Effectiveness of the renovation in Moscow based on calculations of static and dynamic indicators

Svetlana Kolobova
Moscow State University of Civil Engineering, Yaroslavskoe shosse, 26, Moscow, Russia

E-mail: KolobovaSV@mgsu.ru

Abstract. The article analyzes the need for renovation of panel residential buildings in Moscow in the period up to 2030. In order to prevent the mass occurrence of emergency housing, the Moscow government decided to repair the residential building mainly at the expense of the city budget. To implement this long-term investment project, 100 billion rubles (or 1.25 million euros) are allocated annually from the city budget of the capital. Given the socio-economic importance of the State investment and construction program of renovation in Moscow and the allocation for its implementation of a significant amount of budget investments, it will be necessary to developed technique for evaluating the effectiveness of the investment and construction program. The successful implementation of the state program largely depends on a competent investment management policy during construction activities. Therefore, to assess the economic efficiency of an investment project, it is necessary to make calculations based on static and dynamic indicators. Only after these calculations should a decision be made about the effectiveness and success of the investment project. An important criterion for assessing the state program of renovation at the expense of budgetary funds of Moscow will be the developed options with minimal budgetary costs for the implementation of the program, ensuring the achievement of maximum socio-economic effect.

1. Introduction
Monitoring of physical and moral deterioration of residential buildings of the first period of industrial housing construction in Moscow showed that the technical condition of residential buildings is characterized by a decrease in bearing capacity and the onset of physical deterioration of building structures and in the next 10-15 years an emergency situation may arise. In order to prevent the mass occurrence of emergency housing, the Moscow government decided to repair the residential building mainly at the expense of the city budget. The program was launched in 2017 and approved until 2032. It is planned to allocate 100 billion rubles (or 1.25 million euros) annually for the implementation of the renovation program from the city budget, in General, 1.5 trillion rubles should be spent for 15 years of the renovation program in Moscow. Legislative acts provide for the possibility of attracting extra-budgetary sources of funding. An important distinctive feature of this investment renovation project is that the main investor of the project is the Government of Moscow, and the financing of the renovation program will mainly be carried out from the sources of the city budget. Therefore, it is necessary to assess the socio-economic effect of the state investment program.
2. Literature review
The problem of rehabilitation of panel residential buildings has spread to many countries in Central and Eastern Europe. Despite the typical panel mass housing construction in these countries, there are still many urban planning, architectural and construction differences, and therefore in some countries there are different initial situations for making a decision on the rehabilitation of panel houses. In the countries of Central and Eastern Europe, differences related to the time of construction, the location of typical houses, their size, their types, the construction materials and structures used, and the quality of construction. There were also differences in the size of the housing market segment, the service life and quality of housing and communal services, demographic conditions, housing needs, various socio-political and socio-economic goals, features of the legislative, institutional and financial foundations, and the pace of implementation of various socio-economic development programs in the country.

The successful implementation of the state program largely depends on a competent investment management policy during construction activities [1-6].

The problems of management of investment projects were engaged in Western scientists R. Bacon J. Keynes, A. Marshall, O. Morgenstein, F. Knight, J. Math. Neiman, M. Friedman and others, their research and conclusions have both theoretical and practical character and are based on scientific achievements and experience gained in the field of project management since the 50s of the last century.

Such scientists as Yu.A. Avdeev, G. M. Adelson-Velsky, V. I. Voropaev, S. P. Nikanorov, A. I. Teiman, and M. V. Sheinberg were at the origins of project management in Russia. Currently, such Russian scientists as A. N. Asaul, A. K. Bazhenov, V. V. Buzyrev, V. I. Voropaev, V. L. Elm, V. A. Zarenkov, C. A. Ishchenko, V. I., Liberzon, I. I. Mazur, A. M. Nemchik, H. A. Olderogge, E. B. Smirnov, A. C. Toub, E. P. Utkin, G. N. Zipes, V. D. Shapiro, E. L. Mesnac and others are actively engaged in theoretical and practical issues of project management. Issues of economic effectiveness of investment construction projects have been studied by many Russian scientists-economists [7-13].

The economic conduct of investment analysis assumes that the analysis process is largely formalized. When allocating such investments by the state, special attention is paid to economic calculations and the feasibility of work. Many foreign and domestic scientists have carried out research on planning and analyzing the economic efficiency of investment in the project. [14-22].

3. Materials and methods
Given the socio-economic importance of the State investment and construction program of renovation in Moscow and the allocation for its implementation of a significant amount of budget investments, it will be necessary to develop a technique for evaluating the effectiveness of the investment and construction program. That is, it is necessary to determine the economic efficiency in several areas: calculation of economic efficiency, evaluation of budget efficiency, determination of social efficiency and evaluation of the effectiveness and efficiency of the state program of renovation. For the effective use of the capital’s budget funds and the adoption of an economically justified decision to achieve the goals of renovation of residential buildings, special methodological approaches are needed to calculate and select a rational option at the stage of pre-project preparation. Competent management of investments, investment projects including housing construction, involves obtaining a positive result in the conditions of certain restrictions on time, budget, levels of risk and quality. The principles of renovation presented in the Figure 1. Socio-economic effect of renovation presented in the Figure 2.
4. Results
What kind of houses will be built under the program of renovation:
- new homes will be built with modern materials: concrete or panel of the new generation and on contemporary projects with elevators and wide halls;
- the ceilings in the apartments will be higher, and the soundproofing is much better than in prefabricated houses;
- in all the Windows in the apartments are fitted with double glazing;
- a convenient entrance for people with disabilities. Entrances and elevators are located on the same level;
- bright and unconventional facades will improve the appearance of the capital;
- durability of new homes for 100 years at least.

Socio-economic effect of renovation will be carried out in several areas: assessment of economic efficiency; the definition of social efficiency; the evaluation of budget effectiveness; evaluation efficiency and effectiveness of the State program. Socio-economic effect of renovation presented in the Figure 3.

Figure 3. The economic efficiency in several areas

To assess the State housing renovation program as the main indicators for the calculation of economic efficiency, as well as the comparison of various investment options of the program and the choice of the most optimal one, it is necessary to use static and dynamic indicators of economic efficiency. The state housing renovation program was launched in 2017. It is designed for 15 years until 2032, so budget investments in the program in 2017 and subsequent annual budget investments until 2032 will have a different time value. Therefore, for an objective assessment of efficiency, it is necessary to perform the ratio of time-separated cash flows to a single point in time by discounting. The main task of an investment project is to analyze investments. This planning consists of two stages: data identification and data evaluation, which can in turn be divided into 5 levels: 1. Description of investment opportunities; 2. Determination of cash flows; 3. Financial analysis; 4. To conduct a risk analysis; 5. Evaluating results for decision-making.

The profitability of investment projects is determined using well-known methods of investment accounting: static and dynamic. Static indicators of economic efficiency presented in the Table 1.
Table 1. Static indicators of economic efficiency

| N | Static indicators |
|---|-------------------|
| 1 | Budget investment $\sum BI_i$ |
| 2 | Return on investment $\sum RI_i$ |
| 3 | Monetary flows $\sum MF_i$ |
| 4 | Clean monetary flows $\sum MF^c_i$ |
| 5 | Necessity of budgetary investments $\sum BI_i$ |
| 6 | Profit $PR$ : $PR = (\sum RI_i - \sum BI_i)$ |
| 7 | Net profit $NEPR$: $NEPR = PR \times (1 - TR)$, (1) |
| 8 | Payback $PT$ - the minimum time interval (from the beginning of the renovation program), beyond which the integral effect becomes non-negative in the future, is determined by: $PT = (\sum BI_i / \sum MF^c_i)$ (2) |
| 9 | Profitability (profit rate) $RBI$ - specific profit for each ruble invested in the project is calculated: $RBI = (NEPR / \sum BI_i)$ (3) |
| 10 | Stock of financial strength $F$: $F = (PR / \sum RI_i)$ (4) |
| 11 | The ratio of the market price $MP$ of residential objects of the renovation program to their reduced cost $RC$, or to the unit cost of resettlement of residents $CRR$ |

Static methods of return on investment do not take into account time differences in the event of investment payments. However, the time factor plays a very important role in the construction of buildings and the distribution of individual payments over time, due to the long planning period. Therefore, first of all, dynamic methods of investment accounting are taken into account for analyzing the return on investment. Dynamic indicators of economic efficiency presented in the Table 2.

Table 2. Dynamic indicators of economic efficiency

| N | Dynamic indicator |
|---|-------------------|
| 1 | Discounting factor is calculated as follows: $f = 1 / (1 + (d/100) t)$, (5) |
| 2 | Net present value of $NPV$ - the sum of the current effects for the considered calculation period, reduced to the initial step, or the excess of the integral results over the integral costs, is determined by: $NPV = (\sum (f^i \cdot MF^c_i))$, (6) |
| 3 | The profitability index $VI$ is the ratio of sum of positive discounted cash flow to the sum of negative discounted cash flow: |
\[ VI = \sum (f^i \cdot MF^{c^+}_i) / \left( \sum (f^i \cdot MF^{c^-}_i) \right) \] \hspace{1cm} (7)

where \( MF^{c^+}_i \) - the positive part of the cash flow in the \( i \)-th period, cleared of taxes;

\( MF^{c^-}_i \) - negative part of cash flow in the \( i \)-th period;

\( f^i \) - discount rate in the \( i \)-th period;

Each method includes certain approaches to determining economic indicators. It should be noted that static methods of return on investment do not take into account time differences in the event of investment payments. But when building buildings, especially high-rise buildings, the time factor and the distribution of individual payments over time play a very important role, due to the long planning period. Therefore, first of all, dynamic methods of investment accounting are taken into account for analyzing the return on investment.

According to the theory of the time value of money, a dynamic group of indicators, in contrast to a group of static indicators, takes into account the change in the value of money at different times. This factor must be taken into account by owners, investors, developers, credit institutions, entrepreneurs, since dynamic indicators really reflect the economic efficiency of the project. This is why we are discounting cash flows-investments, that is, bringing future income to the present day, to the beginning of investment of the project. Only after these calculations should a decision be made about the effectiveness and success of the investment project.

5. Discussion and Conclusions

The economically justified decision on budget financing of the state program of renovation in Moscow is made on the basis of calculations of economic efficiency, the evaluation of budget effectiveness, the definition of social efficiency and evaluation efficiency and effectiveness of the State program. Calculation of economic efficiency is necessary for a comprehensive analysis of legal, sociological, organizational, environmental, technical, economic areas of the state program of renovation. These calculations should take into account not only static, but also dynamic indicators. The more stable the state financial policy, the more likely the economic calculations will be. This evaluation analyzes the sub-projects of the renovation program taking into account the time characteristics. Cost-effectiveness calculations should be reliable, understandable and verifiable. An important criterion for assessing the state program of renovation at the expense of budgetary funds of Moscow will be the developed options with minimal budgetary costs for the implementation of the program, ensuring the achievement of maximum socio-economic effect.

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