement under thermal cycling fatigue: A comparative study with moderate heat cement and ordinary Portland cement // Construction and Building Materials. 2024. No. 412. P. 134863.
6. He J., Li Q., Meng Q. et al. Experimental study on hygroscopic behaviour of salt-containing aerated concrete // Building Science. 2023. No. 39 (6). Pp. 10–17. DOI: 10.13614/j.cnki.11-1962/tu.2023.06.02
7. Jin M., Ma Y., Li W. et al. Multi-scale investigation on composition-structure of C-(A)-S-H with different Al/Si ratios under attack of decalcification action // Cement and Concrete Research. 2023. No. 172. P. 107251.
8. Guimar es A.S., Ribeiro I.M., Freitas T.S. TRHUMIDADE — A water diffusivity model to predict moisture content profiles // Cogent Engineering. 2018. No. 5 (1). P. 1459007.
9. Yin X., Li X., Huang Z. et al. Prediction of concrete hydration heat temperature by integrating digital twin and LSTM neural network // Journal of Xi'an University of Architecture & Technology (Natural Science Edition). 2025. No. 57 (2). Pp. 167–173+316. DOI: 10.15986/j.1006-7930.2025.02.002
10. Yang G., Ye T., Wang G. Prediction analysis of foundation pit deformation based on genetic algorithm optimized LSTM neural network // Anhui Architecture. 2025. No. 32 (4). Pp. 116-118+176. DOI: 10.16330/j.cnki.1007-7359.2025.4.35

Об авторах: **Джоу Джибо** — кандидат наук, преподаватель; **Школа архитектуры и дизайна, Харбинский технологический институт**; 150006, г. Харбин, Китай; **Ключевая лаборатория науки и технологий в области окружающей среды городских и сельских населенных пунктов Холодного региона, Министерство промышленности и информационных технологий**; 150006, г. Харбин, Китай; zhibo_zhou@hit.edu.cn;

Ван Янь — магистрант; **Школа архитектуры и дизайна, Харбинский технологический институт**; 150006, г. Харбин, Китай; **Ключевая лаборатория науки и технологий в области окружающей среды городских и сельских населенных пунктов Холодного региона, Министерство промышленности и информационных технологий**; 150006, г. Харбин, Китай; suncheng@hit.edu.cn;

Сюй Цзявэй — магистр; **Школа архитектуры и дизайна, Харбинский технологический институт**; 150006, г. Харбин, Китай; **Ключевая лаборатория науки и технологий в области окружающей среды городских и сельских населенных пунктов Холодного региона, Министерство промышленности и информационных технологий**; 150006, г. Харбин, Китай; suncheng@hit.edu.cn;

Ли Бо — магистрант; **Школа архитектуры и дизайна, Харбинский технологический институт**; 150006, г. Харбин, Китай; **Ключевая лаборатория науки и технологий в области окружающей среды городских и сельских населенных пунктов Холодного региона, Министерство промышленности и информационных технологий**; 150006, г. Харбин, Китай; suncheng@hit.edu.cn;

Юй Вэньруй — магистрант; **Школа архитектуры и дизайна, Харбинский технологический институт**; 150006, г. Харбин, Китай; **Ключевая лаборатория науки и технологий в области окружающей среды городских и сельских населенных пунктов Холодного региона, Министерство промышленности и информационных технологий**; 150006, г. Харбин, Китай; suncheng@hit.edu.cn;

Абрамова Елена Вячеславовна — д-р техн. наук, профессор; **Научно-исследовательский институт строительной физики Российской академии архитектуры и строительных наук**; 127238, г. Москва, Локомотивный проезд, д. 21, Российская Федерация; **Московский государственный технический университет имени Н.Э. Баумана**; г. Москва, ул. Бауманская, д. 2, стр. 5, 105005; e.v.abramova11@yandex.ru.

For citation: ZHOU Zhibo, WANG Yan, XU Jiawei, LI Bo, YU Wenrui, Abramova E.V. Preliminary experimental scheme for two-dimensional heat and moisture transfer in porous building materials. *Real Estate: Economics, Management*. 2025; 3:53-61.

Для цитирования: *Джоу Джибо, Ван Янь, Сюй Цзявэй, Ли Бо, Юй Вэньруй, Абрамова Е.В.* Preliminary experimental scheme for two-dimensional heat and moisture transfer in porous building materials // Недвижимость: экономика, управление. 2025. № 3. С. 53–61.

UDC 347.214.2:347.232

Sedakov S.Yu.

Real Estate, Unauthorized Constructions, and Forensic Examination

This article examines the conceptual understandings of property law, specifically real estate, as advanced by prominent civil law scholars across various historical periods and as reflected in Russian legislation from the late 19th to the early 21st century.

Despite the temporary marginalization of property rights within the civil law system, the article notes a departure in Russian legal theory and legislation from the established classical doctrine recognizing the multiplicity of real estate objects. The current Civil Code of the Russian Federation is presented as a logical progression in the evolution of these conceptual ideas on property law.

The opinion is put forward that future development of legislation concerning real estate and property law, in general, will follow this main trajectory. One path is the implementation of the "Concept for the Development of Legislation on Property Rights", developed by leading Russian civil law scholars. This Concept is evolving and undergoing changes but is nevertheless being phased into the civil law system. It proposes expanding the scope of limited *in rem* rights, particularly by implementing the principle of unity of fate for a land plot and the structures located on it.

Within the legal and law enforcement community, the multiplicity of real estate objects has created the problem of unregistered structures (unauthorized constructions). The most recent amendment to Article 222 of the Russian Civil Code on unauthorized constructions was made in 2018 (as revised by Federal Law No. 339-FZ of August 3, 2018) and has since generated extensive case law. Relevant cases have been heard by both the Supreme Court of the Russian Federation and the Constitutional Court.

Judicial review of disputes involving unauthorized constructions invariably necessitates the appointment of a forensic construction-technical expert examination. While this examination is typically a fundamental piece of evidence for the court's ruling, there are instances where a judicial act is rendered contrary to or independently of the expert opinion. The article reviews specific legal disputes that were resolved independently of the findings from the court-ordered forensic technical examinations, with the final rulings issued by the Supreme Court of the Russian Federation.

Keywords: *Real Estate, Multiple Structures, Unauthorized Construction, Structure Built Without a Permit, Demolition, Expert Testimony, Forensic Construction Expert Examination*



Sedakov Sergey Yurievich,
Associate Professor, Candidate of Sciences (in Law), Department of OSUN; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; ORCID: 0009-0007-4756-2499; setka@ro.ru

The development of property relations in our country received its primary impetus during the period from 1994 to 2006, with the sequential adoption of the parts of the Civil Code of the Russian Federation (the "Civil Code" or "CC RF"). The first part (which took effect on January 1, 1995) consisted of three sections: General Provisions, Property Rights and Other Rights in Rem, and the General Part of the Law of Obligations. In legal history, the most embattled area has arguably been the law of property (rights in rem), which, like a phoenix, repeatedly died and was reborn. "The remnants of rights in rem that survived in the 1922 Civil Code were expelled from the 1964 Civil Code…" [1]. It should be clarified, however, that the 1922 Civil Code of the RSFSR did contain a section titled "Law of Property", which encompassed ownership, pledge, and building rights. In the 1964 Code, the law of property reflected only the right of ownership, with a severely truncated description of the classification of things.

A cornerstone of the law of property is the concept of real estate and the associated legal relations. The term "real estate" refers primarily to land plots (and, more broadly, land as a natural feature and resource). During the Soviet era of nationalization, land was removed from commercial circulation, and land law became an independent legal field. To some extent, the principles and norms of land relations established in the 1922 Land Code of the RSFSR persisted until 2001, when the Land Code of the Russian Federation (the "Land Code" or "LC RF") took effect. This separation of civil law into distinct codes remains in place today. However, the Land Code of the Russian Federation incorporated rules that are civil-law in nature — covering ownership and other rights in rem to land plots, contracts for the sale and lease of land plots, and others. The corresponding provisions of the Civil Code began to be applied as supplementary.

This situation, where the civil law system contains overlapping and duplicative norms, is expected to be resolved through a reform of the Civil Code. It was initially anticipated that amendments to the section of the Civil Code on rights in rem would render the corresponding provisions of the Land Code obsolete, leading to their repeal [2]. The land legislation itself includes provisions referencing timelines for planned legislative changes, some extending as far as 2033 (the latest version of this law is dated July 31, 2025)[1].

As is known, Russia's civil law system belongs to the Germanic branch of the continental civil law tradition. Consequently, the ideal objective of the reform was to align the fundamental norms of Russian

[1] On the Enactment of the Land Code of the Russian Federation : Federal Law No. 137-FZ of October 25, 2001. Articles 3 (Part 2.7), 3.7 (Part 2), 8, 9, 19, etc.

property law with the traditional approaches of classic European continental codifications, based on the Concept for the draft text of the relevant section.

According to the Concept for the Development of Russian Legislation on Property Law, it was envisaged to expand the range of limited real rights (*numerus clausus*), in particular, by implementing the principle of unity of fate of a land plot and the buildings located on it, " ...which is expected to significantly simplify the turnover of land plots and, consequently, prevent potential disputes in courts and other jurisdictional bodies" [3].

Even Roman jurists believed that "only that which is rooted in the earth is considered part of the land" (anything that is rooted in the ground is considered part of the plot): *Fundi nihil est, nisi quod terra se tenet*. (D.19.1.17. Ulp.) [4]. Likewise: Gai 2.73 *Praeterea id quod in solo nostro ab aliquo aedificatum est, quamuis ille suo nomine aedificauerit, iure naturali nostrum fit, quia superficies solo cedit* (Moreover, whatever is built on our soil by someone becomes ours by natural law, even if he built it in his own name, because whatever is attached to the surface belongs to the soil) [5].

Friedrich Thibaud, a founder of the modern theory of property law, wrote in the 18th century: "no person who had a right to claim the principal thing together with its accessories could claim the latter alone if his right of action with respect to the principal thing was lost and if he had no independent right to the additional things…" At the same time, he also wrote: "There is no presumption that a thing belongs to its principal thing or is absolutely inseparable from it" [6].

By the end of the 19th century, the renowned German pandectist Heinrich Dernburg noted a fundamental rule: "If buildings and similar structures are erected on a plot, serving not merely temporary needs, …these structures become component parts of the plot and belong to the owner of the plot…" [6]. According to the Pandectist school of thought, the objects of property rights can only be land plots as individually defined things, while buildings and structures represent component parts of the land plots on which they are located: "The right of land ownership affords [the owner] free disposal of the surface of the earth and everything firmly attached to it…" [7]. In classical civil law, a land plot and the buildings on it are considered in the relation of a principal thing and its accessory (*accessio*) [8].

An analysis of the diverse legislative solutions in European legal systems falls far beyond the scope of the tasks set in this article, which are limited to an analysis of the theoretical views of certain representatives of civil law scholarship and are focused on the development of specific legal norms and law enforcement practice. Article 130 of the Russian Civil Code classifies not only land plots as immovable things (real estate), but also buildings, structures, unfinished construction objects, and (since 2016) residential and non-residential premises (among other things). This means the doctrine of real estate separates the rights to land plots from the rights to other associated things or objects. Even pre-revolutionary Russian law, in the Code of Laws (*Svod zakonov*), recognized by law as immovable property not only land but also separate houses and structures: "Lands and all appurtenances, houses, plants, factories, shops, all buildings and vacant lots (a), as well as railways are recognized by law as immovable properties" (Article 384); "Immovable properties that can be divided into separate parts in such a way that each can constitute a separate holding are called divisible; when they, by their nature or by law, cannot be subject to such division, they are called indivisible" (Article 393) [9].

It cannot be asserted that the viewpoint of Russian civil law scholarship is irreconcilably contradictory to the aforementioned opinion of F. Thibaud; however, 19th-century Pandectism developed an unambiguous view on this issue. That is, a broader concept of real estate has developed in the Russian legal tradition than in Pandect law [9]. This represents a departure from the accepted classical model of civil law, according to which everything firmly attached to a plot is subsumed by its ownership regime (here and throughout, the discussion concerns only private owners of land plots).

So, domestic civil law doctrine and legislative practice have long moved away from the classical (pandect) model of property law, where the legal regime of land ownership subsumed all immovable things (real estate) as its integral parts. Currently, in establishing private ownership, the law has arrived at a diversity of immovable things within a single land plot. In this regard, property relations, from a historical perspective, will develop towards refining the ownership regime. This is because the mere legislative recognition of a multiplicity of immovable objects inevitably gives rise to intractable enforcement challenges.

Within our legal and judicial enforcement systems, this circumstance (the multiplicity of objects) creates a specific problem of unregistered structures, referred to in the Russian Civil Code as "unauthorized constructions". The problem appears contrived, yet deeply entrenched. Its primary cause lies in tax collection (the search for ways to increase payments by administrative authorities, or ways to evade them by owners) [10].

The problem of unregistered constructions, in a substantive legal sense, is resolved by local administrative authorities based on Articles 285 and 222 of the Russian Civil Code, relevant articles of administrative and procedural law, and other accompanying prohibitive regulations.

Article 285 of the Russian Civil Code provides for the possibility of land plot seizure if, among other reasons, an unauthorized construction has been erected on the plot and the persons specified in clause 2 of Article 222 of this Code have failed to fulfill their legal obligations to demolish it or bring it into compliance with established requirements. In other words, the meaning of these articles offers the said persons an alternative: to bring the construction into compliance with requirements or to demolish it. If this condition is not met, the threat of plot seizure looms. The legal drafting technique initially intended for this part of the article seems to have been forgotten, as court practice shows that administrative authorities, upon discovering such a construction, invariably demand its demolition. The number of lawsuits for the demolition of unauthorized constructions is enormous. From October 2019 to September 1, 2025, the Supreme Court of the Russian Federation alone heard 1,340 cases under these articles.

However, the Supreme Court of the Russian Federation consistently clarifies in its rulings on specific cases that "...the demolition of an unauthorized construction is an extreme measure of state intervention in relations concerning the erection (creation) of real property objects, and the elimination of the consequences of a violation must be proportionate to the violation itself, must not create an imbalance between public and private interest leading to the disruption of the stability of commercial transactions and the infliction of disproportionate losses"[2]. Furthermore, it states that "demolition of an unauthorized construction is an extreme measure of civil liability, applicable only when the consequences of the violation cannot be eliminated by other means, and the preservation of

[2] On certain issues arising in judicial practice when applying the rules on unauthorized construction : Ruling of the Plenum of the Supreme Court of the Russian Federation dated December 12, 2023, No. 44. Clauses 10, 19, 25.

the construction violates the rights and legally protected interests of citizens, and these violations are irremediable"[3].

It appears that the Russian Supreme Court's position is being interpreted selectively by both local and federal administrative bodies. They seem to view the upcoming changes to land legislation primarily as an expansion of their administrative powers to demolish structures and, more broadly, to regulate construction on privately owned land plots.

The proposed amendments, in essence, grant a three-year period for developing the land plot and an additional five years for completing construction. As stated, "*By March 1, 2028, when the development period expires, all supervisory and municipal control bodies will face the question of whether the land plot is being used for its designated purpose and in accordance with its permitted use starting from March 2, 2028*"[4].

The anticipated consequence of unauthorized construction, construction delays (or "failure to develop" the land) is the demolition of the structure, and in the worst-case scenario, the seizure of the land plot itself. At this time, it is unknown what the final outcome of the legislative process will be, so any predictions or discussions on this specific point are premature.

In nearly all cases where administrative bodies raise concerns about violations of land law through unauthorized construction (or other non-compliant construction), the court orders a forensic construction and technical expert examination. However, in some cases, issues of unauthorized construction are resolved independently of the expert's findings — either without ordering an examination at all or by ruling contrary to its conclusions.

In both civil and criminal proceedings, an expert examination is considered a form of evidence — a source of information upon which the court bases its conclusions regarding the existence (or absence) of circumstances that support a party's position (in civil cases) or characterize an unlawful act (in criminal cases). Both types of proceedings require the establishment of facts, which are often decisive in cases involving unauthorized construction, though not always. Let's examine a few such instances.

For example, in the aforementioned civil case (No. 18-KG25-214-K4 of August 4, 2025), it was revealed that two contradictory forensic construction and technical expert reports existed for the same unauthorized structure — one from the civil dispute and another from a criminal case. The Supreme Court (its Civil Cases Judicial Collegium) indicated that the courts handling the case should have considered the possibility of preserving the structure regardless of the experts' conclusions, since demolition is an extreme measure. The Court also pointed to the option of commissioning a repeat or additional expert examination.

In another civil case (No. 18-KG25-199-K4 of August 5, 2025), the lower courts also ruled independently of the expert opinion, citing the circumstance that the residential house was erected without obtaining the requisite permits, including for site planning. However, the Supreme Court pointed out that a construction permit is not required for the construction of individual residential housing projects (clause 1.1, part 17, article 51 of the Russian Urban Development Code). Furthermore, no red lines exist within the settlement boundaries, and their establishment is not planned; consequently, there were no grounds to classify the disputed structure as unauthorized due to the lack of site planning documentation (part 3, article 41 of the Russian Urban Development Code).

The findings of a construction technical expert examination must be considered by courts not only for their final conclusions but also based on the internal content of the report. The Supreme Court reviewed case No. 18-KG25-249-K4 (July 29, 2025), in which the court of first instance denied a petition for the demolition of an unauthorized structure. However, the higher courts reached the opposite decision based on a judicial construction technical expert examination conducted during the appellate stage. In the expert report, specifically in its research section, the expert concluded that the object of study does not comply with the structural standards for residential buildings and lacks the spatial-planning and functional layout of premises that create conditions for permanent residence. Therefore, based on its technical characteristics, it cannot be recognized as an individual residential house; meaning the object of study is a non-residential building with the actual purpose of a small accommodation facility (mini-hotel). Additionally, the object under study lacks auxiliary rooms typical of residential buildings, such as a study, walk-in closet, pantry, dining room, living room, or children's room. Yet, at the same time, it also lacks spaces characteristic of hotels, such as administrative offices, guest reception areas, floor lobbies, and other similar rooms. The contradictory nature of the report's research section is evident: the object lacks auxiliary rooms characteristic of residential premises, but it also lacks rooms characteristic of hotels.

The Supreme Court indicated that the appellate court's conclusion — that the capital construction project is a hotel, which cannot be located on the defendant's land plot with the permitted use "for individual residential construction" — was based solely on the fact that the disputed object contains six isolated rooms, consisting of furnished rooms equipped with bathrooms and having separate entrances, and lacks premises that create conditions for permanent residence.

For an expert opinion to be unambiguous in its necessity and correctness, the examination must be conducted properly. Primarily, the internal logic of the investigation is significant; it must conform to well-known laws of logic, in this case, the law of non-contradiction. "Violations of this law are grounds for ordering a repeat examination..., which often deprives the expert's report of its status as evidence in the case" [10]. The range of questions put before the expert must be exhaustive for resolving the specific case. The list of questions is quite standard and should, of course, include straightforward issues such as the necessity for or existence of permits. "This list includes the following questions (does it conform, does it create, does it cause):

- the building (structure or facility) to conform to urban development legislation (including land use and development regulations) in parts requiring interpretation through specialized knowledge;
- the building (structure or facility) to conform to building codes and regulations, as well as fire safety requirements;
- the building (structure or facility) to conform to the issued construction permit;
- the building (structure or facility) to conform to the urban development plan of the land plot;
- the (structure or facility) to conform to the project design;
- the building, structure, or facility to create a threat to the life and health of citizens" [11].

[3] Ruling of the Supreme Court of the Russian Federation of August 4, 2025, in case No. 18-KG25-214-K4; ruling of the Supreme Court of the Russian Federation of August 5, 2025, in case No. 18-KG25-199-K4; ruling of the Supreme Court of the Russian Federation of July 29, 2025, in case No. 18-KG25-249-K4 and numerous other similar cases.

[4] Butovetsky A.I. Innovations in Land and Real Estate. Report, May 18-25, 2025. Part 2. URL: https://icped.ru/articles/zem/kopiya-chast2.-novovvedeniya-v-sfere-zemli-i-nedvizhimosti/ (rus.)

When ordering an expert examination, the court specifies (among other things) the facts that the examination is intended to confirm or refute, as well as the questions posed to the expert (Part 1, Article 80 of the Russian Code of Civil Procedure). It is the expert, within their expert report, who determines whether there has been a violation of construction, urban development, fire safety, sanitary, and other established norms and parameters, as well as land use and zoning regulations.

The court evaluates the expert report based on its inner conviction, which is formed through a comprehensive, complete, objective, and direct examination of the document, and if necessary, on the expert's oral clarifications provided during a court hearing. It is evident that the court is bound by the questions it posed to the expert. Consequently, if the answers to these questions are unequivocal, it is impossible to disregard them without compelling reasons.

The Russian Constitutional Court, while reviewing the constitutionality of the provisions of Article 222 of the Russian Civil Code, noted that under the revised version of this article (as of August 3, 2018) a structure is not considered an unauthorized construction if it was built in violation of established limitations on the use of the land plot, provided the owner of said structure did not know and could not have known about such limitations applicable to their plot[5] (Ruling of the Constitutional Court of the Russian Federation No. 48-P of November 11, 2021). Furthermore, when courts consider cases involving changes to the federal legal grounds for recognizing a building, structure, or other erection as an unauthorized construction, they must establish the landowner's good faith at the time of construction.

These circumstances are established by the court through a comprehensive examination of the case materials and can also influence the outcome of the case independently of the expert report's findings.

Since the obligation to demolish an unauthorized construction constitutes a sanction for an offense — which may involve violating norms governing the allocation of the land plot and its development — the Constitutional Court concluded that imposing the burden of demolition presupposes the owner's fault and does not imply imposing the obligation to demolish an unauthorized construction at their own expense on a non-culpable party. The degree of fault is also a matter exclusively for judicial determination. Specifically, landowners must have the opportunity to be aware of limitations on their rights, especially when new, previously non-existent limitations are introduced. This means it is essential to ascertain whether the person who carried out the construction knew or could have known about the existence of these limitations.

[5] On the case of verifying the constitutionality of the provisions of paragraph 6 of part four of Article 392 of the Civil Procedure Code of the Russian Federation, paragraph 1 of Article 222 of the Civil Code of the Russian Federation and Article 32 of the Federal Law "On Gas Supply in the Russian Federation" in connection with the complaint of citizen Yu.V. Tikhonov : Resolution of the Constitutional Court of the Russian Federation of November 11, 2021 No. 48-P.

Moreover, when assessing the conduct of the person who erected the structure, current legislation is based on the principle of protecting parties acting in good faith in civil transactions. For a person who did not know and could not have known about the (newly introduced) limitations, such demolition does not constitute a sanction and cannot be carried out at their expense. Imposing adverse consequences, such as the obligation to demolish the structure at their own cost, on a party who acted in good faith is impermissible in any case. If a person did not know and could not have known about the limitations on their land plot, or if this issue was not examined by the court, then such a judicial decision would lack legality and substantiation.

Thus, we see that in judicial practice there are instances where a forensic construction-technical expert examination, while necessary, is not the foundation for the court's ruling. Instead, the justification is based on the interpretation of substantive legal norms and their role within the legal system. Furthermore, the judicial qualification of a specific disputed legal relationship cannot rely on an expert's findings in cases where the constitutional property rights of the owner — which fall outside the scope of a forensic construction-technical examination — are violated or require protection.

REFERENCES

1. Dozhdev D.V. European tradition of private law: Studies in Roman and comparative law. Vol. 1. Moscow, 2021; 466. EDN ZVRORZ. (rus.).
2. Sukhanov E.A. Problems of Codification of Corporate and Property Law. Selected Works 2013–2017. Moscow, Statut. 2018; 496. (rus.).
3. Ivanov A.A. On the Draft Concept for the Development of Legislation on Property Law. Bulletin of the Supreme Arbitration Court of the Russian Federation. 2009; 4:103. EDN MNHPTN. URL: https://web.archive.org/web/20240807030505/https://igzakon.ru/magazine/article-pdf/?id=1498 (rus.).
4. The Digests of Justinian. Vol. III. Moscow, 2003; 779.
5. Gaius. Institutes. Translation by Dydynsky. Moscow, 1997; 361.
6. Thibaut A.F.J. Sistem des PandektenRecht. London-Dublin, 1846; 934. URL: https://archive.org/details/bub_gb_-XtEAAAAcAAJ/page/n37/mode/2up (ger.).
7. Dernburg H. Pandects. Vol. II. (transl. from German). St. Petersburg, 1905; 81:934. URL: https://rusneb.ru/catalog/010003_000061_c783e80c1f1195315785414aa486d7cb/ (rus.).
8. Sukhanov E.A. Property Law. Moscow, 2016; 86-87. (rus.).
9. Complete Code of Laws of the Russian Empire. P. 1. Book 2. Vol. X. St. Petersburg, 1911; 796. URL: https://www.consultant.ru/edu/student/download_books/book/svod_zakonov_rossijskoj_imperii_tom_x/ (rus.).
10. Butyrin A.Yu., Stativa E.B., Manukhina O.A. Eight Laws of Logic for the Forensic Construction Expert. Theory and Practice of Forensic Science. 2021; 16(1):19-32. DOI: 10.30764/1819-2785-2021-1-19-32. EDN ANXKYR. (rus.).
11. Butyrin A.Yu., Krylova M.D., Anokhina D.G. Using special knowledge in construction engineering technology in court to determine whether a disputed structure was built without a permit. Theory and Practice of Forensic Science. 2016; 2(42):86-95. EDN WFRXON. (rus.).

Недвижимость, самовольные постройки и судебная экспертиза

В статье рассматриваются концептуальные представления об имущественном праве, в частности, о недвижимости, которые высказывались видными цивилистами различных эпох, а также получили свое отражение в законодательстве России конца XIX – начала XXI в. Несмотря на временное забвение гражданско-правовой системой вещного права, в статье констатируется отход российской правовой теории и законодательства от общепринятых классических представлений о множественности объектов недвижимости. Закономерным продолжением развития концептуальных представлений о вещном праве является современный Гражданский кодекс Российской Федерации. Высказывается мнение о дальнейшем магистральном развитии законо-

дательства в части недвижимости и вещного права в целом. Один из путей — это реализация Концепции развития законодательства о вещном праве, которая была разработана виднейшими российскими цивилистами. Концепция развивается и претерпевает изменения, но тем не менее поэтапно внедряется в гражданско-правовую систему. Концепция предполагает расширение круга ограниченных вещных прав, в частности, реализацию принципа единства судьбы земельного участка и находящихся на нем строений. В правовой и правоприменительной среде множественность объектов недвижимости породила проблему незарегистрированных строений (самовольных построек). Последнее изменение статьи 222 Гражданского кодекса РФ о самовольных постройках имело место в 2018 г. (редакция Федерального закона от 03.08.2018 № 339-ФЗ) и в настоящее время получило обширную судебную практику. Судебные дела рассматривались как Верховным судом Российской Федерации, так и Конституционным судом. Рассмотрение судами спорных вопросов в связи с самовольными постройками неизменно требует назначения судебной строительно-технической экспертизы. Судебная строительно-техническая экспертиза, как правило, является одним из основополагающих доказательств при вынесении судом решения по делу, однако имеют место случаи, когда судебный акт принимается вопреки либо независимо от экспертного заключения. Рассмотрены конкретные судебные споры, разрешение которых состоялось независимо от выводов назначенных судебно-технических экспертиз, окончательное решение по которым принималось Верховным судом РФ.

Ключевые слова: *вещное право, недвижимость, множественность объектов, самовольная постройка, снос, судебная строительно-техническая экспертиза*

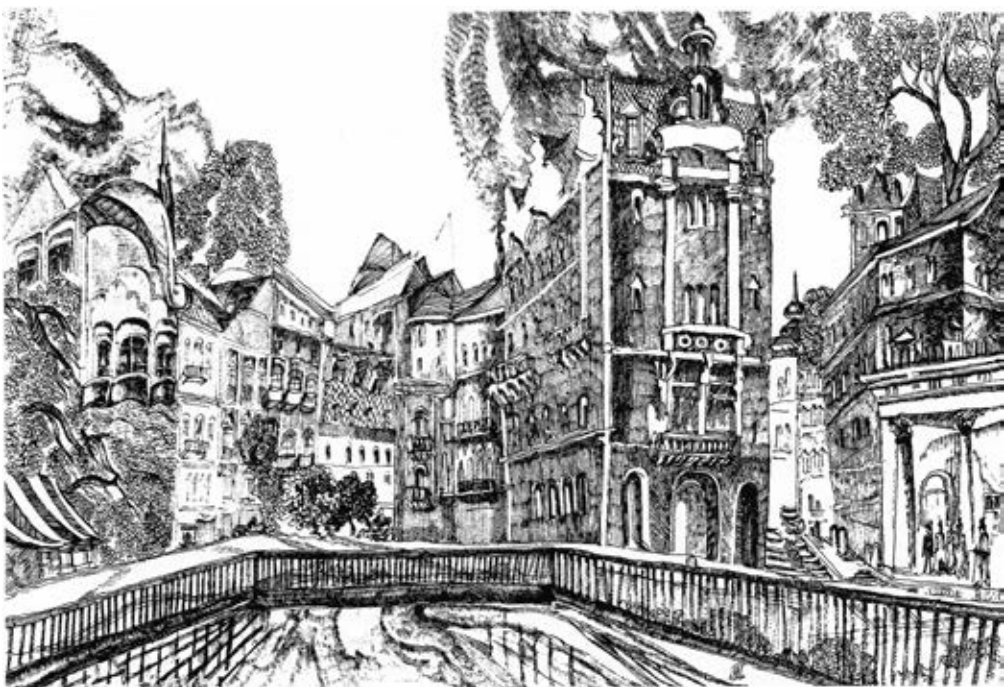
СПИСОК ИСТОЧНИКОВ

1. Дождев Д.В. Европейская традиция частного права: Исследования по римскому и сравнительному праву. Т. 1. М., 2021, 466 с. EDN ZVRORZ.
2. Суханов Е.А. Проблемы кодификации корпоративного и вещного права. Избранные труды 2013–2017 гг. М. : Статут, 2018. 496 с.
3. Иванов А.А. О проекте Концепции развития законодательства о вещном праве // Вестник Высшего Арбитражного Суда Российской Федерации. 2009. № 4. С. 102–185. EDN MNHPTN. URL: https://web.archive.org/web/20240807030505/https://igzakon.ru/magazine/article-pdf/?id=1498
4. Дигесты Юстиниана. Т. III. М., 2003. 779 с.
5. Гай. Институции. Пер. Дыдынского. М., 1997. 361 с.
6. Thibaut A.F.J. Sistem des PandektenRecht. London-Dublin, 1846. 934 p. URL: https://archive.org/details/bub_gb_-XtEAAAAcAAJ/page/n37/mode/2up
7. Дернбург Г. Пандекты. Вещное право. Т. 2. СПб., 1905. 364 с. (пер. с нем.) URL: https://rusneb.ru/catalog/010003_000061_c783e80c1f1195315785414aa486d7cb/
8. Суханов Е.А. Вещное право. М., 2016. С. 86–87.
9. Полный Свод законов Российской империи. Ч. 1, кн. II, т. X. СПб., 1911. 796 с. URL: https://www.consultant.ru/edu/student/download_books/book/svod_zakonov_rossijskoj_imperii_tom_x/
10. Бутырин А.Ю., Статива Е.Б., Манухина О.А. Восемь законов логики для судебного эксперта-строителя // Теория и практика судебной экспертизы. 2021. № 16 (1). С. 19–32. DOI: 10.30764/1819-2785-2021-1-19-32. EDN ANXKYR.
11. Бутырин А.Ю., Крылова М.И., Анохина Д.Г. Использование специальных строительно-технических знаний при рассмотрении судом вопроса о том, является ли спорная постройка самовольной // Теория и практика судебной экспертизы. 2016. № 2 (42). С. 86–95. EDN WFRXON.

Об авторе: **Седаков Сергей Юрьевич** — кандидат юридических наук, доцент, кафедра ОСУН; **Национальный исследовательский Московский государственный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; ORCID: 0009-0007-4756-2499; setka@ro.ru.

For citation: Sedakov S.Yu. Real Estate, Unauthorized Constructions, and Forensic Examination. *Real Estate: Economics, Management*. 2025; 3:62-66.

Для цитирования: *Седаков С.Ю.* Real Estate, Unauthorized Constructions, and Forensic Examination // Недвижимость: экономика, управление. 2025. № 3. С. 62–66.



Карловы Вары (автор иллюстрации – Павлова Лия Иосифовна)

UDC 378

Yankovsky A.V.
Kildeeva T.I.
Frygina D.I.
Dmitrova E.D.

Experience of international professional training of students of the OSUN Department in Vietnam

The paper provides information on how the Department "Organization of Construction and Real Estate Management" (OSUN) of the National Research University MGSU again turned a page in its long history, supporting a unique educational initiative — the organization of international practical training for students in the Socialist Republic of Vietnam. The key partners of the project were Ho Chi Minh City University of Architecture, construction companies Ricons and Newtecons, which occupy leading positions in education and the construction industry in Vietnam, respectively.
Construction companies Ricons and Newtecons, specializing in the implementation of large development projects, make a significant contribution to shaping the architectural appearance of large cities in Vietnam. This is achieved through the implementation of large-scale, architecturally complex development projects that meet high standards of safety and quality.
Many years of experience in international cooperation of the Department of OSUN, combined with current trends in education, have become a reliable basis for the implementation of project training for students in Vietnam.
The project's performance fully met the expectations of all participants. The partners highly appreciated the results achieved and expressed interest in expanding professional cooperation, which indicates the prospects of the chosen area of international educational interaction. The intercultural internship environment has become an effective tool for developing professional skills and developing global thinking among future specialists.
Keywords: *International professional training, Ho Chi Minh City University of Architecture, construction company Ricons, construction company Newtecons, construction in Ho Chi Minh City, on-site construction control, information modelling technologies, unique construction, international cooperation*



Alexander Vladimirovich Yankovsky,
Leading Engineer; Research Center for Integrated Territory Development; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; Alex.ynk@inbox.ru



Tatyana Igorevna Kildeeva,
PhD in Economics; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; ID RSCI: 9487-6761, Scopus AuthorID: 57194454597, WoS ResearcherID: GOH-0800-2022, ORCID: 0000-0001-8290-9784; Slepkovaprofi@gmail.com



Daria Igorevna Frygina,
student; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; dariafrygina@yandex.ru



Evgenia Dmitrievna Dmitrova,
student; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; dmitrovvajane@gmail.com

INTRODUCTION

The modern construction industry — is a global system where interaction between countries becomes a key factor in progress. International partnerships make it possible to solve large-scale problems, introduce innovations and increase the competitiveness of market participants.

Considering the international cooperation between Russia and Vietnam in the construction industry, it is developing within the framework of a strategic partnership, covering both educational and scientific projects, as well as the practical implementation of infrastructure facilities. However, there are also differences due to climate, economics and regulatory requirements.

The Department "Organization of Construction and Real Estate Management" (OSUN) has existed since 1930, training specialists in the field of construction, investment development and real estate management. Over the decades of its existence, the department has developed a unique approach to teaching, aimed at comprehensive mastery by students of all the main stages of the implementation of investment and construction projects, from planning and risk assessment to the organization of the technological process and effective management of real estate.

Today, the Department of OSUN is one of the leading departments of the university, offering a wide range of educational areas, including development, project management, real estate valuation and housing management. Specialists are trained at the intersection of engineering, economics, law and management, which ensures graduates' competitiveness and high demand in the labor market.

The department is actively integrating into the global scientific community, collaborating with major international organizations. Students have the opportunity to undergo internships and internships in foreign companies and institutions, exchange experiences with colleagues from abroad. By constantly updating teaching methods and introducing new technologies, department staff ensure high quality training of specialists capable of solving the most complex problems of modern construction [1].

Thanks to the efforts of the head of the department "Construction Organization and Real Estate Management" (OSUN), Doctor of Technical Sciences, Doctor of Economic Sciences, Professor Petr Grigorievich Grabovyy and with the support of the Institute of Economic Sciences, it was possible to organize summer practical training in the Socialist Republic of Vietnam. The host was the long-time partner of the National Research University MGSU — Ho Chi Minh City University of Architecture (UAN) [2] (Fig. 1).

THE MAIN PART

In May 2025, Russian Foreign Minister Sergei Lavrov spoke about his intention to continue cooperation in the field of education with Vietnam: "Along with mutually beneficial interaction in the field of science and technology, we are committed to continuing cooperation in the field of education... Joint work has begun to create the first Russian school in Hanoi.

Yakovleva A.A.
Maksimova K.V.
Kozenkova A.A.
Grabovoi A.L.



Angelina Alekseevna Yakovleva,
student; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; angel.yaa2004@yandex.ru



Kristina Vyacheslavovna Maksimova,
student; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; maxximovakristina@yandex.ru



Anna Alekseevna Kozenkova,
student; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; kozenkova2001@yandex.ru



Artyom Leonidovich Grabovoi,
student; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; artgrabovoy@gmail.com





Fig. 1. Ho Chi Minh City University of Architecture

Vietnamese who know Russian and Russians who speak Vietnamese act as a kind of locomotive for the further rapprochement of our peoples". Based on the results negotiations between Russian President Vladimir Putin and Secretary General of the Central Committee of the Communist Party of Vietnam To Lam in the country's Kremlin signed several documents, including cooperation in the field of education. "The parties <...> advocate the promotion of research programmes and projects in priority areas for both countries, and also agreed to declare 2026 the Year of Russian-Vietnamese cooperation in the field of science and education", says the joint declaration of the states [3].

It is worth noting that the National Research University MGSU, supporting state strategic initiatives and to strengthen international relations with the Vietnamese side, sent 6 students to the city of Ho Chi Minh City to undergo summer executive internship from July 2 to July 26, 2025.

The practice began with the organizational assistance of employees of the OSUN department, who ensured uninterrupted departure from Moscow. The department ensured close interaction with the host party in advance, agreed on a practice programme, identified areas of work and guaranteed compliance with safety requirements and training standards (Table).

Professional training programme for MGSU students at construction sites in Vietnam

Period	At a construction site	In the office
Week 1	Safety briefings: introductory, primary, repeat, targeted. Obtaining personal protective equipment. Participation in organizational meetings. Introductory conversations with the head of the security department. Familiarization with the construction site	Meeting with the leadership of Ho Chi Minh City University of Architecture. Familiarization with the practical training programme. Introduction to the activities of the unit. Study of design documentation. Study of working documentation. Study of the national standards of the Socialist Republic of Vietnam. Perform individual tasks. Participation in workshops
Week 2	Ricons Unique Building Site Technical Tour. Technical tour of Newtecon's unique construction projects. Familiarization with the company's information resources. Participation in internal corporate events of companies Ricons and Newtecon	Performing individual tasks of the production and technical department of companies. Participation in the construction of calendar-network schedules for work completion. Participation in the formation of a statement of actual volumes of work. Making changes to design and working documentation. Participation in operational meetings. Attendance at the lecture "Features of calendar planning during the construction of unique facilities in Vietnam" (based on the Ho Chi Minh City University of Architecture)
Week 3	Sightseeing tours of the city and suburbs of Ho Chi Minh City. Generalization of acquired skills during internship	Report generation. Final meetings with Ricons representatives and Newtecon and Rector of Ho Chi Minh City University of Architecture

Upon arrival in Vietnam, the meeting of NRU MGSU students was provided by representatives of the diplomatic mission and consulate of the Russian Federation, where they provided detailed instructions. This meeting emphasized the state's special attention to issues of quality vocational education and international academic mobility. This reception became evidence of the importance of cooperation between the two countries in the field of education and the readiness of both sides to support young professionals, strengthen friendly ties and form a new generation of competent ones specialists who are ready to effectively implement joint projects in the future [4].

INTERNSHIP IN THE SOCIALIST REPUBLIC OF VIETNAM

On the first day of practice, Ho Chi Minh City University of Architecture, which acted as the host, organized a meeting within the walls of the university (Fig. 2). Representatives of both universities confirmed their long-standing cooperation: joint scientific-educational events and conferences are regularly held both in Russia and Vietnam. Students were divided into two groups and informed in detail about the companies and facilities where they would undergo internships. Two students were assigned to a company "Ricons" for a residential development project TT AVIO. The second group, consisting of four the person was sent to the company "Newtecons" to work on the construction of educational campuses at Wang Lang University. In addition to the teachers, the meeting was attended by two Vietnamese students who joined the second group for joint practical work and exchange of experience [5][1, 2].

Within the framework of the organizational part, language and everyday issues, safety rules at construction sites, and a practice schedule were discussed mentoring system and contacts of responsible persons on the part of host companies and the university.

At the end, university staff organized a festive evening with traditional Vietnamese cuisine (Fig. 3). In a relaxed atmosphere, practical recommendations for adaptation, information about living conditions, transport, and cultural characteristics of life in Vietnam were given, and further joint events and meetings were planned during the practice.

During the first days, students got acquainted with life in the company, colleagues, and completed their initial tasks — undergoing safety training; familiarization with the organizational structure of the company; studying introductory materials on objects (Fig. 4).

The construction company "Newtecons" was founded on October 23, 2003. "Newtecons" is the leading general contractor in Vietnam and undertakes all work: from laying the foundation, building the basement and main building to finishing work and creating landscape infrastructure. Newtecons is currently on the list of companies with the best working conditions and social programme in Asia[3].

The company's slogan is to be based on trust. Trust is the benchmark of Newtecons values. In 2022, Newtecons was ranked in the top ten the best construction contractors in Vietnam. Famous projects of the company Newtecons:

1. Skyscraper The Landmark 81 — Ho Chi Minh City landmark with a height of 461.2 m, which became the tallest building in Vietnam. It was completed in 2018. The building has an elegant and modern design inspired by bamboo sticks (Fig. 5).

2. Long Thanh International Airport is an airport under construction in Vietnam, located in Long Thanh District (Dong Nai Province) (Fig. 6).

3. Wang Lang University — currently, 3 towers are being built on the territory of the university (Fig. 7). The project has unique architecture, modern facades and 3 interconnected basements.

Obligations of students during practical training in a company "Newtecons" and "Ricons": Passing a safety briefing; Studying documentation; Office work[4].

Another group of students did an internship at a construction company "Ricons", which was founded in 2004 and quickly gained popularity in the market, especially in the field of real estate investment. Constantly expanding, Ricons entered the construction market and made it its main focus. Over more than 20 years of existence and development, the company "Ricons" has implemented construction projects throughout the country: from high-rise buildings, hotels and resorts to factories and infrastructure. As a brand born from high social aspirations, Ricons strives to change the world for the better by providing quality products and services and thereby contributing to the development of society. Thanks to its powerful internal resources, Ricons is becoming a symbol of Vietnam's construction industry and influencing the entire world.

[1] URL: https://mgsu.ru/universityabout/Struktura/Kafedri/OSUN/ (rus.).

[2] URL: http://en.uah.edu.vn/

[3] A Bid to Change the World Order : Foreign Media on Putin's Visit to Hanoi. June 21, 2024. URL: https://tass.ru/mezhdunarodnaya-panorama/21162369 (rus.).

[4] Construction of $1 Billion Lego Plant Begins in Vietnam. URL: https://www.vietnews.en/topnews/vo-vetname-nachalos-stroitelstvo-zavoda-lego-stoimostyu-1-milliard-dollarov





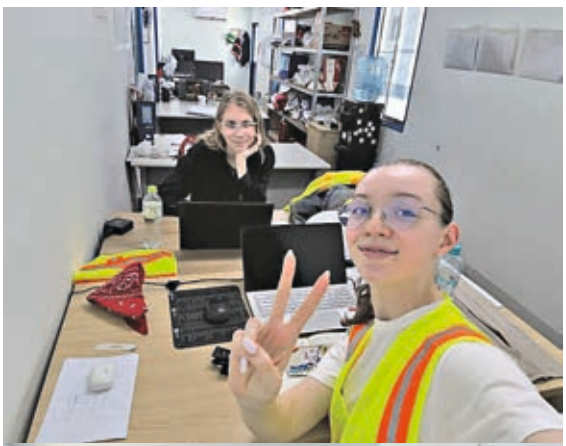
Fig. 2. Meeting at Ho Chi Minh City University of Architecture





Fig. 3. Festive evening







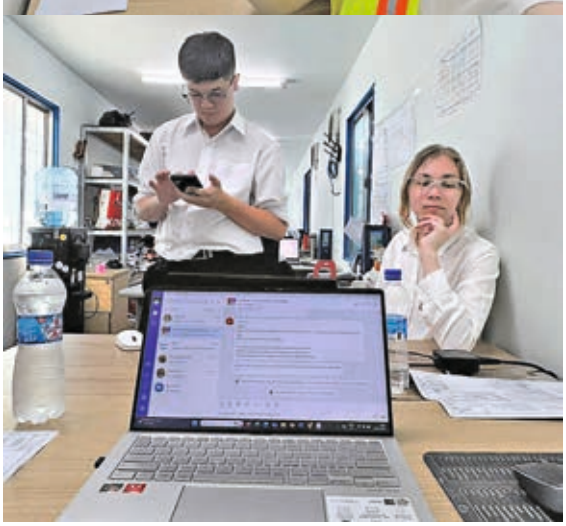


Fig. 4. Introductory briefings at internship sites. Work in company offices “Newtecons” and “Ricons”



Fig. 5. Object "The Landmark 81"



Fig. 6. Visualization of Long Thanh Airport



Fig. 7. Visualization of Wang Lang University



Fig. 8. Work on the construction site of the facility "VAN LANG University"

During the main period of practice, students studied the main stages of construction, as well as features related to climatic and seismic conditions in the region. Students familiarized themselves with the rules registration and storage of documentation, estimates and reports on work performed. Using the ArchiCAD programme, we reviewed the visualization of the project. And with the help of the AutoCAD programme we worked with drawings of design documentation. Students were also introduced to the Sketchup programme and Dalux software, designed for managing construction projects and 3D modelling, which they were able to use to obtain information. During the internship, students were given tours of the construction site, focusing on the T2 radial tower (Fig. 8). Students were able to observe the technology of construction work and ask clarifying and interesting questions from specialists. This experience helped to see the practical side of the construction process, consolidating the theoretical knowledge provided by the university and understanding the complexities of construction and installation work[5, 6].

PROJECT FEATURES "VAN LANG UNIVERSITY"

University project VAN LANG in Ho Chi Minh City is a large-scale construction task that requires a special approach. First of all, it stands out for its extraordinary architecture, for example, the T2 body in the shape of a drum, as well as the unique fasade solutions of all buildings. An equally important element is the complex of underground structures, consisting of three interconnected levels that will be connected to existing underground structures. Each of these underground floors exceeds 14,000 square meters.

It is expected that construction will be completed in 24 months, which will be equally distributed between the stages of construction of the underground and above-ground parts. Newtecons, with significant experience in foundation construction and the support of investors, consultants and local authorities, was able to competently address problems associated with concrete pouring, material delivery and vehicle passage due to the large foundation area and difficult road conditions at the site.

When completed, this project will embody the comprehensive design of Van Lang University's Campus 3, which will undoubtedly contribute substantially to the region and make it one of the largest construction projects in the area. In addition, the significance of the project is emphasized by the fact that it is dedicated to the cel-

[5] Website of the company Ricons. URL: https://www.ricons.vn/?lang=en

[6] Resolution of the Government of the Socialist Republic of Vietnam No. 40/2019/ND-CP from 05/13/2019. On Amendments and Supplements to a Number of Articles of Resolutions Detailing and Regulating the Implementation of the Law on Environmental Protection. URL: http://vbpl.vn/botainguyen/Pages/vbpq-van-ban-goc.aspx?ItemID=135365



Fig. 9. Work on the construction site of the facility "TT AVIO"

ebration of the 30th anniversary of the founding of Van Lang University, which adds special importance and symbolism to it[7].

PROJECT FEATURES "TT AVIO"

TT AVIO (Fig. 9) is a comfort-class residential development located in the up-and-coming Binh Duong area that provides proximity to main transport arteries. The complex consists of 2 towers — 30 and 37 floors. The project is a modern approach to organizing residential space and is aimed at wealthy local residents, investors and expats[8].

The housing estate provides:

- minimising CO_2 emissions through the use of renewable energy sources;
- automated energy control system;
- use of recycled and renewable resources;
- digital connectivity of smart home systems.

This clearly demonstrates how an integrated approach to energy efficiency can lead to a significant reduction in environmental impact while increasing comfort and cost-effectiveness.

The residential complex has a rich infrastructure that meets all the needs of the target audience: from a modern spa on high-rise floors with panoramic views of the Saigon River to a multi-level shopping center with premium brand boutiques and luxury restaurants on the ground floors. And, of course, we should not forget about the thoughtful improvement of the territory, which includes multi-level landscape gardens, quiet recreation areas, children's playgrounds equipped to the highest safety standards, and pedestrian alleys that create a unique living environment where modern architecture harmoniously combines with green oases[9, 10].

The duties of the students, when working at this site, included:

- familiarization with project documentation;
- calculation of the concrete volume of non-standard floors;
- drawing up a calendar plan for one of the towers.

[7] Main website of the company Newtecons. URL: https://newtecons.vn/en/

[8] Report "Vietnam Construction Industry" — Size and Share Analysis — Growth Trends and Forecasts (2024–2029). URL: https://www.mordorintelligence.com/ru/industry-reports/vietnam-construction-market (rus.).

[9] Lavrov spoke about cooperation with Vietnam in the field of education. URL: https://ria.ru/20250507/rossija-2015448906.html (rus.).

[10] Lavrov S.V. Russia and Vietnam: 75 years of friendship, trust and mutual assistance. URL: https://interaffairs.ru/news/show/51441 (rus.).



Fig. 10. Joint events

The project manager also dedicated students to the specifics of construction in Vietnam.

EXTRACURRICULAR ACTIVITIES

Throughout their practice, Ho Chi Minh City University of Architecture and partner companies have created an extremely friendly and hospitable atmosphere for Russian students. To introduce guests to Vietnamese culture, a series of educational events and excursions around the southern capital of Vietnam were organized for them (Fig. 10).

Students attended cultural and sports events: a sports day with the participation of large construction companies in Vietnam, where they were present as invited fans, which contributed to the establishment of informal contacts.

The university also organized a tour of the city of Ho Chi Minh City, which included visits to key architectural and infrastructural sites objects, which expanded the understanding of the local construction environment and urban planning features.

CONCLUSION

The final meeting with the Ho Chi Minh City University leadership included a stocktaking of the practice, an evaluation of the results and a discussion of further steps for cooperation. For the first time this year, students were awarded internship certificates.



Fig. 11. Final meeting within the walls of Ho Chi Minh City University of Architecture

Practice has shown that the level of training meets international standards, allowing for successful integration into the work processes of foreign partners (Fig. 11).

Participation in international practice became for students not only an invaluable experience professionally, which made it possible to apply theoretical knowledge in practice in an international environment, but also an important event in personal and cultural development. Students were able to make useful acquaintances and connections that will help strengthen further cooperation between Vietnam and Russia.

REFERENCES

1. Grabovyy P.G., Solunsky A.I. Organization, planning and management of construction. Moscow, Prospect, 2013; 528. EDN QVBYMP (rus.).

2. Grabovyy P.G., Kapustkina A.V., Belyakov S.I., Danilkin I.A., Syzrantsev G.A., Kirillova A.N. et al. Organization of construction and real estate development : textbook in 3 volumes; NRU MGSU. Moscow, ASV, 2024; 624. EDN YEMYEW (rus.).

3. Belyakov S.I., Butyrin A.Yu., Volkov R.V., Grabovyy P.G., Zaitseva L.I., Jongen K. et al. Economics and Management of Real Estate. Part I: Economics of Real Estate : textbook, 4th ed. and add. / ed. P.G. Grabovyy. Moscow, Publishing House ASV Prosvetitel, 2019; 504. EDN QFLGCQ (rus.).

4. Yankovsky A.V., Khromykh V.D., Ponomareva A.A., Shokina I.I., Chernyshova A.S. Content and results of the intership of NRU MGSU students in the Republic of Vietnam in 2024. Real estate: economics, management. 2024; 3:20-25. DOI: 10.22337/2073-8412-2024-3-20-25 (rus.).

5. Mottaeva A.B., Baranova A.S., Valuev E.I., Varganov I.E., Grabovyy A.L. New trends in the development of the MGSU department "Organization of construction and real estate management". How the industrial practice of MGSU students at Akkuyu NPP was held. Real estate: economics, management. 2024; 3:13-19. DOI: 10.22337/2073-8412-2024-3-13-19 (rus.).

Опыт международной профессиональной подготовки студентов кафедры ОСУН во Вьетнаме

В статье представлена информация о том, как кафедра «Организации строительства и управления недвижимостью» (ОСУН) НИУ МГСУ вновь перелистнула страницу в своей многолетней истории, поддержав уникальную образовательную инициативу — организацию международной производственной практики для студентов в Социалистической Республике Вьетнам. Ключевыми партнерами проекта стали Хошиминский архитектурный университет, строительные компании Ricons и Newtecons, которые занимают лидирующие позиции в сфере образования и строительной отрасли во Вьетнаме соответственно.

Строительные компании Ricons и Newtecons, специализирующиеся на реализации больших девелоперских проектов, вносят существенный вклад в формирование архитектурного облика крупных городов Вьетнама. Это достигается посредством реализации масштабных, архитектурно сложных девелоперских проектов, отвечающих высоким стандартам безопасности и качества.

Многолетний опыт международного сотрудничества кафедры ОСУН в сочетании с актуальными тенденциями в образовании стал надежным базисом для реализации проектной подготовки студентов во Вьетнаме.

Результативность проекта полностью оправдала ожидания всех участников. Партнеры дали высокую оценку достигнутым результатам и выразили заинтересованность в расширении профессионального сотрудничества, что свидетельствует о перспективности выбранного направления международного образовательного взаимодействия. Межкультурная среда стажировки стала эффективным инструментом развития профессиональных навыков и формирования глобального мышления у будущих специалистов.

Ключевые слова: *международная профессиональная подготовка, Хошиминский архитектурный университет, строительная компания Ricons, строительная компания Newtecons, строительство в Хошимине, строительный контроль на площадке, технологии информационного моделирования, уникальное строительство, международное сотрудничество*

СПИСОК ИСТОЧНИКОВ

1. Грабовый П.Г., Солунский А.И. Организация, планирование и управление строительством. М. : Проспект, 2013. 528 с. EDN QVBYMP.

2. Грабовый П.Г., Капусткина А.В., Беляков С.И., Данилкин И.А., Сызранцев Г.А., Кириллова А.Н. и др. Организация строительства и девелопмент недвижимости : учебник в 3-х томах; НИУ МГСУ. М. : АСВ; 2024. 624 с. EDN YEMYEW.

3. Беляков С.И., Бутырин А.Ю., Волков Р.В., Грабовый П.Г., Зайцева Л.И., Йонген К. и др. Экономика и управление недвижимостью. Ч. I: Экономика недвижимости : учебник, 4-е изд. и доп. / под ред. П.Г. Грабового. М. : Издательский Дом АСВ: Просветитель, 2019. 504 с. EDN QFLGCQ.

4. Янковский А.В., Хромых В.Д., Пономарева А.А., Шокина Я.И., Чернышова А.С. Содержание и итоги производственной практики студентов НИУ МГСУ в республике Вьетнам в 2024 году // Недвижимость: экономика, управление. 2024. № 3. С. 20–25. DOI: 10.22337/2073-8412-2024-3-20-25

5. Моттаева А.Б., Баранова А.С., Валуев Е.И., Варганов И.Е., Грабовой А.Л. Новые тренды развития кафедры ОСУН. Как прошла производственная практика студентов МГСУ на АЭС «Аккую» // Недвижимость: экономика, управление. 2024. № 3. С. 13–19. DOI: 10.22337/2073-8412-2024-3-13-19

Об авторах: **Янковский Александр Владимирович** — ведущий инженер; **Научно-исследовательский центр «Комплексное освоение территории»; Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; Alex.ynk@inbox.ru;

Кильдеева Татьяна Игоревна — кандидат экономических наук, доцент; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; РИНЦ ID: 9487-6761, Scopus AuthorID: 57194454597, WoS ResearcherID: GOH-0800-2022, ORCID: 0000-0001-8290-9784; Slepkovaprofi@gmail.com;

Фрыгина Дарья Игоревна — студент; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; dariafrygina@yandex.ru;

Дмитрова Евгения Дмитриевна — студент; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; dmitrovvajane@gmail.com;

Яковлева Ангелина Алексеевна — студент; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; angel.yaa2004@yandex.ru;

Максимова Кристина Вячеславовна — студент; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; maxximovakristina@yandex.ru;

Козенкова Анна Алексеевна — студент; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; kozenkova2001@yandex.ru;

Грабовой Артём Леонидович — студент; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; artgrabovoy@gmail.com.

For citation: Yankovsky A.V., Kildeeva T.I., Frygina D.I., Dmitrova E.D., Yakovleva A.A., Maksimova K.V., Kozenkova A.A., Grabovoi A.L. Experience of international professional training of students of the OSUN Department in Vietnam. *Real Estate: Economics, Management*. 2025; 3:67-76.

Для цитирования: *Янковский А.В., Кильдеева Т.И., Фрыгина Д.И., Дмитрова Е.Д., Яковлева А.А., Максимова К.В., Козенкова А.А., Грабовой А.Л.* Experience of international professional training of students of the OSUN Department in Vietnam // Недвижимость: экономика, управление. 2025. № 3. С. 67–76.



Московский дворик (автор иллюстрации – Павлова Лия Иосифовна)