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Life cycle of a renovation programme: identification, analysis and systematization of risks

This article is devoted to studying the life cycle of urban housing renovation programmes, which encompasses preparation, design, construction, relocation, and subsequent operation of renovated real estate. Special attention is given to identifying, analyzing, and classifying risks associated with each stage of implementation. For this purpose, a detailed classification of risks has been developed, covering organizational, economic, technical, and socio-environmental aspects. A housing renovation programme represents a complex multi-stage process where every phase comes with specific risk factors. For instance, during the preparatory stage, issues arise concerning urban planning documentation, quality of engineering surveys, and project approval procedures. The construction works are exposed to risks such as insufficient funding, low-quality materials or equipment, adverse weather conditions, and potential legal disputes. The resettlement stage involves communication problems with residents, delays, and litigation processes. The graphic model of the programme's life cycle visualizes its structure and associated risks. The main objective of the study is to develop an effective monitoring and risk management system aimed at enhancing the success rate of implementing the programme and achieving planned indicators for modernizing large cities' residential infrastructure. Additionally, the authors propose optimizing decision-making procedures and coordinating efforts among all participants involved in each stage of the programme's execution. Effective risk management helps minimize negative consequences and improve overall efficiency by ensuring comfortable living conditions for citizens and long-term sustainability of implemented projects. This approach will significantly reduce financial and time costs while mitigating unfavourable impacts and enabling sustainable positive outcomes from the implementation of the renovation programme.
Keywords: *life cycle, renovation programme, risk classification, analysis, project implementation efficiency*



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In accordance with the Resolution of the Government of Moscow dated August 1, 2017 No. 497-PP "The Renovation Programme for Housing Stock in Moscow", housing stock renovation in Moscow is a set of measures aimed at updating living environment conditions and creating favorable living conditions for citizens as well as public spaces to prevent an increase in dilapidated housing stock in Moscow, ensuring residential area development and improvement[1].

The solution to problems related to upgrading dilapidated housing in the country requires a special approach to developing and implementing regional renovation programmes. This determines the relevance of the research topic. The author focuses on studying the main stages of the programme's life cycle, such as the preparatory stage, construction stage, resettlement and operation stage.

Any programme envisages a phase of liquidation or closure. However, this study does not consider the closing stage of the programme due to the fact that, according to the experience of the capital city, it is impractical to liquidate or terminate the renovation programme. Therefore, the renovation programme should be made indefinite. After upgrading dilapidated housing, which mainly includes five-story buildings, nine- and twelve-story houses built in the 1960s and 1970s will come next in line for renewal. A proper understanding and implementation of the programme's life cycle stages, along with risk management, contributes to improving the quality of the programme and ensures its effective realization [1].

The most important characteristic and feature of the process of development and implementation of urban investment programmes is its stage-by-stage or phased nature. The programme and projects included in it go through their entire life cycle. Considered together, they form a programme cycle. Research on scientific approaches to this problem has been conducted by domestic and foreign scholars such as V.I. Voropaev, V.D. Shapiro, A. Daien, F. Boucherel, E. Verzuh, T. Peters, S.E. Portney et al. Their studies mainly focus on project management, which serves as a theoretical basis for projecting established concepts from science and practice onto the field of urban construction-investment programmes [2].

Regardless of the complexity and scope of work required to implement these programmes, they all progress through specific states — phases (stages, steps) — in their lifecycle [3, 4].

The programme life cycle refers to the sequence of stages (phases) that a programme goes through from inception to completion and achievement of results. It describes the path of the programme as an integrated process encompassing sub-stages such as planning, execution, closure, or repetition of implementation cycles if multiple recurring cycles are provided within the programme framework.

There is no single universal method for dividing a renovation programme into life-cycle phases. In this study, the author proposes his own approach to separating the programme's life cycle into distinct stages (Fig.).

[1] The Housing Stock Renovation Programme in Moscow City : Resolution No. 497-PP of the Government of Moscow dated August 1, 2017. Official website of the Mayor and Government of Moscow : official site. Moscow. URL: https://www.mos.ru/authority/documents/doc/36739220

At each stage of the programme's life cycle, risks may arise that hinder achieving the programme goals. Realization of these risks can affect various indicators of programme effectiveness. Key performance metrics exposed to risk include:

- final cost;
- additional expenses and costs during implementation;
- work efficiency and quality;
- content.

Timelines for implementing individual stages and the overall programme [5–7].

The article outlines certain types of activities and processes carried out by participants at a particular stage of the renovation programme life cycle (Fig.). Additionally, the author identifies potential risks associated with performing these tasks activities [3].

Risk identification involves detecting and analyzing potential risks capable of influencing the outcomes and objectives of a programme. This process includes continuous discovery and examination of diverse factors, circumstances, threats that could lead to negative consequences or uncertainties. Risk identification is crucial for successful and effective programme management. Continuous risk identification becomes particularly significant during periods of major changes occurring both nationally and within the construction industry [8].

To identify risks, various methods can be employed, including statistical, analytical, expert-based methods, analogy techniques, etc. [9–11].

Identified risks are documented in a risk register. Alongside recording the risk in the registry, it is assigned a probability level and impact severity on the programme [12, 13].

In the paper, some possible risks related to different types of work where various risks may occur during the implementation phase of the renovation programme are presented. Risks associated with programme implementation have been classified by the author according to the stages of realization based on the developed life cycle of the renovation programme (Table 1). Some risks identified include those of the preparatory stage before commencement of construction works, the construction stage itself, the relocation stage, and the operation stage [14, 15].

Table 1. Classification of Risks According to Main Stages of the Renovation Programme Lifecycle. Developed by authors

Stage	Activity	Risk
Preparatory stage	Pre-project preparation, issuance of urban planning documentation	Delay in issuing urban planning documents could affect scheduling of design and construction stages
		Risk of errors in urban planning documentation
		Risk of improperly selected land site for the "starter" housing unit
		Risk of restricted areas (sanitary protection zones, etc.) on the land
		Risk of misalignment with the classification of permitted uses of land
	Contract conclusion	Risk of errors in preparing tender documentation
		Risk of contracting with an unreliable partner
		Risk of working under a poorly-drafted contract (object scope, terms, conditions, payments, guarantees)
	Land and property registration, rights to land parcel	Risk of discrepancies between territorial planning and zoning documents and intended land usage
		Risk of unauthorized activities (illegal construction or land use) leading to penalties and lawsuits
		Risk of late establishment of easements if depending on adjacent properties
		Risk of legislative changes necessitating additional costs and delays
		Risk of unregistered land and property relationships
	Surveys, design, expertise	Risk of issues arising from poor quality engineering surveys
		Risk of extended approvals for architectural and urban planning decisions
		Risk of negative expert opinions due to design flaws
		Risk of lacking full package of initial permission documentation
	Relocation and Demolition (for second and subsequent waves of relocation)	Risk of prolonged resident relocation linked to court cases, extending demotion and new constructions
		Risk of complications in disconnecting homes from utilities
		Risk of delayed demolition processes due to lack of authorization
	Site preparation	Risk of increased construction delays due to preservation or realignment of existing utility networks
		Risk of presence of limiting elements like sport fields, garages, influencing programme timeline
		Risk of conducting preparatory works in constrained environments
Construction stage	Permit application for construction	Risk of errors in applying for construction permits
		Risk of not meeting operational schedules
	Demolition of residential buildings	Risk of negative impacts on surrounding buildings
		Logistics risks near neighboring structures
		Safety risks for individuals and staff involved in demolition
	Construction	Risk of supplying low-quality construction materials
		Risk of using sub-standard construction equipment
		Risk of having no skilled workforce available

End of the Table 1

Stage	Activity	Risk
	Completion of construction	Risk of long delays in accepting projects at commissioning
		Risk of failing to finish construction within specified road map schedule
		Risk of errors in registering newly-built assets with cadasters
		Risk of errors in applying for construction permits
Relocation and exploitation stage	Hand-over of housing units for settlement	Risk of postponement of relocation due to detected defects
		Risk of prolonged correction of defects found during apartment inspections
		Risk of changed need for relocation without reserved flats
	Exploitation	Risk of delaying transfer of asset for occupation
		Risk of selecting an untrustworthy management company
		Risk of imposing high rates by the management company on public services

Most risks associated with the implementation of a renovation programme can also be categorized according to the following categories of risks [16, 17]:

1. Construction Risks: these relate to any type of construction activity. They represent a set of risks that might emerge at any time during construction and assembly operations, potentially destroying or significantly distorting building structures or components, extending deadlines, and affecting the overall timetable of the renovation programme.

2. Design Risks: these refer to potential issues or adverse effects arising during the design process that could negatively influence project goals, schedules, budgets, or quality. Such risks may be either evident or latent and result from internal factors like design errors or resource shortfalls, as well as external ones such as legislative changes or market fluctuations.

3. Management Risks: these involve wrong managerial decisions leading to financial losses, reputational damage, or other unfavorable outcomes for the renovation programme.

4. Legal Risks: these pertain to potential legal challenges, loss of revenue, capital erosion, additional expenses, or liabilities stemming from violations or non-compliance with regulatory norms throughout the programme's lifecycle (laws, regulations, directives, corporate documents, etc.).

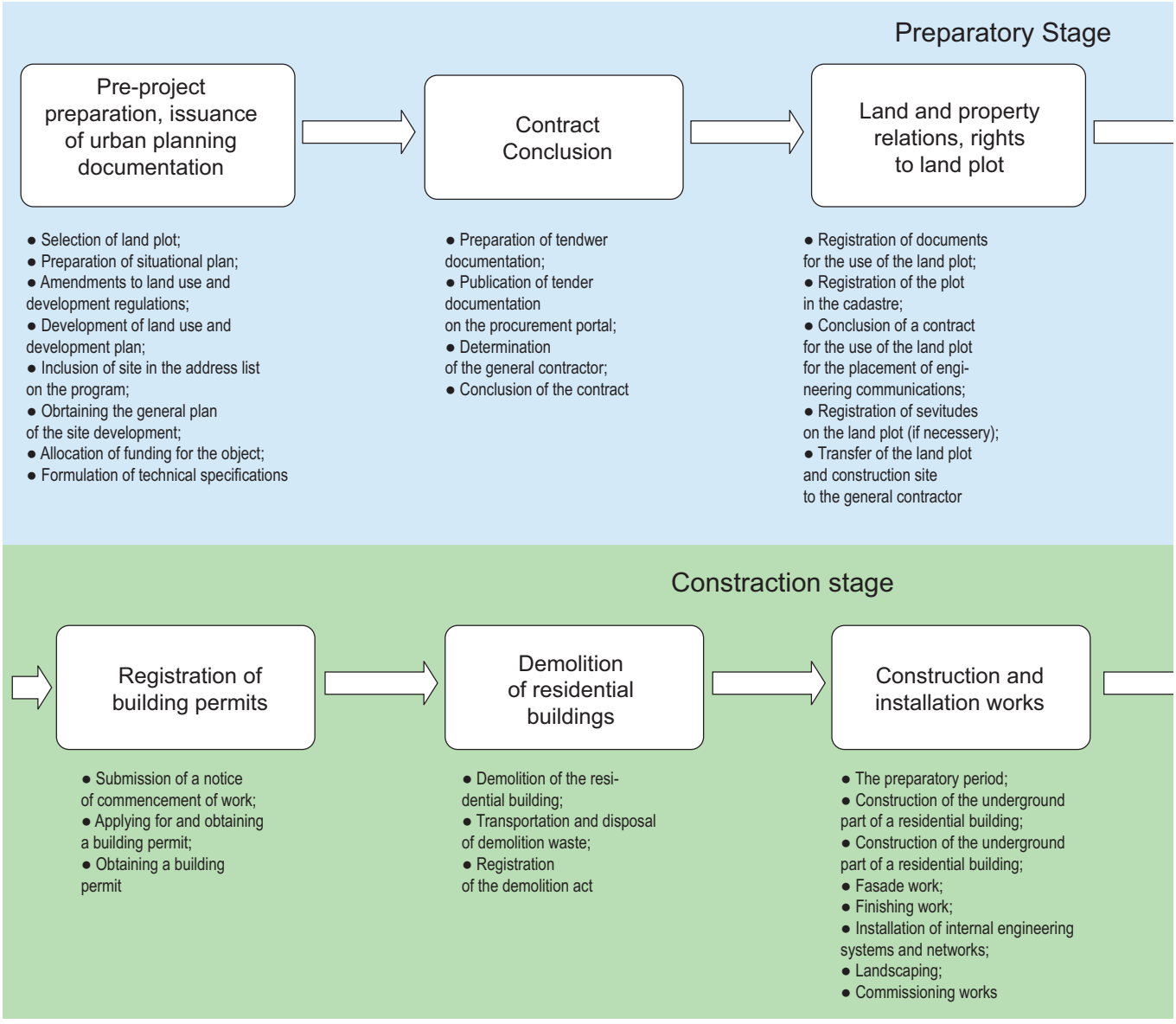
5. Financial Risks: renovation programmes inherently carry high levels of expenditure and operational risks. Often, unforeseen financial expenditures necessitate extra funding for project execution. Financial risks denote the likelihood of monetary losses incurred while conducting business activities.

6. Reputational Risks: these entail potential harm to the image or credibility of the renovation programme due to public dissatisfaction, lawsuits, or other detrimental events.

7. Environmental Risks: these concern harmful environmental impacts resulting from anthropogenic or natural processes during renovations. They may affect human health, biodiversity, ecosystems, and, when poorly managed, cause severe ecological damage in areas undergoing extensive transformation. Typically, these arise because of breaches in environmental protection standards or safety regulations.

Table 2. Classification of renovation programme risks across major categories. Developed by the authors

Number	Category of risk with renovation programme	Risk Characteristic for Category
1	Construction risks	Risk of staffing construction phases with qualified personnel
2	Design risks	Risks of making amendments to technical specifications, technical requirements, floor plans, etc.
3	Management risks	Risks of inefficient allocation of labor and material resources
4	Legal risks	Risk of violating contractual obligations
5	Financial risks	Risk of significant increase in the initial cost of the programme
6	Reputational risks	Risk of reputation loss due to changes in initial conditions and guarantees of the programme during its implementation
7	Environmental risks	Risks of deterioration in urban environment quality and comfort, climate and landscape changes resulting from destruction of green zones and plantations
8	Political risks	Risks of sanctions being introduced on special machinery and materials supplies
9	Marketing risks	Risk of choosing erroneous marketing strategy and sales portfolio
10	Operational risks	Risk of inadequate maintenance of built facilities by the management company
11	Social risks	Risk of increasing load on social infrastructure due to higher density of construction
12	Economic risks	Risks associated with tax increases
13	Commercial risks	Risks of losing revenue or incurring extra expenses as a result of commercial transactions
14	Information security risks	Risks associated with information leakage
15	Operational risks	Risks of employee mistakes caused by negligence or insufficient qualifications



Lifecycle of renovation programme (key stages). Developed by the authors

8. Political Risks: these reflect the possibility of losses or reduced profitability caused by political decisions or events.

9. Marketing Risks: marketing risks encompass deviations in financial and production indicators of the renovation programme, often triggered by demand contraction, price declines, intensifying competition, deteriorating market conditions, ineffective marketing strategies, or other risk factors.

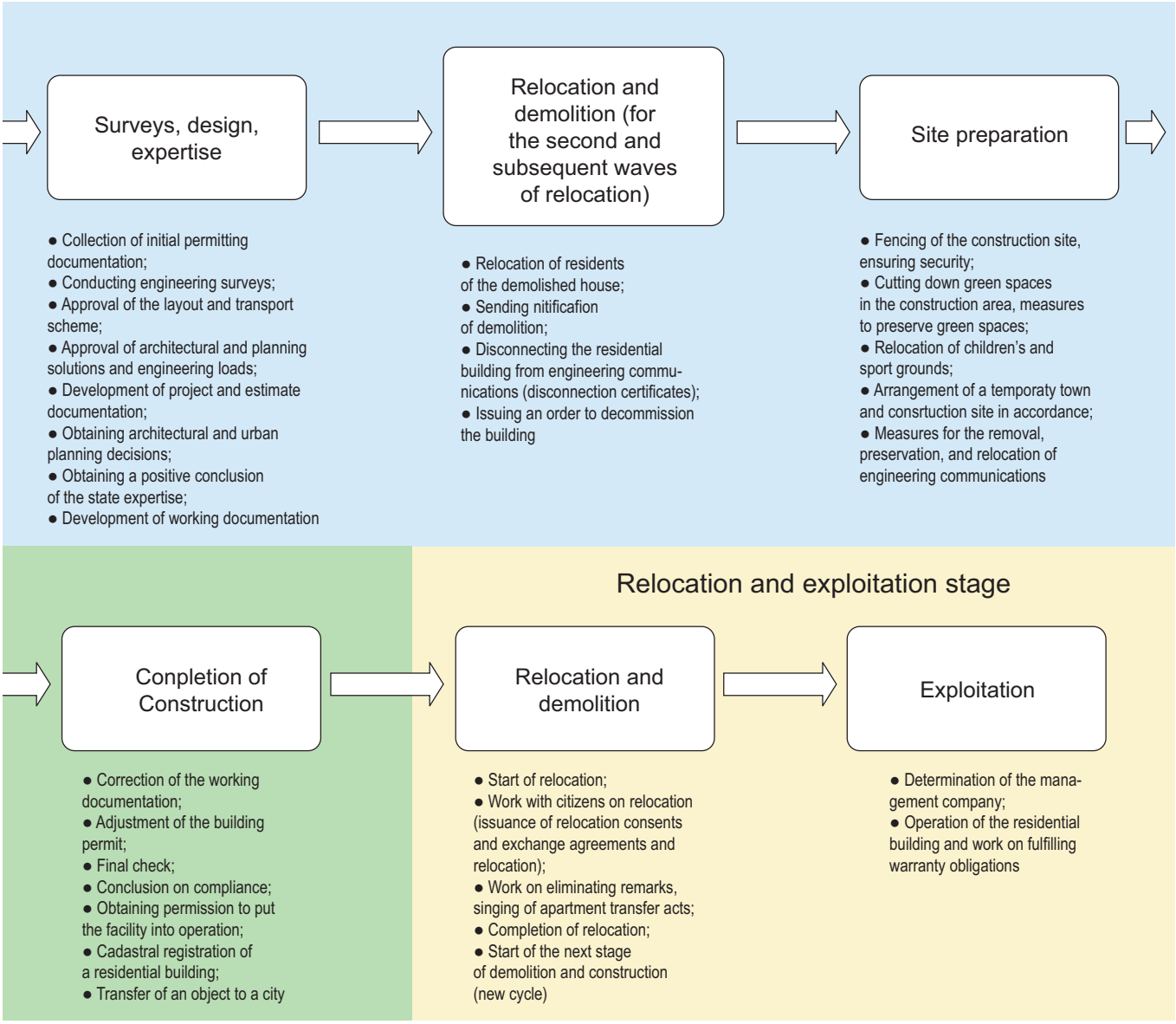
10. Operational Risks: these include the possibilities of losses or damages during the use of buildings, equipment, engineering systems, or transport networks constructed under the renovation programme. Issues may range from physical damage to assets, infrastructure, or properties, inadequate maintenance causing environmental harm, non-adherence to instructions, accidents, emergencies, increased operational costs, or failures in utility systems.

11. Social Risks: these describe the likelihood of negative societal impacts or disruptions caused by shifts in social dynamics or deviations from accepted norms.

12. Economic Risks: economic risks signify the chance of financial losses resulting from random outcomes of economic decision-making or actions. They arise from adverse economic changes within the enterprise, the renovation programme specifically, or the broader national economy. Broadly speaking, economic risks encapsulate all minor risks and primarily manifest as changes in market conditions or liquidity mismatches.

13. Commercial Risks: commercial risks arise during the sale of goods and services, resulting from the potential loss of resources, missed income opportunities, or additional costs incurred through commercial transactions.

14. Information Security Risks: characteristic of renovation programmes, these risks relate to data storage and processing vulnerabilities involving architectural plans, blueprints, financial information about programme costs, personal details of employees, contractors, and clients. These risks emerge from digitization trends, as electronic formats dominate data storage, contract signing, modeling, and project management practices.



15. Operational Risks: these are linked to mistakes made during operational procedures, exceeding official authority limits, misconduct, or abuse of power. They reflect the likelihood of losses, revenue reduction, or capital depletion due to inefficient internal processes, employee errors, technological malfunctions, or external influences (Table 2).

Thus, systematic classification of risks across implementation stages and risk categories, along with understanding the life cycle of the renovation programme and accompanying risks, enables us to select appropriate risk management methods aimed at reducing costs, improving programme efficiency, and achieving predefined objectives.

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Жизненный цикл программы реновации: идентификация, анализ и систематизация рисков

Статья посвящена исследованию жизненного цикла программы реновации жилищного фонда городов, который охватывает подготовку, проектирование, строительство, переселение и последующую эксплуатацию обновленной недвижимости. Особое внимание уделено выявлению, анализу и систематизации рисков, присущих каждому этапу реализации программы. Для этого разработана подробная классификация рисков, охватывающая организационные, экономические, технические и социально-экологические аспекты. Программа реновации представляет собой сложный многоступенчатый процесс, каждая фаза которого сопровождается определенными факторами риска. Например, подготовительная стадия характеризуется проблемами градостроительной документации, качеством инженерно-геологических изысканий и согласованием проектной документации. Строительно-монтажные работы подвержены риску недостаточного финансирования, низкому качеству материалов и техники, неблагоприятным погодным условиям и возможным судебным спорам. Этап переселения населения вызывает проблемы коммуникации с жителями, задержки сроков и судебные разбирательства. Разработанная графическая модель жизненного цикла программы визуализирует структуру этапов и ассоциированные с ними риски. Основная цель исследования заключается в формировании эффективной системы мониторинга и управления рисками, направленной на повышение успешности реализации программы и достижение запланированных показателей модернизации жилищной инфраструктуры крупных городов. Кроме того, авторы предлагают оптимизировать процедуры принятия управленческих решений и координировать усилия всех участников программы на каждой стадии ее реализации. Эффективное управление рисками помогает минимизировать негативные последствия и повысить общую эффективность процесса реновации, обеспечивая комфортные условия проживания горожан и долгосрочную устойчивость реализуемых проектов. Такой подход позволит значительно снизить финансовые и временные затраты, уменьшить влияние неблагоприятных факторов и достичь устойчивого положительного эффекта от реализации программы реновации.

Ключевые слова: *жизненный цикл, программа реновации, классификация рисков, анализ, эффективность реализации проекта*

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